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FIFRA SCIENTIFIC ADVISORY PANEL (SAP)

OPEN MEETING

INTERPRETATION OF THE
ECOLOGICAL SIGNIFICANCE OF
ATRAZINE STREAMWATER CONCENTRATIONS
USING A STATISTICALLY DESIGNED
MONITORING PROGRAM

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 10 DECEMBER 5, 2007
 11 MR. DOWNING: Okay, I'd like to welcome
 12 everybody to day two, and I'd like to open up the
 13 meeting this morning with a hearty greeting and welcome
 14 the snow and all that sort of thing, but we don't have
 15 to worry about that, because we're here.
 16 I wanted to just remind
 17 everyone...sometimes it's hard to remember that when
 18 you get into the thick of it, but to, number one, be
 19 sure to turn your mike on before you try to talk, and
 20 then, also remind you that we do want to hear at least
 21 your last name before you start speaking, and,
 22 primarily, that's for the transcript.
 23 I think what we're going to do now is go
 24 ahead. I'm going to turn it over to the chair. I
 25 don't really have any other announcements for you
 today, at least right...not now, and turn it over to

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1 Welcome back. We have another day ahead of us. I
 2 understand that I want to thank Ken Portier for filling
 3 in for me yesterday afternoon. I had a teaching
 4 commitment out at the University of Maryland, but,
 5 again, I appreciate Ken's assistance on that.
 6 I'm Steve Heeringa. I am the chair of
 7 the FIFRA Science Advisory Panel. I am a
 8 biostatistician, applied statistician, at the
 9 University of Michigan who specializes in population-
 10 based research. Again, my function here is not to
 11 provide specific expertise but to chair the session and
 12 make sure that the guaranteed expertise of our panel
 13 that's assembled is, in fact, brought out and addresses
 14 charge questions and scientific issues at hand.
 15 So, I'd like to, again this morning,
 16 have the members of the panel introduce themselves and
 17 provide a little bit of their background and
 18 affiliation, please.
 19 DR. PORTIER: I'm Ken Portier, Director
 20 of Statistics at the American Cancer Society National
 21 Home Office in Atlanta. I'm an applied statistician
 22 and member of the permanent panel.
 23 DR. SCHLENK: My name is Dan Schlenk.
 24 I'm a professor of environmental toxicology at the
 25 University of California at Riverside. I'm a member of

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1 the permanent panel, and my expertise is in fate and
 2 effects of pesticides in aquatic organisms.
 3 DR. HANDWERGER: I'm Stuart Handwerker.
 4 I'm a member of the permanent panel. I'm professor of
 5 pediatrics and cell and cancer biology at the
 6 University of Cincinnati College of Medicine, and my
 7 expertise is in eating corn.
 8 DR. ISOM: Good morning. I'm Gary Isom,
 9 professor of toxicology at Purdue University. My
 10 research interests are in neurotoxicology and molecular
 11 mechanisms in neural degeneration, and I'm a permanent
 12 member of the panel.
 13 DR. CHAMBERS: I'm Jan Chambers. I'm
 14 the director of the Center for Environmental Health
 15 Sciences in the College of Veterinary Medicine at
 16 Mississippi State University, and I'm a member of the
 17 permanent panel. My expertise is in neurotoxicology.
 18 DR. YOUNG: I'm Linda Young. I'm
 19 professor of statistics at the University of Florida.
 20 My expertise is in spatial statistics and in modeling
 21 relationships between environmental health and...well,
 22 the environment and public health.
 23 DR. CHU: I'm Michael Chu, assistant
 24 professor at Grand Valley State University. My
 25 background is hydrologic and environmental modeling.

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1 DR. EFFLAND: Bill Effland, soil
 2 scientist with the USDA Natural Resources Conservation
 3 Service. I'm headquartered here in Beltsville,
 4 Maryland. My interests are in resource inventory
 5 analysis, environmental monitoring and modeling.
 6 DR. LERCH: I'm Bob Lerch. I'm a soil
 7 scientist with the Agricultural Research Service in
 8 Columbia, Missouri. My research interests are
 9 contaminant fate in transport and watershed management.
 10 DR. ELLSWORTH: My name is Tim
 11 Ellsworth. I'm an associate professor at the
 12 University of Illinois. My area of expertise is soil
 13 physics, contaminant fate in transport, and
 14 geostatistics.
 15 MR. GILLIOM: My name is Bob Gilliom
 16 with the U.S. Geological Survey. I direct pesticide
 17 studies for the National Water Quality Assessment
 18 Program. I'm in Sacramento.
 19 DR. FAIRCHILD: My name is Jim
 20 Fairchild. I'm an aquatic ecologist with the U.S.
 21 Geological Survey in Columbia, Missouri. My research
 22 interest is in effects of herbicides at population
 23 community and ecosystem levels.
 24 DR. RANDOLPH: My name is J.C. Randolph.
 25 I'm a professor of environmental science in the School

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1 of Public and Environmental Affairs, Indiana
2 University, Bloomington. I'm an ecosystem ecologist
3 and have interests in geospatial analysis.

4 DR. NOVAK: I am Jeffrey Novak. I am a
5 soil scientist with the USDA Ag Research Services out
6 of Florence, South Carolina. My primary area of
7 research is fate of soil...I mean, the fate of
8 nutrients in soil and aquatic ecosystems. Secondary
9 area of research is the effects of soils on climate
10 change and bioenergy production.

11 DR. LA POINT: I'm Tom La Point,
12 professor in biological sciences at the University of
13 North Texas. My area of expertise is in fate and
14 effects of chemicals in the aquatic environment and
15 risk assessment.

16 DR. GRUE: I'm Chris Grue. I lead the
17 Washington Cooperative Fish and Wildlife Research Unit
18 at the University of Washington, and my area of
19 expertise is fish and wildlife toxicology.

20 DR. GAY: I'm Paige Gay. I'm a research
21 scientist for the University of Georgia. I'm a water
22 chemist by trade. However, we do look at various other
23 water quality issues that are related to agriculture.

24 DR. HEERINGA: Thank you very much,
25 panel members. I guess all we really need is a...

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1 about whether there's been any validation of the CASM
2 model relative to its predicting absolute effects on
3 any of the systems we're dealing with and also on
4 validating its projections about the time dependence
5 of...of the effects.

6 And the...I'd like to go back to...to
7 address these questions as well as I think I can to
8 just one slide I presented on the problem definition,
9 and that was the slide that presented the exposure
10 concentration versus duration with different Brock
11 scores for the microcosm/mesocosm studies.

12 Now, as I pointed out yesterday,
13 the...our...our question, these microcosm/mesocosm
14 scores define the level of protection of the method and
15 also defined the level of concern as far as

16 concentrations we would be concerned about...where did
17 my cursor go...in that already in the preliminary I
18 read, there was an identification based on this kind of
19 data that...that concerns started arising in the bulk
20 of the data in the 20-day to 60-day range or 15-day to
21 60-day range of about 10 to 20 g/L of atrazine, and
22 that is the...if we were just concerned about exposures
23 of that magnitude, of that duration, there would be
24 nothing more to do.

25 I mean, we could have a simple method

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1 bowl of grits for Stuart, and we'll be all set here.

2 I think, that aside, I want to begin
3 today's session by turning to members of the EPA
4 scientific staff for some opening remarks, and I think
5 I'll turn to Dr. Irene or Dr. Brady also, either one.
6 You take your choice.

7 DR. IRENE: Well, I actually don't have
8 any. I haven't prepared any opening remarks. I think
9 yesterday went very well, and I'm going to defer, I
10 think...do the rest of you have...yes, I'm now going to
11 defer to Russ Erickson to perhaps pick up from where we
12 left off yesterday, if that's okay with everybody.

13 DR. HEERINGA: I think what we'd like to
14 plan to do is there's a little followup, I understand,
15 on yesterday's presentation, and then Dr. Portier
16 informed me that I think there's probably need for a
17 few additional questions that need to be answered and
18 items to be covered. So, Dr. Erickson, please.

19 DR. ERICKSON: Thank you, Mr. Chairman.
20 Yeah, I appreciate this time for...to address some
21 comments regarding some of the very good questions
22 from

22 yesterday which I don't think I adequately addressed
23 then, and...and I hope my comments here will help the
24 discussion, particularly on the first charge question.

25 The questions related yesterday more to

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1 that...that decided where to position the level of
2 concern within that area of uncertainty, and we would
3 be done if we did not have to address the issue of what
4 about shorter durations.

5 Certainly, shorter durations of 10 to 20
6 g/L are not necessarily of concern, but what are? Is
7 100? Is 200 down at a few days in the spiky exposures
8 that we see in the field? Likewise, out at longer
9 exposures, there...there might be concern at...at lower
10 concentrations, although we don't expect to see those
11 kind of...kind of exposures.

12 And so, there's a ti...time dependence
13 to be expected in the...in this data which is indicated
14 to some extent in this data, but we can't quantify from
15 this data, and, in fact, in answer to one of the
16 questions yesterday, there...there is no definitive
17 microcosm/mesocosm data against which to test
18 predictions of the time dependence of this...this sort
19 of data in which we would have a consistent
20 quantitative endpoint to look at the...at time trends
21 of.

22 And so, the question is what to do about
23 that, and our answer was to apply the community model
24 to this.

25 And the...and so, we need a procedure

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1 that would address not just the time dependence of
2 microcosm/mesocosm but could be plausibly applicable to
3 types of exposures we have...have in the field. But
4 the thing about this method is it still must come back
5 and...and establish a level of concern here for these
6 durations in the range that's already been identified.
7 It must be consistent with the...microcosm/mesocosm
8 data.

9 And so, it would be nice to have a
10 method where we could apply a predictive model to each
11 of these microcosm/mesocosm experiments and do
12 absolute

13 predictions of one, actually predict these Brock scores
14 for this variety of systems, but if we had a
15 procedure...but if we had a procedure for that, it
16 would...the application of that procedure would also
17 need to have...we would have to have a version of CASM
18 tailored for every study here, but we would also have
19 to have a version of CASM tailored to every field
20 system, and that, we felt, was infeasible.

21 And so, we...we...but we...but it really
22 also is not needed, because if we have a system which
23 we feel has an appropriate...the processes that drive
24 the time dependence of response, we can calibrate it to
25 this...these data, as I...as we showed yesterday, and
we don't need to do those absolute predictions.

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1 But as an aside, if we...we were
2 convinced that CASM is an appropriate vehicle and that
3 it has previous successes on a site-specific basis of
4 describing system behavior so that it incorporates
5 the...the processes we feel would...would be important
6 to the time response of toxicity, and I would...if...if
7 the panel wants more information regarding that line, I
8 would refer them to...to Dr. Bartell, then, because
9 I...I feel he would be able to brief you on...more on
10 how the model both in previous applications and also in
11 its current configuration for CASM atrazine regarding a
12 midwestern stream at least shows elements of behavior
13 that are empirically observed in...in these types of
14 systems which, at least to some degree, provides some
15 valid...validity to the model, but I would have to
16 defer to Steve Bartell for that information.

17 But there were a few more things that I
18 would...like I said, it would be nice to have an
19 absolute model to predict it, but even if we took
20 CASM and applied it one of these mesocosms and showed
21 yes, we...we can predict it, it really doesn't add much
22 validity to CASM, because that's already been
23 demonstrated on multiple times for the model. And
24 applying it to one mesocosm really doesn't gain us
25 anything, because the issue here is how does it, again,

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1 extrapolate over time rather than how does it do
2 absolute predictions. And so, if we...just one more
3 validation on a specific system really isn't going to
4 provide validity for the...the purpose applied here.
5 The...but a final point I would like
6 to...to do in response to the questions, though, is
7 that although we do not have microcosm/mesocosm data
8 with a...a quantitative endpoint that we can track
9 through time and look at the time de...dependence
10 across studies or within a study to do that, we do know
11 a lot about the time dependence of atrazine toxicity to
12 the component species here. That is known. That we do
13 have empirical information on, and that, in fact, is
14 the major driving force within the model.

15 What CASM is actually doing as the...the
16 driving force for it, though it then adds certain
17 interactions within the community, what it basically
18 starts out at is it looks at the toxicity information
19 and...and projects for each species the...the toxicity
20 through time which we do have empirical information on
21 for the dr...this driving force, adds it all together,
22 and integrates it in with a community interaction
23 method...method, but at...at a first approximation, it
24 starts out with looking at multiple species and saying
25 this species on this day would have this percent

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1 reduction on growth or this percent reduction on
2 growth, and, in fact, that is material we do have
3 empirical information on the...the time dependence, and
4 it is the driving force for the time dependence of the
5 model, a major driving force for that.

6 So, from two standpoints, then, I would
7 say that we have information that...that supports the
8 validity of the model. First of all, we know that
9 it's...it's driving the...it starts with the toxicity
10 through time which is very important for establishing
11 the...the time dependence here. And...and then,
12 secondly, that CASM has been applied on system-specific
13 methods successfully to...to provide reasonable
14 behavior for these types of systems.

15 But the bottom line, then, but as far as
16 actual empirical data on an ecosystem, experimental
17 ecosystem that looks at the time dependence that we can
18 test our predictions of time dependence again, no, we
19 do not have that...that type of validation information.

20 And those are my additional remarks.
21 DR. FAIRCHILD: You said you don't have
22 that type of validation information, but you could
23 provide that with an extensive data set such as the
24 Denoil data set from Kansas, couldn't you?

25 DR. ERICKSON: I...

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1 DR. FAIRCHILD: Again, that is...would
2 be a site-specific CASM model, but that would at least
3 give us in this room confidence that this model is...is
4 going to have some reasonable accuracy. The same could
5 be done, possibly, with the...couldn't it be done with
6 the Krieger data set from Honey Creek?

7 DR. ERICKSON: The...regar...well, first
8 of all, as I said yesterday, I'm not familiar enough
9 with these mesocosm/microcosm data sets to...to...to
10 answer that question well, but I would specify...I
11 would state some of the requirements for...to really
12 test this, and as I...and I do...I read some of those
13 papers, and the...if I remember correctly, I don't
14 think they really have the level of quantification
15 through time to provide the...the quantitative effects
16 value that could be used for this validation.

17 I...I could be mistaken, but I do not
18 think that they...they have that as far as, say, for
19 a...what I've dealt with on a...on an individual
20 organism level, I've dealt a lot with the effect of
21 time variability on toxicity, and, in fact, that's why
22 I got involved in this in the first place, and on an
23 individual species basis. And the...the issue here
24 would be the...ideally, you would have...from a
25 particular study, you would have like a week-long

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1 DR. FAIRCHILD: Accuracy of the Denoil
2 data set, because it has multiple...they did a series
3 of four or five studies. They had multiple
4 concentrations. They had most...multiple endpoints.
5 They went as far as actually providing the ecological
6 relevance of the endpoints, and it's an extremely
7 valuable data set, and, you know, I see assigned the
8 Brock's...well, in the Brock paper, I think it was a 4
9 or 5, but that was a very valuable data set that I...I
10 think needs to be discussed as part of the accuracy and
11 utility of this model.

12 DR. ERICKSON: If I might just say, I
13 think...I don't know if there's additional data from
14 Denoil's in here, but these points out at the longer
15 duration, I think they were the study that did the 300-
16 day exposures part of...at least one of their
17 studies...

18 DR. FAIRCHILD: Right, but...

19 DR. ERICKSON: ...and...and the...and,
20 again, I am...I guess the perspective I was looking at
21 it in is that they did not have an LOEC at that...at
22 that...for that...at the end of that exposure and that
23 the lowest concentration was...well, they did...they
24 did have an NOEC in terms of the treatment
25 concentration.

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1 atrazine exposure on a range of concentrations, then,
2 separately, you know, a month-long and, separately, a
3 few month-long to look at, and then to look at the
4 residual effects for each of those across so that you
5 could have a consistent comparison between the
6 different...that you would actually be comparing apples
7 to apples as far as consistent comparison across time.

8 And I...and I don't believe any of
9 these...these studies do that, and the alternative
10 would be to look at...at effects through time as they
11 do develop, and I don't know how...I don't know enough
12 about the data set to say whether that would be
13 feasible or not.

14 DR. FAIRCHILD: Could we ask...

15 DR. ERICKSON: Or I guess I'm missing
16 your question here.

17 DR. FAIRCHILD: Is Dr. Giddings here?
18 Or if he's in, Dr. Bartell. I think Dr. Giddings, I
19 know, is familiar with that data set. Perhaps could he
20 comment?

21 DR. HEERINGA: Dr. Giddings, are you...

22 DR. FAIRCHILD: Yes, could he comment on
23 this?

24 DR. HEERINGA: ...available and willing
25 to comment on that, please?

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1 DR. FAIRCHILD: Well, they...they may
2 have not have had...calculated NOC, but if it's...I
3 think one could gain more trust in...in evaluating that
4 data set than simply applying 1 ppb as a NOEC in the
5 CASM model or at least in the Montag aspect of the
6 slope evaluation.

7 DR. ERICKSON: I guess I don't
8 understand your comment about 1 ppb.

9 DR. FAIRCHILD: There was some
10 discussion in the material provided us in terms of how
11 to calculate the slopes of the individual dose
12 responses.

13 DR. ERICKSON: Yeah, but...but
14 there...there is no 1 ppb that factors into any of
15 our...our...our calculations here. If...if you want me
16 to go into that further, I can.

17 DR. FAIRCHILD: I'd rather hear from Dr.
18 Giddings.

19 DR. ERICKSON: Yeah, I mean...

20 DR. HEERINGA: Let's...Dr. Giddings, if
21 you would, please. Dr....you want to...clear what the
22 question is from Dr. Fairchild?

23 DR. GIDDINGS: Well, maybe it would be
24 good if he repeated it.

25 DR. HEERINGA: Just please,

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1 resay...restate it, James.
 2 DR. FAIRCHILD: The question was Dr.
 3 Erickson has said that...that originally, there was a
 4 question of has this model been valigate...validated
 5 against a specific microcosm or mesocosm and the answer
 6 was there was a two-part answer. Well, you could do
 7 that, but that would make the model only applicable to
 8 that one ecosystem.

9 The second comment was he did not think that
 10 there was a data set out there of sufficient quality
 11 that that could even be attempted. And I...I think
 12 that the Denoil data set would lend itself to the CASM
 13 model to determine is it really predicting in terms of
 14 species...species loss for the level of effects that
 15 were observed in...in some of their endpoints.

16 DR. GIDDINGS: Well, I'm...I'm Jeff
 17 Giddings. I work for a company called Compliance
 18 Services International. I'm an aquatic ecologist by
 19 training. I've been working on aquatic...or ecological
 20 risk assessment of pesticides for about 20 years and
 21 have spent a lot of time investigating the mesocosm and
 22 microcosm data for atrazine as well as being involved
 23 in other aspects of the atrazine risk assessment.

24 So, yes, I am familiar with the...the
 25 Kansas studies, the Denoil studies, and I'm sure that

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1 it's true that they did some ancillary experiments
 2 where they took water and organisms out of the ponds
 3 and did various things in the laboratory during the
 4 course of that mesocosm study, but I think the...that's
 5 not the sort of information that would necessarily be
 6 readily comparable to what CASM would do.

7 But one could look at the...at the
 8 monitoring data for those ponds themselves and...over
 9 time and compare that with the behavior of CASM if...if
 10 CASM would be...could be configured to...to simulate
 11 the conditions in the ponds.

12 DR. HEERINGA: Thank you, Dr. Giddings.

13 I want to make sure that we move along
 14 here, cover all of the questions. I understand, Dr.
 15 Grue, that you had a question at the end of the day
 16 yesterday for Dr. Erickson, too.

17 DR. GRUE: I did. I think it will be
 18 covered in my...in my comments...

19 DR. HEERINGA: Okay.

20 DR. GRUE: ...related to the...the first
 21 question, but maybe I could ask it specifically here.
 22 The...part of the concern is looking at the changes in
 23 the SSI. What does that really relate to ecologically?
 24 And I think that's part of the struggles that...that
 25 many of us are having from the ecological side, because

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1 the data, the underlying data, if the raw data could be
 2 retrieved, would be the kind of information that could
 3 be compared with a CASM simulation that was tailored to
 4 that particular system. It doesn't...there are not a
 5 series of different exposure durations in that study,
 6 but one could look at the time course of effects on
 7 different components of the system, species, individual
 8 species, and at community and ecosystem level
 9 properties of those systems over time.

10 DR. FAIRCHILD: But there were multiple
 11 studies done in that.

12 DR. GIDDINGS: Yes.

13 DR. FAIRCHILD: I mean, for example,
 14 they did some flask studies and they...they looked at
 15 physiological indicators such as carbon uptake over a
 16 shorter duration, and those were species isolated from
 17 the system. So, you know, to some extent, they do have
 18 a series of studies of different durations of different
 19 endpoints, and they go as far as to determine, I think,
 20 from a regulatory standpoint, which is important, is
 21 what is going to be a regulatory endpoint of...of
 22 ecological relevance and significance that the EPA is
 23 going to use, whether, then, theoretically, the loss of
 24 three or decreased biomass of three species.

25 DR. GIDDINGS: Jeff Giddings. Well,

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1 we're taking an ecological model and utilizing it to
 2 score, come up with a score, that allows, then, EPA to
 3 look at that relative to the LOC, but what is...what
 4 are those changes that the model is predicting that
 5 would...in primary production or in consumers that
 6 translates, say, to an SSI that's significantly below
 7 the LOC versus one that either is at or exceeds the
 8 LOC?

9 In other words, just relative speaking,
 10 just in terms of relative terms, is that possible and
 11 would that help address some of the concerns associated
 12 with the performance of the model?

13 DR. ERICKSON: This is Russell Erickson.
 14 I guess...I'm not sure I'm completely following the
 15 question, but the...you stated about the SSI being the
 16 model score, and I'd like to emphasize that in that
 17 it...it is not defining the level of protection. It's
 18 a...it's a score of the model that is then correlated
 19 to the microcosm/mesocosm data that define the level of
 20 protection, and just so that we're...we're clear on
 21 that.

22 Now, as far as what...what comprises
 23 that score, the...there's more detailed output from
 24 CASM which will define the time course of the...the
 25 primary producers. And generally what happens, as

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1 would be expected, is that given the...the greater
 2 sensitivity of the different species, the SSI reflects
 3 a decline of the...of sensitive species relative to the
 4 tolerant species.
 5 And generally associated with that
 6 is...is...is an overall decline in total
 7 produce...primary producer biomass, and the...and what
 8 I tried to show yesterday with the effects index is
 9 that you could just switch over to the total primary
 10 producer biomass. So, there's a...there's...there's a
 11 decline mainly in the sensitive species, as would be
 12 expected, which means that there is reduced biomass
 13 production, reduced average biomass of the...of that
 14 and...and mainly showing up in the sensitive species.
 15 And...but if we just looked at the total
 16 producer biomass and, again, because we're doing this
 17 on a...we're just using the time extrapolation rather
 18 than the absolute predictions as the...as what the
 19 model is actually used for, we end up with...with very
 20 similar risk assessments.
 21 Or if we looked at the maximum SSI
 22 deviation which basically, again, is a...occurs, you
 23 know, right during or immediately after exposure, the
 24 exposure period, and represents a decline in the
 25 relative biomass of the sensitive species, again, we

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1 get similar risk assessments, again, because we're only
 2 using the information about how that...that index
 3 varies with...with time of exposure.
 4 But, again, it's...it's a fairly simple
 5 response in a way. There's a...there's a shift of the
 6 biomass. There's a total...there's a reduction in the
 7 total biomass and a shift of the biomass to the
 8 tolerant plant species.
 9 DR. GRUE: Maybe I can just follow up.
 10 DR. ERICKSON: Yes.
 11 DR. GRUE: But it would be...it would be
 12 really nice to show some actual output from a model
 13 related to the different scores. In the...in the
 14 documentation that was provided...and I think it
 15 pertains to a question I asked yesterday...those were
 16 hypothetical examples of species coming in...excuse
 17 me...species dropping out and switches in biomass, but
 18 I think, at least for me, I struggle...
 19 DR. ERICKSON: Okay.
 20 DR. GRUE: ...with trying to relate
 21 the...the change in the SSI with what the model is
 22 actually producing, realizing still...realizing that
 23 it's a construct to allow you to...
 24 DR. ERICKSON: Right.
 25 DR. GRUE: ...actually score these

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1 different atrazine exposures.
 2 DR. ERICKSON: Okay, well, it's...it's
 3 sunken into me now. This is Russ Erickson. Okay, I
 4 don't have...we do have that output from the model, but
 5 I don't have it available here. We might ask Dr.
 6 Bartell if he has some output traces that might address
 7 your issue so that you can see the time course of the
 8 primary producer populations through...through time for
 9 maybe for a reference simulation which shows the
 10 behavior through...of the unimpacted system and how it
 11 would...would shift with that time, and
 12 I...I...I...again, that...that information would be
 13 available. I just don't have it with me, and I
 14 could...I could see the...really see the merit if
 15 adding it to our paper as far as just one example of
 16 what this all means.
 17 So, yeah, I think that...that could be
 18 done, and I think...but for the purposes of this
 19 meeting, you know, we can ask Dr. Bartell or I could
 20 try to, you know, dig out the information and...and
 21 have it available tomorrow. So...
 22 DR. HEERINGA: Dr. Erickson, I'd like to
 23 suggest that I think if Dr. Grue and others agree
 24 that...with that particular piece of information, that
 25 if you can supply an example...we don't have to have it

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1 now, but within the course of the next day or day and a
 2 half, it would be great.
 3 DR. GRUE: Well, or even if it's not
 4 possible here at this meeting...I think it would be
 5 great to have it at this meeting, but I think it's...it
 6 would go a long way to help address some of the...the
 7 concerns from the ecological perspective of this thing.
 8 DR. HEERINGA: Oh, okay.
 9 What I'd like to do at this point...Dr.
 10 Effland has a question? I want to make sure that...I
 11 think there's some value in moving on to the charge
 12 questions, because a lot of the conversation we have
 13 here, including clarifications, can actually take place
 14 in the context of the response, but if there are
 15 questions of clarification or information, Dr. Effland,
 16 please.
 17 DR. EFFLAND: Yes, I'd...I'd appreciate
 18 it if I could just ask a few, and they...they probably
 19 will overlap with the charge questions, but...
 20 DR. HEERINGA: That's okay. I...I
 21 think...at some point, I think, I want to make sure for
 22 the panel, too, that even if we have some outstanding
 23 questions or some discussion of clarification on a
 24 particular issue, we can, in fact, work that out
 25 through an exchange a little bit with the EPA

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1 scientific staff during the charge questions, too, but
2 if you really have something that you don't understand
3 that you think is absolutely necessary to address the
4 charge question...

5 DR. EFFLAND: I held off from yesterday,
6 but I...

7 DR. HEERINGA: Please, go ahead.

8 DR. EFFLAND: ...hope the panel will
9 permit it...in the interest of finishing before 5:30
10 yesterday.

11 As far as the sensitivity analysis, do
12 you run the model or someone at EPA run the...the
13 modeling is done at EPA?

14 DR. ERICKSON: Yeah, this is Russell
15 Erickson. Yeah, everything that I presented we ran.

16 DR. EFFLAND: Okay.

17 DR. ERICKSON: Basically, we have a...a
18 model product from...that Syngenta supported the
19 development of but that we...we were able to review and
20 provide inputs on, and, in fact, there, like I said
21 yesterday, there are still some...some review responses
22 from us that...that are in the process of being
23 corrected where we felt that the...that the model needs
24 some correction, and the...but...but yeah, no,
25 every...everything that I showed you we did.

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1 you're going to do sensitivity analysis on if you have
2 hundreds to...and then...and then, there was a comment
3 yesterday about interactions which I think is a very
4 important question, and that if you add the
5 interactions in and look at the combinations between
6 just the individual input variables and the
7 interactions, I...I'm not sure how you're going to be
8 able to accomplish the sensitivity analysis.

9 DR. ERICKSON: Okay. Well, I think
10 although there are hundreds of...there's input
11 variables and parameters, if I have...if I have
12 modelists here that draw the distinction, and
13 the...and, I mean, input variables being such things as
14 the physical/chemical driving factors and parameters
15 being something like the bioenergetics parameters in
16 the...in the driving equations.

17 Yes, there are a hun...there are...the
18 bioenergetics parameters, if you look at each
19 individual bioenergetics parameters over a few dozen
20 species, yeah, there are...there are hundreds of
21 parameters there.

22 The approach in the sensitivity analysis
23 would be to...which is...which is in the...which is in
24 the process of being developed and being discussed is
25 to...is to look at different model community constructs

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1 DR. EFFLAND: Okay.

2 DR. ERICKSON: And, in fact, most of the
3 conceptual model as far as the...the risk assessment
4 conceptual model and problem definition originated
5 with...with EPA.

6 DR. EFFLAND: Okay, that...that's good.
7 The number of input variables for the model, roughly?

8 DR. ERICKSON: Oh, I mean, there are
9 many hundreds. I mean, we have...

10 DR. EFFLAND: And so, you're going to
11 conduct sensitivity analysis on all the input
12 variables?

13 DR. ERICKSON: No, I mean, not
14 individual. When I talk about many hundreds, I
15 mean...well...well, I mean if you...the...the
16 input...there are...well, there's obviously the...the
17 whole series of like nutrients, like temperature as
18 ac...actual environmental driving factors, water
19 velocity, depth, things like that. The...we've taken
20 sort of...rather than...I mean, that almost provides an
21 infinite poss...possibilities as far as looking at
22 different nutrient profiles.

23 DR. EFFLAND: I would agree...Bill
24 Effland again. My question and, actually, my concern
25 is that you're going to pick and choose which variables

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1 and...and in the process, these...these...the species
2 identifications and the bioenergetics parameters will
3 be changed, and there will be different community
4 structures, and that will, at least from my
5 perspective, provide a sensitivity analysis that...that
6 covers, really literally over maybe several variations,
7 would cover hundreds of parameters, because
8 we're...we're modifying them, but we're not
9 ident...we're not going to identify at the level of if
10 we modify this one bioenergetics parameter for this one
11 species, that's not the level that we're looking at.
12 We're looking at what...what do we change if we change
13 the entire structure of the bioenergetics in...in
14 different ways to...to emulate different types of
15 systems, and that is the...that would take care of a
16 lot of...of parameters.

17 As was mentioned yesterday, when we get
18 to the physical/chemical parameters, there it would be
19 feasible to do this in terms of well, we can modify,
20 you know, both light and...light and temperature and
21 nutrients together in a way that perhaps emulates
22 extremes over the...the corn belt, for example.

23 And so, I think there can be a finite
24 number of...of sensitivity analyses that speak to
25 whether there is concern about how the model

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1 is...is...is constructed, but, again, as I...I hope I
2 said yesterday, the...the...the point of this...the
3 sensitivity analysis, hopefully, is to, because this is
4 all being...we're only parsing out the time dependence
5 factor from the models, the question is what the
6 sensitivity is to that, not any absolute effects.

7 And if the...if, separately, light,
8 temperature, and nutrients did not have much of an
9 effect and then we look at some selected interactions,
10 we can probably take care of that realm in...in...in
11 a...in a finite number of...of sensitivity analyses. I
12 mean, a reasonable number.

13 DR. HEERINGA: Dr. Young?

14 DR. YOUNG: Linda Young. I think one of
15 the...the challenges that I'm facing here is...is that
16 most of this work is predicated on belief in the model
17 and when we talk about uncertainties, there's also the
18 uncertainty for the lack of fit of the model.

19 And...and I don't see...I don't
20 understand how that's going to be quantified. And the
21 reason I think it's important is that there are several
22 significant differences between the streams and the
23 mesocosm and microcosm studies.

24 For example, it was pointed out
25 yesterday that they either have a steady increase in

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1 similar enough among systems, though, that the effect
2 of exposure time is...is similar among systems that we
3 can compare among systems just as we're comparing
among

4 the mesocosm/microcosms here which are rather a diverse
5 set in the first place, that we assume that they're
6 relevant to the field which are different systems.

7 We're assuming that the time dependence of response is
8 similar among different systems.

9 And so that we start out maybe with a
10 basic assumption from this microcosm/mesocosm data
that

11 if it's relevant to the field, what that means is that
12 if we had...if we did have an exposure in the field
13 of...of, you know, 10 to 20 g/L of atrazine over
14 several weeks...which we don't, but, I mean, if we
15 did...able to test another field system, that we would
16 have a response similar in the range of these
17 microcosms and mesocosms, that they are...they define
18 a set of responses that are relevant to the field.

19 That is an implicit or explicit, now,
20 assumption in using these microcosm/mesocosm data at
21 all, that they have that relevance.

22 And then the...beyond that, then, what
23 we're assuming here is that by incorporating the...the
24 time dependence of toxicity into this model, that we're

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1 atrazine or one bump and that the flow was pretty
2 consistent. Those two things aren't observed in
3 nature, and it's a common problem when you move like
4 from the laboratory to the field that the additional
5 variability in the field causes things to happen that
6 are unanticipated.

7 And so, I think that's why we're all
8 looking for this ground treatment that...that the model
9 can actually adjust to that additional variability.

10 Is there any way that we can...can get a
11 measure of that type of uncertainty?

12 DR. ERICKSON: Well, I guess...well,
13 we've already discussed the, you know, presenting where
14 we can present some simulations to the degree that
15 that...and comparison with selected systems to...to
16 actual behavior as far as believing the model.

17 The...I would, again, go to back...I
18 mean, maybe I'm sounding, you know, repetitive here,
19 but the...the argument I would present here would be
20 that, again, the model is only needed to address the
21 time variability issue and to what extent can...and
22 that...that the absolute predictions. And...and a
23 fundamental assumption there is that...and...and I...I
24 grant it's going to be assumption that we can't...is
25 that the...the time variability is something that is

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1 time dependence on...on...on response and that is shown
2 to be at least not inconsistent with the
3 microcosm/mesocosm data, although the data is sparse
4 enough that it's not definitive.

5 And what I would again keep coming back
6 to is that...that the, to me, the...the variability
7 issue that we need to be concerned about is the
8 variability of the...the time dependence and the...and
9 that's why when we presented the sensitivity analysis,
10 we presented it as does...that relative multiplication
11 factor I presented really is...addresses the question,
12 is the effect of the time dependence of the different
13 model variations the same?

14 And so, I...it's parsing out. It's
15 isolating the effect of the...the time dependence, the
16 time dependence predictions of each model, and parsing
17 out any difference in the absolute predictions. And
18 it's trying to...it doesn't, in fact, look at...it's
19 comparing what I think should be compared, that does
20 this wide array of models that we look at...and this
21 could be expanded to...the sensitivity analysis could
22 be expanded to different models, to completely
23 different constructs, and to some degree, we will be
24 doing that.

25 But if...if they all are very consistent

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1 with respect to what they say is the relative risks of
2 different time series, then I would argue that
3 that's...that the...that is what we should be looking
4 at as far as accomplishing our purposes here and that
5 the...that...that whether we predict that in this
6 system, you know, there will be a different set of
7 species that respond on an absolute basis different is
8 not what we want here, that what we want is a...is a
9 model that is robust with respect to...to what it says
10 about the time dependence.

11 DR. HEERINGA: At this point, I think
12 I'm going to ask us to move on. We've had good
13 discussion. This will continue, and I'll give you a
14 little bit of my thought process here.

15 What happens in these meetings is that
16 the first topic dominates the discussion, and we tend
17 to not progress fast enough to the penalty of the
18 second and third. So, I'm going to watch the time over
19 the next two days, and I think that we'll have plenty
20 of time to cover all of the issues, but if, again, with
21 the...your tolerance of this, I'd like to move on to
22 the charge questions, if we could at this point.

23 So, what I'd like to do is to have
24 either Mr. Brady or Dr. Irene read the charge question
25 into the record, or, Russ, were you going to read it

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1 documentation that has been provided to the SAP
2 members
3 and EPA that EPA, Syngenta, and its contractor made a
4 significant effort towards addressing the objectives
5 underlying the conditions for the re-registration of
6 atrazine, and they are to be commended for the quality
7 of the supporting documentation and what appears to be
8 a productive working relationship.

9 As noted by both, the complexity and
10 sophistication and the modeling effort represents a
11 significant advancement to the risk assessment process.
12 The intensity of the field monitoring effort resulting
13 in the development of exposure time series, described
14 as chemographs, and the availability of community
15 response data from a relative large number of
16 micro/mesocosm studies provide the opportunity to
17 integrate these data in an aquatic community simulation
18 model to determine if levels of concern, LOCs, are
19 exceeded in the field, in this case, streams that are
20 likely to receive atrazine inputs.

21 The decision to use a community
22 simulation model was based on the greater sensitivity
23 of primary producers, plants, the potential for direct
24 and indirect effects, and the ability to incorporate
25 compensatory mechanisms and seasonality and the
26 potential for recovery. The Comprehensive Aquatic

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1 in?

2 DR. ERICKSON: No, I'll...I'll bring it
3 up.

4 DR. HEERINGA: Okay.

5 MR. BRADY: Okay, so the charge question
6 is...this is Don Brady, by the way...please comment on
7 the use of a community simulation model for assessing
8 the relative effects of different exposure time series.
9 Please provide any recommendations for a community
10 response model other than or along with CASM that could
11 be used for addressing the effects of atrazine. What
12 are the strengths and weaknesses associated with other
13 models?

14 Please comment on approaches that do not
15 require an aquatic community response model and discuss
16 the advantages and disadvantages of any alternative
17 non-modeling approaches for extrapolating the effects
18 seen in micro/mesocosm data to the effects resulting
19 from field exposure.

20 DR. HEERINGA: Thank you very much, and
21 Dr. Grue is our lead discussant on this question.

22 DR. GRUE: Well, thank you, and I
23 prepared some...a response for my part and to be
24 followed by comments by Jim Randolph and Bob Gilliom.

25 First of all, it's clear from the

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1 Systems Model, CASM, was selected and tailored to
2 perform the atrazine risk assessments.

3 The incorporation of the food web
4 analysis and bioenergetics modeling are currently being
5 applied to the assessment and management of strategies
6 directed at stressors within aquatic systems, for
7 example, the impacts of introduced species or
8 manipulations aimed at achieving targeted management
9 objectives. There's no reason the assessments of
10 pesticide impacts should not include these same tools.

11 With respect to the selection of CASM,
12 it would have been helpful if additional justification
13 for the focus on streams versus other surface waters
14 was included in the documentation, especially in light
15 of the continuing controversy over the effects of
16 atrazine on amphibian, species that may be more likely
17 associated with other waters.

18 Dr. Irene addressed this issue in her
19 opening remarks by more clearly describing the context
20 in which the stream assessment is being conducted
21 relative to other aquatic systems influence, and I
22 appreciate that.

23 Because my own research has largely
24 focused on organism versus community responses to
25 pesticides, I trust Drs. Gilliom and Randolph as

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1 whether...as well as others on the panel with greater
2 experience with aquatic toxicity models will address
3 questions associated with model selection and the
4 strengths and weaknesses of the alternatives.
5 Based on the review presented by Dr.
6 Bartell and given the desire for a community effects
7 model, choices appear to be limited, and I am
8 personally less concerned with model selection than how
9 the model is parameterized relative to its use and
10 application.

11 As the authors of the model
12 documentation have noted, there are a number of
13 assumptions on which the model is based and several
14 limitations to the model. Some, but not all, have been
15 addressed in the EPA summary document or in the charge
16 to the SAP, and the latter may warrant further
17 examination. I direct panel members to Volz, et. al.,
18 2007, pages 22 to 23.

19 Although the model is being used to
20 relate environmental exposure to an LOC derived from
21 laboratory data in a manner similar to the quotient and
22 not as an absolute measure of community change at
23 particular sites, it is a model and one in which
24 ecological processes are being simulated. As such, the
25 Agency will be faced with concerns about model

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1 concern may be drivers and require both types of
2 approaches.

3 I want to end my comments by again
4 complimenting the Agency, Syngenta, and its contractors
5 on developing what likely will be a model for future
6 risk assessments, at least in cases where comparable
7 data are available. Given the constraints on the
8 existing regulatory paradigm and the need to
9 effectively utilize existing laboratory toxicity
10 effects data, the group's efforts to improve the
11 exposure and effects assessments for atrazine are a
12 step in the right direction.

13 DR. HEERINGA: Thank you, Chris. Our
14 first associate discussant is Bob Gilliom.

15 MR. GILLIOM: Thank you. Bob Gilliom,
16 USGS.

17 I think I'll try to amend mine to kind
18 of supplement what Chris said, and some of it will
19 overlap.

20 DR. HEERINGA: Chris, could you shut
21 your mike off?

22 DR. GRUE: Oh, okay.

23 MR. GILLIOM: I think that my first
24 overall comment which...which corresponds to something
25 Chris said was...is I don't think, pertained to this

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1 calibration, transparency, and the interpretation of
2 model outputs.

3 For example...and this gets back to my
4 earlier comments and other comments made by panel
5 members...what does a particular deviation in the SSI
6 translate to in terms of biomass of primary producers?
7 What is the difference in primary production and
8 consumption between sites that are substantially below
9 the LOC versus those that either exceed or approach the
10 LOC?

11 To what extent is the model
12 conservative? I've heard some differences in opinion
13 in terms of how conservative the model is. And are the
14 safety margins adequate?

15 With respect to approaches that do not
16 require an aquatic community response model, that is,
17 criteria developed for specific representative or most
18 sensitive species or Taxa from species
19 sensitive...sensitivity distributions, they do not
20 address community responses, again, assuming the latter
21 are the goal. As noted above, I agree with the
22 decision to adopt a community effects model. However,
23 where specific species are the focus of risk
24 assessments, for example, with threatened or endangered
25 species, both direct and indirect effects on species of

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1 first question, that the model itself would matter.
2 It's...it's a...all those equivalent models, to me,
3 would result in the same questions that are coming up.
4 So, that...that would be my first point.

5 Second, I...I think I understand what
6 you mean by how the model results are calibrated to the
7 Brock score results from the mesocosm and microcosm
8 studies, and...and I think even saying that, though,
9 there are still some issues that need to be addressed
10 relative to validation.

11 And the one part of it, the first part,
12 to me, is that given that you're mainly using the model
13 to represent time dependency in the system rather than
14 just using a single LOC concentration level or just a
15 simple set of rolling averages, you need to give
16 confidence that the process simulation in the model is
17 adequately represented in time dependency. It's the
18 whole reason you're using it, is to represent time
19 dependency, and it's...it's really hard to sift out
20 through all this whether CASM, as applied to atrazine,
21 with those different EC50 values and the sensitivity to
22 that and so forth is representing time dependency like
23 conceptually it's being depended upon. So, that would
24 be one.

25 And that gets to the idea of maybe

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1 validating with some icon data sets that are out there
 2 or whatever. I don't know that field of availability
 3 but even some of the microcosm or mesocosm studies.
 4 The...the second point on validation
 5 would be some very simple checks of...of whether the
 6 predicted results that are coming up for the highest
 7 LOC scores or the lowest are...are matching at all what
 8 you see in the field at the monitoring sites. The
 9 program which produced all this fantastic monitoring
 10 data was...was...is kind of an interesting distinction
 11 slip that some places it's called the, you know, the
 12 atrazine ecological...exposure ecological monitoring
 13 program, and in other places, it's called the atrazine
 14 ecological monitoring program. It really is the
 15 exposure program.
 16 There's no coher...there's no coincident
 17 monitoring at all of what those systems were like.
 18 It...it would have been nice to know a little bit
 19 whether there's any correlation between in the field
 20 biological quality and the extremes of those conditions
 21 observed.
 22 So, it...it leaves you with this kind of
 23 uncomfortable feeling that it might not be related to
 24 reality, and I know it's a difficult thing and you've
 25 got a lot more data here than you usually do have for

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1 before my involvement, but I'm pretty sure no,
 2 that...that issue was not addressed.
 3 MR. GILLIOM: That's all my comments for
 4 how.
 5 DR. HEERINGA: Thank you very much, Bob.
 6 Our next associate discussant is Dr. Randolph.
 7 DR. RANDOLPH: J.C. Randolph. Thanks
 8 very much to my colleagues, Dr. Grue and Dr. Gilliom.
 9 As the third discussant, of course, I
 10 find that most of the really salient points have been
 11 made, and I don't have much in addition to add to
 12 the...the previous comments.
 13 I did look at the question of the
 14 selection of CASM as an appropriate model, and while,
 15 as we discussed, there are a number of important issues
 16 associated with CASM, as modified in the CASM atrazine
 17 model, it, from my review, it does appear to be
 18 a...a...a very logical choice and one that seems well
 19 suited to this particular task. I'm unaware of any
 20 other similar model out there that would perhaps
 21 accomplish these objectives any better.
 22 DR. HEERINGA: Thank you, Dr. Randolph.
 23 At this point, I guess what I'd like to
 24 do is to open it up, the floor up, to any of the other
 25 panel members for comments on...on this particular

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1 bringing lab data to field relevance. So, I'm not
 2 saying I have the answer, but it's a problem.
 3 And then, I guess the last thing I would
 4 say is that the...and this is...and let me ask this as
 5 a question, because we...we need to bring out some
 6 questions in this in addition to just comments, and I
 7 didn't ask this earlier. When you...part of the
 8 premise of the approach is to collapse the question to
 9 the plants only side of the equation because of the
 10 different...the large differences in toxicity between
 11 plants and animals. And in addition, on the plant
 12 side, the decision was made to stick only with the
 13 active ingredient of atrazine, because that's what is,
 14 by far, the most sensitive issue with plants, and the
 15 degradatives don't matter.
 16 My question is...is, when the decision
 17 was made that the animal toxicities were all far below,
 18 was that looked at any point with the addition of all
 19 the degradants, since, for animals, it's a more
 20 additive toxicity issue than it is such extreme
 21 differences? And I just want to know whether that was
 22 looked at all before the decision was made to go only
 23 to plants and only to the active ingredient.
 24 DR. ERICKSON: This is Russell Erickson.
 25 No, not to my knowledge. Those...some of this happened

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1 question. Yes, Dr. La Point?
 2 DR. LA POINT: Yeah, I like very much
 3 the idea that for this to see that on...on CASM that a
 4 bioenergetics model is being used, because I think
 5 for...for plankton, parphyton, particularly in their
 6 responses is...and as was discussed yesterday, the
 7 nature of atrazine affecting, as a chemical that
 8 precludes photosynthetic...photosynthesis and then
 9 there's recovery from that, I think that the
 10 bioenergetics is really important.
 11 I think some of the issues on...in terms
 12 of on this one, whether CASM could be used for
 13 assessing the effects of atrazine, I just want to
 14 support what have already been said about the...the
 15 nature of the model as a model and...and what I'm
 16 looking for is kind of a trust and degree of maybe even
 17 simplicity in a model that we can...can look at.
 18 And CASM, when it...when it's used and
 19 its correlated with the responses in the mesocosms and
 20 microcosms...and I have to say as an aside it's really
 21 nice to see that all the time and effort spent on a lot
 22 of those early tests are coming to fruition finally.
 23 This is really truly wonderful.
 24 But if you look at the Brock report and
 25 the...the review that Dr. Giddings did, I mean, there

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1 were...69 of those were phytoplankton or parapyton,
2 and only 8 were macrophytes, and yet, then you...we
3 apply this now to the Honey Creek in Ohio data set, and
4 it's all reflected...or to be used, not reflected...to
5 be used in the...in the Midwest where there's high
6 suspended solids, the TSS load is pretty high. It's a
7 very different operation.

8 It...it gets back to the idea of
9 how...and I know that...that atrazine is appropriate
10 for this. I mean, there's a ton of data. It's
11 wonderful. And that it...it doesn't sorb, so the TSS
12 is not there. It's a function of the light.

13 But the problem is it's a matter of the
14 kinds of communities or species that are present there
15 and how reflective using the microcosm/mesocosm data
16 are of going back to the Midwest. I think...I'm pretty
17 sure it's protective. That's a good thing, but it
18 seems like a huge...the...the...and I really like the
19 bioenergetics.

20 I mean, CASM works well with
21 zooplankton, with phytoplankton, with parapyton, but
22 to employ a...as a...as a model in this instance where
23 it might work...you had mentioned it, Dr. Erickson,
24 before about looking at the...the critical issues there
25 where it's 20...10 to 20 g over a 20 to 40-day

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1 period. There would be some utility, again...I guess
2 that's what I'm ultimately calling for, is some
3 validation for this, supporting Jim's earlier comment
4 about using the...some of the Denoil data, for
5 instance, just to see how it...how it responds, whether
6 it's sensitive to that. That's all I'd call for.

7 DR. HEERINGA: Yes, Dr. Ellsworth?

8 DR. ELLSWORTH: I just have a comment,
9 too, here, and the comment is, you know, this is, from
10 what I'm understanding, a very complex great model in
11 terms of describing the various aquatic processes among
12 these species. I'm...I'm relating it to what I'm
13 familiar with which would be chemical fate in transport
14 models.

15 You know, you have very complex models.
16 You know, one I'm familiar with, 150 parameters or
17 something to describe preferential flow or something in
18 soil. But there's no way in the world you're ever
19 going to calibrate that model. It's so complex.

20 But what you can use it for is start to
21 try to get an idea of interactions between preferential
22 and matrix flow and what that might have, you know.
23 But as far as calibrating it and applying it, it's too
24 complex, but it helps us understand the processes.

25 And it's sounding to me a little bit

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1 like, from my perspective here, that this is a similar
2 type of a theme and that, you know, I've got a
3 reductionist tendency to try to get it down, but I'm
4 wondering if it's...it is a tool to look at this LOC,
5 but I'm not convinced it's the only tool that should be
6 used.

7 I'm...I'm wondering if there's not more
8 of a lumped parameter, simpler way of...of doing these
9 things that...that kind of...I mean, like in flow in
10 transport, there's real simple Green and Anth
11 approximations for certain things, you know, that work
12 great, or there's tipping bucket analogies for flow in
13 soil that actually, in many situations on a watershed
14 scale, work great. They're the right scale for the
15 problem.

16 And I'm not sure this is the right tool.
17 I'm not convinced this is the right tool for the
18 problem.

19 So, some of the issues that Robert
20 mentioned yesterday about, you know, maybe this would
21 be better at one point in the watershed down gradient
22 where the chemographs are more uniform or the variables
23 are more homogenous in time. You know, there's
24 probably a scale dependence on this model where it is
25 more appropriate in that watershed than at other

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1 locations.

2 So, I've got some concerns along that
3 line that I wanted to express.

4 DR. HEERINGA: Thank you very much, Dr.
5 Ellsworth. Dr. Fairchild?

6 DR. FAIRCHILD: Jim Fairchild. It's
7 asked if there are other alternative approaches that
8 could have been used in this situation, because they
9 have a very strong data set looking at exposure
10 duration profiles, but I guess it strikes me as I don't
11 necessarily see, in the case of atrazine, what this
12 model provides beyond Dr. Solomon's 1996 paper that
13 provided a species sensitivity distribution which, in
14 my mind, was very, very transparent, one of the largest
15 aquatic ecosystem...or ecotoxin data set that's
16 available. And so, I don't know that it adds
17 this...this much to the estuarine question other than
18 possibly saying that some of these est...other
19 estimates, indeed, are conservative.

20 Now, there may be other uses that
21 haven't been described in this meeting within EPA for
22 using it, so, you know, it may be the best may to be to
23 say that we know these particular characteristics of
24 atrazine. It's very long lived. We know it's a
25 photosynthetic inhibitor. We know that we have not

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1 found effects in the field up to 20 g/L.
 2 And maybe it's better...it's best value
 3 is to be used in the risk assessment process as a
 4 screening tool to say that if it...these other
 5 chemicals do not have these expo...toxicity and
 6 exposure duration profiles similar to atrazine, then
 7 maybe they can be fast tracked or something like that.
 8 So, I mean, it's a tremendous data set
 9 and extremely interesting. I'm still just a little bit
 10 concerned about the transparency to the people that are
 11 going to be using or that are going to be trying to
 12 meet the objectives to meet concentration exposure
 13 deadlines and...and, personally, I just think it
 14 doesn't have the transparency of the species
 15 sensitivity distribution.
 16 DR. HEERINGA: Thank you, Jim. Dr.
 17 Gilliom?
 18 MR. GILLIOM: I wanted to just follow up
 19 that line of thinking with a question that was related
 20 to the last part of the charge question, and
 21 that...that is, does...after you guys have looked at
 22 all this and evaluated it now in all these trials, does
 23 the model really provide better distinction between the
 24 boundaries of the Brock scores which is the whole basis
 25 of the thing than does a series of moving averages?

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1 difference is, Dr. Fairchild, and I think the value
 2 added to this is...again, that's where I see the value
 3 added, being able to...to look at the...to weighted
 4 average.
 5 And regarding...oh, excuse
 6 me...regarding the rolling average issue, the rolling
 7 averages came from the model. I don't know how we'd do
 8 rolling averages without...
 9 MR. GILLIOM: I mean, I think that's
 10 totally reasonable that you would use the model as part
 11 of the tool to get to the averages. And yet, at the
 12 same time, realize that your whole argument for the
 13 fact that the model is calibrated, so to speak, is by
 14 comparing back to the way it replicates the Brock score
 15 division.
 16 DR. ERICKSON: Well, I would...well, I
 17 would say that there's a potential regarding rolling
 18 averages, but I would like to point out to the panel
 19 that the rolling averages were not created for the
 20 purposes of actually estimating the LOC but for
 21 triggering the use of CASM.
 22 And while there's the potential for that
 23 approach to be further refined, the rolling averages
 24 that were previously reported were not for the purposes
 25 of an LOC, and there are some issues there as far as

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1 Does it discriminate any better at all? Because I'm
 2 not seeing it if it does, but...
 3 DR. HEERINGA: Yes, Dr. Erickson,
 4 please, if you can.
 5 DR. ERICKSON: This is Russell Erickson.
 6 I guess, getting back to Dr. Fairchild's and Dr.
 7 Gilliom's questions, both, I think the point I would
 8 first make is that going back to the original question
 9 is that the distinction between the Brock scores is
 10 limited to a certain range of exposure durations, and
 11 the only reason we went into...into doing something
 12 other was to answer the question, well, if you only
 13 have a two or three-day exposure, how are you going to
 14 regulate it, or how are you going to interpret it?
 15 MR. GILLIOM: Yeah, I understand.
 16 DR. ERICKSON: And...and as...as far as
 17 I remember, and I hope I'm not mistaken, the...the
 18 earlier risk assessments didn't really address
 19 the...the duration and fluctuating concentration issue
 20 in the way we thought it should be addressed in terms
 21 of looking at a shorter exposure, and even if we know
 22 these shorter exposures have effects, how are you going
 23 to weight them relative to longer exposures which have
 24 the same effects over a longer duration?
 25 And that's what I...where I think the

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1 doing it in...in that way, but there...there probably
 2 is...is a potential there.
 3 DR. HEERINGA: At this point...yes, Mr.
 4 Brady?
 5 MR. BRADY: I was...I was just wondering
 6 if, from EPA's standpoint, if we could ask the panel
 7 for any other thoughts on the use of non-model
 8 approaches to establish the understanding of this time
 9 course exposure that Dr. Erickson referenced. That was
 10 the second...
 11 DR. HEERINGA: Second part of the
 12 question.
 13 MR. BRADY: ...part of the question, and
 14 I was just wondering if there are any additional
 15 thoughts from the panel members on that. Thank you.
 16 DR. HEERINGA: Chris or Bob?
 17 MR. GILLIOM: I...I would...my last
 18 comment is kind of related to that, because...and
 19 think what it boils down to is the suggestion that
 20 maybe a combination of the model analysis, the
 21 micro/mesocosm results as they stand at their own
 22 duration levels could be put together into a reasoned
 23 approach of what the moving average thresholds could be
 24 in certain levels...in certain ranges to be protective.
 25 So, it's kind of a hybrid approach is

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1 what comes to mind, because I think if the whole
2 pro...the whole issue of transparency was brought up.
3 I think if...if the whole process is contingent every
4 time on the whole model construct and running things,
5 it's going to be pretty hard for a lot of people to
6 understand.
7 And so, if there was a hybrid approach
8 that could translate that into some reasonably
9 protective consensus values everybody was okay with,
10 that would be easier. So, that...my non-model approach
11 is to leave the model a little in the background, bring
12 it together with other things, and translate it into a
13 more traditional range of...of trigger levels or
14 thresholds in concentration terms.
15 DR. HEERINGA: Thank you very much.
16 DR. FAIRCHILD: I'd say...
17 DR. HEERINGA: Dr. Fairchild?
18 DR. FAIRCHILD: ...that one other simple
19 way to...to explore the effect of exposure duration is
20 to simply study it. I mean, as part of our packet, we
21 received a study done with Lemna that demonstrated that
22 the effects or the response or critical threshold did
23 not change much after 7 days to 7, 14, to 21 days, and
24 it also showed that there was recovery in that system.
25 So, that data is out there and could be

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1 DR. HEERINGA: Mr. Brady, if you want
2 to, read the second question.
3 MR. BRADY: Okay.
4 DR. HEERINGA: Thank you, Dr. Erickson.
5 MR. BRADY: Second question, the general
6 methodology employed in this analysis consists of a)
7 correlating model outputs to the micro/mesocosm data to
8 determine the model LOC, and b) applying the model to
9 chemographs of interest to determine whether the LOC is
10 exceeded.
11 Please comment on the scientific
12 strengths and limitations of this approach.
13 DR. HEERINGA: Indirectly, we've already
14 had some discussion on this, but...
15 MR. BRADY: Right.
16 DR. HEERINGA: ...I'll turn to our lead
17 discussant, Dr. Ellsworth.
18 DR. ELLSWORTH: Okay, Tim Ellsworth.
19 The approach, briefly, followed here is,
20 step one, they had a base model configuration for CASM.
21 The model parameters were obtained from the literature,
22 and the physical/chemical attributes corresponded to an
23 I...Ohio stream. This base model was assumed to
24 represent a generic aquatic community in a level 2 or 3
25 midwestern stream.

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1 easily added if you have...have those questions.
2 DR. HEERINGA: Okay. I want to thank
3 the panel members for that discussion. What I'd like
4 to do is turn to Dr. Erickson, Dr. Brady, and Dr.
5 Irene, if you feel whether the panel has addressed this
6 question at this point. I mean, these issues may come
7 up in the discussion of the subsequent four questions
8 on this component, but...
9 MR. BRADY: I think so. Thank you.
10 DR. HEERINGA: In that case, let's move
11 on to charge question number two.
12 DR. ERICKSON: May I just clarify an
13 issue?
14 DR. HEERINGA: Sure, absolutely, Dr.
15 Erickson.
16 DR. ERICKSON: With Dr. Fairchild. I
17 mean, I...on Dr. Fairchild's last comment, I would say
18 that we did incorporate that work into the...the
19 dri...toxicity drivers in the model, and the...and
20 the...and beyond that, the question was looking at
21 the...the integration of the effects over multiple
22 species over the species sensitivity distribution and
23 as the effects changed through time, but we
24 did...that...that work is...was considered in...in the
25 model as far as the toxicity drivers.

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1 Step two, they did a one-year simulation
2 for each of these mesocosm/microcosm studies and
3 compared it with a one-year baseline control simulation
4 with no exposure, and they evaluated several indices in
5 model outputs between the base control and the
6 meso/microcosm conditions, atrazine duration exposure.
7 These included the annual average SSI,
8 percent reduction relative to the control, and an
9 annual maximum SSI, and the difference between total
10 plant biomass in the control and the exposed
11 simulation.
12 And, third, for each model
13 index...indexed study, they developed a graph of the
14 index across one axis and the Brock score across the
15 other, and this was used to identify an LOC in the
16 calibration in terms of an equal quantity of false
17 negatives and false positives. So, that was kind of
18 trying to...the calibration step, if I'm understanding
19 that correct.
20 And so...and then, there was a fourth
21 step, but I have several comments on the above. First,
22 I think one of the scientific strengths, like they've
23 repeatedly said here, is there's a very valuable data
24 set in the microcosm/mesocosm experiments that they're
25 using, and, you know, part of that, I guess, ties in

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1 with I still have this reductionist tendency. I see a
 2 lot of scatter in those scores versus their index, you
 3 know, on the plot that Dr. Erickson showed, figure 2-3,
 4 I believe it was, showing on one axis the index,
 5 various indexes, and on the vertical axis, the Brock
 6 scores, and there was a lot of scatter in that data.
 7 And part, you know, what was maybe going
 8 through my mind is, were there factors, again, in each
 9 of those microcosm/mesocosm experiments that explain
 10 part of that variability that was occurring there, and
 11 was there a way in somehow identifying what those
 12 factors...those differences were and using them in your
 13 generic stream to modify your index values somehow?
 14 I mean, I was trying to reduce that
 15 uncertainty that was so apparent in those data. So, I
 16 wondered if there was an opportunity there at all to
 17 try to modify your calibration based on looking at
 18 that.
 19 Second, again here, like we talked about
 20 this morning...and I understand, I think, more clearly
 21 where you're coming from...but this idea that, you
 22 know, I know I'm not...you know, you're...you've been
 23 saying it's this time course, this complex chemograph
 24 that you're really trying to figure out how do I assess
 25 an effect for that. That's what you're trying to do.

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1 I understand that, but I'm still very concerned not
 2 about absolute values per se, but I would want to know,
 3 in this stream, you know, am I really having an impact
 4 on the aquatic community here.
 5 Where I'm going with this, again, the
 6 idea that there's really been no evaluation of the
 7 model to estimate impacts of atrazine on aquatic
 8 communities in real world environments, and I
 9 understand the complexity in the model, and I'm not
 10 sure how that would ever be done.
 11 But as a consequence, I just...what
 12 confidence can we have in assuming that the relative
 13 effects the model estimates correspond with what's
 14 going on in that stream? The highly variable, you
 15 know, spatial and temporal fluctuations in physical
 16 properties and parameters...I would assume that, you
 17 know, this model was developed for a homogenous water
 18 column.
 19 You know, in a real stream, there's
 20 probably a distribution of parameters within a one
 21 square meter column in this model, you know, and to try
 22 to lump them into one set even, I'm wondering what that
 23 has on the relationships here.
 24 And is there any way...you said you
 25 derived model parameters from the literature. I

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1 understand there's hundreds of model parameters, but
 2 there's some uncertainty in those, you know, from the
 3 literature.
 4 Should that be included in the
 5 uncertainty assessment? You know, was...was the range
 6 of this parameterization that was derived from the
 7 literature, is there some value in trying to quantify
 8 the uncertainty in that parameterization and
 9 incorporate that as part of an uncertainty factor? Was
 10 another comment I had.
 11 And the other one I made earlier which
 12 was that there might be a scale dependence in the
 13 validity of this model that should be looked at in
 14 terms of...and the way to maybe get at that would be to
 15 look at, you know, this idea of...of lumping results by
 16 looking at little microcosms, if you will, within a
 17 column and trying to lump the aggregate of that and see
 18 what the process would look like and see if CASM can
 19 represent this kind of lumped thing that would result
 20 from it.
 21 Anyway, maybe that's not clear, but the
 22 idea that Robert expressed that it's more appropriate
 23 in a homogenous system than it is in one that's highly
 24 variable.
 25 Third, the CASM model performs risk

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1 assessments on the premise that...and this is a quote
 2 from Dr. Bartell, probably not a perfect quote
 3 here...sublethal toxic effects can be realistically
 4 modeled by altering rates of physiological processes
 5 that determine growth in relation to atrazine
 6 concentration exposures.
 7 I didn't see the data that supported
 8 that. The i...are there data that kind of show the
 9 altering rates in these parameters as a function of...I
 10 guess I'm still going back to that. I mean, I...maybe
 11 there are and I just missed that one.
 12 Fourth, the chosen model index does not
 13 distinguish, for me, between what seemed to be highly
 14 contrasting experimental conditions. For example, two
 15 exposure profiles can be considered, the first, a daily
 16 50 percent SSI value for 10 days followed by 0 for the
 17 rest of the year, you know, versus a 1.4 percent SSI
 18 for every day of the year. Those both would give the
 19 same annual average SSI, but, to me, those are very
 20 different impacts on aquatic communities, and I'm not
 21 sure they should have the same index value.
 22 So, I...I guess I've got some concerns
 23 about the index as a...and I know you're just trying to
 24 come up with one measure to represent a really complex
 25 system, and that's a challenge, but I'm not

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1 sure...maybe there should be something else like
 2 associated, a weighted index, that might include
 3 primary production or something else instead of just
 4 a...an individual number perhaps.
 5 And, also, given that most of the
 6 biomass production in Midwestern streams occurs during
 7 April through October which is when atrazine levels are
 8 relatively high, I'm struggling with whether the index,
 9 the annual index, is appropriate, I guess. I don't
 10 know. You probably know...it's not clear to me that it
 11 is, and I...maybe you have good reasons for why that I
 12 didn't understand yet.
 13 And then, the other thing is the
 14 uncertainty assessment which I think will come later,
 15 maybe as...I don't think that's been fully addressed.
 16 I think that's actually a next...later one.
 17 DR. HEERINGA: Next question on
 18 sensitivity analysis and uncertainty
 19 DR. FAIRCHILD: Yeah.
 20 DR. HEERINGA: ...to be brought in
 21 there.
 22 DR. ELLSWORTH: Step...step four, the 16
 23 annual atrazine chemographs that you use of varying
 24 exposure magnitude and duration were selected, it
 25 seemed to me, like on a somewhat ad hoc basis.

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1 I didn't...you know, it wasn't, you
 2 know, clear to me why that set was chosen, and it seems
 3 to have had a pretty heavy weight in terms of the
 4 uncertainty analysis and looking at the multiplication
 5 factors, et cetera, and it's not clear to me that that
 6 encompasses the spectrum of chemographs that maybe
 7 should be considered. You know, I'm not sure how you
 8 would go about assigning those 16, but I...I just had
 9 some questions whether they represent the spectrum that
 10 you should be considering to look at this sensitivity
 11 analysis.
 12 And I'm almost done here. So, the...I
 13 think I'll just quit. I worried a little bit about
 14 rainfall variability, temperature, how that influ...I
 15 mean, like the, you know, the...the studies, the
 16 chemographs that you have are for specific rainfall,
 17 the field ones anyway, which I'm very impressed with
 18 the data set, but it's for specific rainfall patterns
 19 versus timing, application timings, and what's the
 20 uncertainty there in rainfall distributions with
 21 application timing? Surely, that would have an impact
 22 on kind of this uncertainty assessment.
 23 Anyway, that's all I've got.
 24 DR. HEERINGA: Okay, thank you, Dr.
 25 Ellsworth. Our first associate discussant on this

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1 question is Michael Chu, Dr. Chu.
 2 DR. CHU: I'm Michael Chu. I just want
 3 to add a couple of comments on this question.
 4 First, as we know, it's...it's almost
 5 impossible to do atrazine toxicity analyses for all
 6 selected sites under real conditions. So, I think
 7 using the atrazine toxicity data from microcosm and
 8 mesocosm studies is really a natural choice...natural
 9 choice for this...for this ecological assessment study.
 10 But the major...the major issue is how
 11 to use these data. For example, the micro...microcosm
 12 and the mesocosm environmental studies and the data and
 13 also the toxicity conclusions were with regard to
 14 these...these conclusions based on controlled
 15 conditions, and that means the conditions including,
 16 for example, atrazine concentrations, durations,
 17 temperature, light, and so on and so forth.
 18 So, a critical question is how to take
 19 into account these original condition in our
 20 applications and, also, particularly in computer
 21 modeling. At least, I think in addition to atrazine
 22 concentration and duration, we really need to consider
 23 some major factors related to these microcosm and
 24 mesocosm studies.
 25 So, also, when we move from the

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1 micro...microcosm and the mesocosm study to a real
 2 system, how to keep the same conditions in order to
 3 have the same toxic effects. That is, to my
 4 understanding, these kinds of toxicity conclusions are
 5 relative to the conditions. So, how to keep the
 6 conditions in order to have the same toxicity effects.
 7 This is the first one.
 8 The second one, actually, both a and b,
 9 depend on the CASM modeling. So, this model is the
 10 central part of the assessment methodology and all
 11 related analyses. Also, the model is, as we know, the
 12 model is a pore size based model. So...so, I really
 13 think we need to...we need to evaluate in the model
 14 performance first before we use this model for any
 15 predictions.
 16 That means we really need to do some
 17 calibration and validation. We can use the microcosm
 18 or mesocosm data, if possible, or...and real data in
 19 Midwestern streams, especially in Midwestern streams,
 20 because this is our study area.
 21 And the third one, as you know, I tried
 22 to understand what is the real meaning of what is
 23 called the effects index. This effects index is based
 24 on the average...the average SSI values over the entire
 25 simulation period. In our case, say, 365 days.

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1 Why...sometimes I cannot understand the real meaning
 2 why, because, for example, from the same effects index
 3 value may have different meanings, because it may
 4 have...it may represent a different daily SSI time
 5 series. Of course, 365 daily SSI value...values.
 6 So, in other words, also, that means we
 7 may have the same...same effects index may have
 8 different ecological signif...significance.
 9 Also, I understand in this study, we
 10 focused on some relative values or whatever, but I
 11 really want to see this kind of a relative
 12 index...relative index is computed based on absolute
 13 simulations. So, also, this is also...another reason I
 14 really want to emphasize the model calibration and
 15 validation.
 16 Thank you.
 17 DR. HEERINGA: Thank you very much, Dr.
 18 Chu. Our third associate discussant is...is Dr. La
 19 Point.
 20 DR. LA POINT: Thank you.
 21 The use of micro and mesocosm data to
 22 act as the truth for determining an LOC is a good
 23 approach. It uses the extensive data base for atrazine
 24 in experimental ecosystems and forms a basis to
 25 establish not only levels of concern but to see how

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1 experimental ecosystem tests were largely phytoplankton
 2 or parapyton, and we know the recovery and growth
 3 rates for the various sizes of these organisms.
 4 So, plots of concentration and response
 5 and recovery time would help determine or at least
 6 support an LOC. What I'd actually recommend is a post
 7 hoc review of the data to determine scale effects, the
 8 size of the organism to time to respond and the time to
 9 recovery.
 10 And second to this is also, as Dr. Chu
 11 mentioned, I think that understanding the...the
 12 other...the chemographs for the nutrients, how it
 13 influences more of this, would be important to do to
 14 relate the experimental ecosystem responses to a real
 15 world response.
 16 And, second, there may be an influence
 17 of one set of Taxa, for instance, the rooted
 18 macrophytes, that come to dominate the concentration
 19 responses in some of the tests, and we need to know
 20 which those are. It's another layer over the...the
 21 Brock scores, because that can moderate the overall
 22 predictions of carbon produced per meter squared,
 23 especially for some of these that were more pond, that
 24 were ponds, actually, or replicated ponds,
 25 nevertheless.

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1 photosynthetic organisms respond to different
 2 concentrations and different exposure durations, and I
 3 want to join with Dr. Grue in saying I really
 4 compliment the EPA in working with Syngenta and
 5 contractors on this to...it's a great overall study.
 6 Following up, when the LOC is exceeded,
 7 the model is expected to indicate if and, if so, how
 8 much the producer and consumer populations are
 9 affected. The measure of response is a summed SSI over
 10 the selected species decided to be representative of
 11 different watersheds and stream systems, in this case.
 12 So, I have a...a few questions and
 13 suggestions that come from this in terms of work and
 14 the correlation, because in answering the charge
 15 question specifically, I think that yes, correlating
 16 model outputs to the scores, the Brock scores, as we're
 17 calling them, can work. The devil, as always, is in
 18 the details.
 19 I presume the correlations that work
 20 best with similar sets of Taxa, for instance, the
 21 parapyte and the macrophytes, the benthic algae, and
 22 in terms of the complexity of the model, there may be a
 23 simpler approach, because, as Dr. Fairchild mentioned
 24 earlier, we've got a time course for plant species,
 25 because most of the micro and mesocosm in the

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1 Plants, particularly macrophytes, are
 2 known to be leaky systems with respect to carbon,
 3 nitrogen, and phosphorous, and they influence a great
 4 deal of what goes in in terms of the parapytic growth
 5 on them. Hence, atrazine exposures for large plants
 6 will probably influence smaller photosynthetic
 7 organisms in decidedly nonlinear ways, and that
 8 contributes, no doubt, to some of the variability seen
 9 in that...the plot that Dr. Erickson put up there with
 10 the Brock scores and the...and the responses.
 11 Now, one cautionary...not cautionary
 12 note, just because it's excellent. I mean, there's
 13 been a lot of work in this, but in the Brock, et.al.
 14 paper, it...a number of the endpoints were
 15 chlorophylleated biomass as a surrogate endpoint for
 16 plant risk or, at least, phytoplanktonic responses.
 17 And, again, that works well for phytoplankton and, most
 18 probably, parapyton. And as these Taxa are small and
 19 respond quickly, it appears to me that the correlations
 20 will be best with these phytoplanktonic species.
 21 They also tend to be the ones that end
 22 up low or, that is to say, most sensitive on species
 23 sensitivity distributions, and so, that approach is
 24 conservative for a safety assessment for...for atrazine
 25 and, I think, should be employed or compared to this as

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1 a...a second way of looking at the...the model, the
 2 CASM output.
 3 Okay, as we've seen, for the LOCs
 4 calculated primarily on the SSIs for the Midwest, it
 5 appears that the model correlations fit well, and it's
 6 actually pretty conservative. If the risk assessment
 7 is to be useful across the country...and that's a
 8 question, how it would be used...my question is how it
 9 would be used in different agricultural areas such as
 10 the Southeast. There will have to be further research
 11 and, again, validation to determine how well the
 12 overall community responses, particularly the plant
 13 community responses, reflect model predictions.
 14 And then, my last point, again, goes
 15 back to the chemographs, how they...how the other ones
 16 deal with it other than just the chemograph for
 17 the...for atrazine.
 18 That's my comments. Thank you.
 19 DR. HEERINGA: Thank you very much, Dr.
 20 La Point.
 21 Comments from any other of the panel
 22 members on this particular charge question? Dr.
 23 Effland?
 24 DR. EFFLAND: Bill Effland. I just
 25 had...actually, I had a question about the chemographs,

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1 it was sort of picked from the universe we were...of
 2 actual observed chemographs we were dealing with
 3 and...and...and I thought, at least...you know, I'm not
 4 an exposure person. I thought they captured a...a good
 5 breadth.
 6 MR. THURMAN: Yeah, I...I just...follow
 7 up. I mean, the main alteration was...I mean,
 8 basically, we took a look at...at a number of different
 9 chemographs and just tried to characterize the basic
 10 shape which dealt with number of peaks, magnitudes of
 11 peaks, and duration of peaks. And we basically said
 12 let's take a look at what we do have in terms of
 13 atrazine, both in terms of some of the initial
 14 monit...monitoring results and in other monitoring data
 15 we had.
 16 And some of the altering may be where we
 17 had less frequent sampling. We may...we filled in some
 18 of those sampling, but the most part was the order of
 19 the peaks so that, you know, the...the...particularly
 20 where they were different sizes, just different sized
 21 peak...peaks, just kind of changing that combination in
 22 there.
 23 We found a couple of places where we had
 24 some monitoring in reservoirs which tend to have more
 25 of a prolonged exposure, duration of exposure,

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1 the 16 chemographs that...that you show in the series
 2 of slides. Are those actual chemographs? Or I thought
 3 I heard a comment about they were altered somehow, and
 4 I...and I was just curious about that.
 5 DR. ERICKSON: Okay. Some of them are
 6 actual chemographs either from past studies like the
 7 Heidelberg College studies or from the current
 8 monitoring program, the early years of the current
 9 monitoring program, but some of those, then, were
 10 altered to some degree to try to increase the
 11 diversity, the...the breadth of...of the possible
 12 responses.
 13 For example, if there was a chemograph
 14 with two peaks where there was a smaller early season
 15 peak and a later...a larger later season peak, they
 16 were reversed so that the larger peak was earlier just
 17 to address the issue of well, there's a certain amount
 18 of variability in the precipitation patterns, and...and
 19 we did not necessarily catch the entire breadth. And
 20 so, if there was a precipitation pattern that caused
 21 a...a greater early one...Nelson Thurman was the one
 22 who provided me the...these things, so maybe he wants
 23 to comment further.
 24 But, I mean, I was really satisfied with
 25 this relative to the other ones I had...I had seen, but

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1 that...that we pulled in. So, it...but we...the intent
 2 was pulling actual chemographs out and using that as
 3 representation.
 4 And we kind of stopped at three peaks,
 5 and if you look at the analysis we have, we...you see a
 6 lot of these...a lot of these sites actually have four
 7 to six peaks in them. So, we just looked at...kind of
 8 stopped at that set.
 9 DR. ERICKSON: If I can just add one
 10 point to the...this chemograph selection, if you...you
 11 see in the white paper, the...at least for my purposes,
 12 for just addressing the question of the...how sensitive
 13 results are to decisions made in how the model is
 14 formulated which is the basic purpose of the
 15 sensitivity analysis, I was...only the shapes of these
 16 chemographs matter, not the absolute values of the
 17 peaks, because I'm asking the question, basically, how
 18 high is the highest peak in the amplification?
 19 So I'm adjusting the amplitude to
 20 to...to equal the LOC and...and then comparing models
 21 by that. So, the...the models are all compared to the
 22 same chemograph. So, we were looking for diversity of
 23 shapes, not a diversity of amplitudes, because the
 24 amplitude question is taken care of within the
 25 analysis.

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1 DR. HEERINGA: Dr. Grue?
 2 DR. GRUE: I think it would have been
 3 very helpful to have had that clearly stated in the
 4 white paper, because just looking at the wording here,
 5 I...I assumed those were the actual chemographs out of
 6 this atrazine monitoring effort and that they had in no
 7 way been...been manipulated.
 8 And it goes back to the comments you
 9 made about, you know, long duration exposures above 10
 10 to 20 ppb, and when I looked at chemograph 15, I see
 11 exposures exceeding 25 ppb for 60. It's hard to tell
 12 right here, but anyway, way in excess of the time
 13 period you mentioned, you know, couple months. Now, is
 14 that a...is that an actual exposure, or is that a
 15 construct to...to examine the...the performance of
 16 the...the performance of the model?
 17 I guess my point is that it would have
 18 been very helpful to have had that clearly stated, that
 19 some of these were manipulated to facilitate the
 20 analysis of the performance of the model versus actual
 21 data from the field, because it says up here time
 22 series in natural systems, and I'm assuming when that
 23 statement is made that those are actual...actual data,
 24 unless I'm mis...misinterpreting these chemographs.
 25 DR. ERICKSON: Point well taken. Those

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1 just drawing a line to divide the highs and the lows.
 2 It's...it's not a regression analysis or
 3 anything like that with uncertainty incorporated on a
 4 statistical basis. So, correlating is kind of
 5 misleading. I would say you're using it as a decision
 6 criteria to draw a bright line down the middle which
 7 the...the last question I have along this line, then,
 8 is...is that the decision criteria explained is to kind
 9 of equalize production of false negatives and false
 10 positives on an equal basis. And it happened that
 11 there are I forget how many exactly, but there's three
 12 or four on each end of the line or five or six.
 13 From, I guess, the scientific reasoning
 14 point of view, how do you relate that decision criteria
 15 to what you guys normally do with kind of drawing the
 16 line under the more sensitive level when you have such
 17 small sample sizes? So, basically, you're taking a
 18 substantial percentage in either case and letting it go
 19 to the other side of that demarcation line using the
 20 results of the mesocosm and microcosm studies.
 21 So, I wondered what...having not been in
 22 on that and it's not explained very well in there,
 23 what's the background on that choice?
 24 DR. HEERINGA: This is really a question
 25 of what...how high you establish sensitivity

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1 chemographs were partly manipulated and...and
 2 were...the analysis there were strictly to assess model
 3 performances. The analyses of the...for the actual
 4 assessment purposes will come later in the review,
 5 though some of these chemographs will be part of that
 6 analysis for the...a subset of them.
 7 DR. HEERINGA: Additional comments on
 8 this charge question? Yes, Mr. Gilliom?
 9 MR. GILLIOM: Sorry if some of these are
 10 kind of holdover questions we were storing up. Right?
 11 So, the first part of my question is, is EPA
 12 staff...have you guys reviewed and feel, I'll say,
 13 equivalently comfortable with all the Brock scores out
 14 of the meso and microcosm studies so that on
 15 a...basically, on an equal basis, they're all part of
 16 the game, the 77 or whatever? I'm assuming yes, but...
 17 DR. IRENE: Yeah, I think the answer to
 18 that is yes.
 19 MR. GILLIOM: Okay.
 20 DR. HEERINGA: Dr. Irene.
 21 MR. GILLIOM: And then, to the part A
 22 there, then, I just...it's kind of a...maybe it's a
 23 fine point, but when we talk about correlating those
 24 results to the...the Steinhart output from the model,
 25 we're really not correlating them, so to speak; we're

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1 specificity with regard to these criteria, I guess. I
 2 don't know if that's something you can answer at this
 3 point or would prefer to defer. Maybe that's something
 4 that if we could return to?
 5 DR. IRENE: Yeah, I...I'd like to defer
 6 it at this...Stephanie Irene. I'd like to defer it at
 7 this point, and perhaps we can get back to you on that.
 8 Okay?
 9 DR. HEERINGA: Seems log...I mean,
 10 splitting it in half is sort of the default, but
 11 scientifically, I understand the question very clearly
 12 in terms of risk assessment particularly.
 13 Dr. Portier has a...
 14 DR. PORTIER: This is more to the
 15 ecologists on the panel. One of the things we
 16 mentioned yesterday was looking at the similarity
 17 measure which, in a sense, kind of equally looks across
 18 these populations. Right? There's no weighting that's
 19 involved in there.
 20 What do you think...and Dr. La Point
 21 mentioned something about well, but we're really
 22 looking more at the plants than the animals, and my
 23 question is, can that...can that similarity measure be
 24 fine tuned with weighting? Again, within the context
 25 of what EPA's talking about here which is a regional

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1 assessment index, can you conceive of a way of
2 weighting that that would provide that index with a
3 little bit more ecological rigor, if I use that word,
4 that would kind of help you feel more convinced of that
5 index?

6 I'd like to hear us discuss that a
7 little bit.

8 DR. HEERINGA: Dr. La Point started down
9 that road. Please.

10 DR. LA POINT: Yes, I...this is La
11 Point. I think it can be if...if the responses are
12 seen. Jim mentioned earlier about the species
13 sensitivity index which I, again, in the original
14 Solomon paper is very powerful, given all the data that
15 exist for atrazine, and if you look at that, one other
16 component of that is that the more sensitive species
17 tend to be the smaller size species.

18 And...so, size is a very important
19 scaling factor for this...for these organisms, for the
20 plants, and I think, you know, there have been lots of
21 papers written about the responses and recovery
22 potential for smaller organisms, and once the atrazine
23 is removed, once the exposure is gone, the pulse is
24 gone, then those organisms also have a more rapid
25 potential for recovery, so...depending on their

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1 the paraphyton, the phytoplankton were the endpoints or
2 whether it was macrophytes would be pretty revealing in
3 the sense of showing some of the...the predictions that
4 would come out.

5 DR. HEERINGA: Would that also have
6 implication for organisms up the food chain, too, in
7 terms of the impacts there?

8 DR. LA POINT: Well, I see...in terms of
9 an ecological impact, yeah. No, that...that's a good
10 point in terms of carrying it through. If the food
11 base is taken away, of course, that could...but, again,
12 that would be size dependent.

13 DR. HEERINGA: Sure. Dr. Grue?

14 DR. GRUE: I think that's a really good
15 point, and one of the concerns I've had and it's also
16 been voiced by other committee members is what...what
17 effects have the...the inclusion of the macrophytes
18 have...have had on the results of those organisms that
19 are lower on the...in the food web, and I think Dr. La
20 Point's hit that well as well as your comments, and it
21 would be interesting to see how those scores vary,
22 depending on whether the macrophytes are included
23 or...or not.

24 DR. HEERINGA: Okay. Well, at this
25 point, I want to move to take a break, but I think turn

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1 individual sensitivities, of course.

2 But...so I think that's one way right
3 there rather than lumping them all, is to focus on
4 groups based on size.

5 I know there was some discussion earlier
6 about using the animals as well, the consumers, if you
7 wish, but I remain convinced that for atrazine, given
8 the nature of its mode of action, that focusing on the
9 more sensitive component in the...in the ecosystem, the
10 plants, it makes more sense if we're trying to be
11 conservative in this case, but that's my opinion.
12 So...

13 DR. HEERINGA: Dr. La Point, just a
14 naive view of this, your recommendation would be to
15 focus on those more sensitive species, possibly the
16 exclusion of the macrophytes, or would you consider
17 some sort of weighting based on the species sensitivity
18 that's been demonstrated?

19 DR. LA POINT: Well, you'd be doing both
20 if the...because the weighting by that is, again, the
21 size basis as well, but yeah, I think that for a lot of
22 this, if a revision...not a revision but just to look
23 again at the Brock scores in the...in the plot there of
24 the...the LOCs, to do that and...and look at the
25 responses as a function of the primary, whether it was

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1 to Dr. Erickson, Mr. Brady, Dr. Irene, you feel
2 comfortable with the response at this point to this
3 question?

4 MR. BRADY: Do you have anything, Russ?

5 DR. ERICKSON: No, I don't. This is
6 Russ Erickson. No, I think I am quite pleased with the
7 comments and questions and feedback here. I think
8 there...there, you know, obviously could be some
9 explanations from us, but that's not what we're
10 supposed to do right now. So...

11 DR. HEERINGA: Okay. At this point in
12 time, then...and my watch is slightly off, but assume
13 it's 20 after 10:00. Let's take a 15-minute break and
14 reconvene at 25 minutes of 11:00.

15 (WHEREUPON, a brief recess was taken.)

16 DR. HEERINGA: Okay, welcome back,
17 everybody, to the second half of our second morning
18 session of the meeting of the FIFRA Science Advisory
19 Panel on the topic of the Interpretation of the
20 Ecological Significance of Atrazine Stream-Water
21 Concentrations Using a Statistically-Designed
22 Monitoring Program.

23 We have completed at least initial
24 discussion of charge questions 1 and 2, and I believe
25 that Dr. Irene had a comment that she wanted to...

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1 DR. IRENE: Yeah, I...I...this is
 2 Stephanie Irene, and I'd like to make a clarification
 3 for several of the panel members and also for Dr.
 4 Gilliom.
 5 In...in my presentation, I had mentioned
 6 that we decided to use the parent compound, and the
 7 reason for that is that the...all of the degradates
 8 were tested, and they were 700...700 times less potent
 9 than the parent in the plans, and they were not even
 10 toxic at all to fish and invertebrates at the level of
 11 solubility.
 12 So, those are the reasons for just using
 13 for...for the ecological study, and as you...as you
 14 know that for human health, the degradates are
 15 included, so...because of their mammalian toxicity.
 16 Thank you.
 17 DR. HEERINGA: Don Brady, did you have
 18 some...
 19 MR. BRADY: Mr. Chairman, I...I wonder
 20 if it...I'd like to make a suggestion for consideration
 21 of the panel.
 22 A number of the questions that came up,
 23 both in the discussion this morning and in the first
 24 two charge questions related to the CASM model, and I'm
 25 wondering if we could hear Dr. Bartell on some of those

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1 than...that I could, but...and a...the important point
 2 to make about this is, two points.
 3 You have to be careful in terms of just
 4 what combinations of environmental factors that you
 5 vary and how you vary them, because you could be
 6 creating environmental conditions that don't exist
 7 anywhere on the planet, let alone in the Midwest.
 8 And the second point is the results of
 9 modifying those environmental inputs like temperature,
 10 nutrient, so on and so forth, really affects the
 11 production dynamics of the reference simulation. In a
 12 sense, you're just moving the location of that stream
 13 around the Midwest in relationship to those
 14 environmental parameters, but you're still running each
 15 of the watershed exposure scenarios through that same
 16 reference condition, and you're essentially just
 17 shifting the location of the Brock scores along the SSI
 18 axis without shifting their relative distribution to
 19 one another.
 20 That's why you don't see a dramatic
 21 impact on some of the endpoints that Russ so capably
 22 presented yesterday.
 23 So, two impoint...two important points
 24 with regard to sensitivity analysis.
 25 If we could get on to...again, I'm going

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1 issues as a...a way to clarify some of those.
 2 DR. HEERINGA: Yes, I think that I'll
 3 accept that as a...if there are questions,
 4 uncertainties, clarification. Dr. Bartell, if...I'd
 5 appreciate it if you could be relatively concise, but
 6 welcome, and I'm going to say that to everybody, so you
 7 shouldn't be...you cannot take offense. And it's
 8 certainly no reflection on his presentations yesterday
 9 which I thought were very well structured.
 10 DR. BARTELL: I'll do my best to talk
 11 faster, but...there are some slides that I think Dan
 12 has right there, if I can have those presented.
 13 Again, my name is Steve Bartell, one of
 14 the two consulting engineers, and I was contracted by
 15 Syngenta to develop CASM atrazine. I am the original
 16 developer of CASM itself.
 17 Because of the concerns expressed, and
 18 rightly so, by the panel members concerning the
 19 validity of the model, I just wanted to offer a few
 20 additional comments for you to consider in your
 21 deliberations with regard to the charge questions.
 22 Actually, as a...as a preface, we performed some of the
 23 multi-variant sensitivity analyses that the panel
 24 sug...suggested in terms of looking at multiple
 25 factors, and Dr. Volz could speak to this more directly

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1 to try and go through this very quickly. I would just
 2 offer these comments in relationship using a...you
 3 know, it's easy to refute a model, any model, at some
 4 level of detail. The question is what you're left when
 5 you do that, but, in effect, if you're using the model
 6 in research and development, you want to falsify the
 7 model, because that tells you what is the next
 8 experiment to perform, what's the next critical piece
 9 of data to improve the model performance and improve
 10 your understanding of the system.
 11 However, when you're using the model in
 12 more of a decision making context, it's exactly the
 13 opposite. You want to have some confidence that the
 14 results that you're basing those decisions on are...are
 15 founded in some fashion.
 16 So, consistent with EPA's framework for
 17 ecological risk assessment, I'd offer several multiple
 18 lines of evidence that we could use to evaluate both
 19 the CASM and the CASM atrazine, and I don't want to
 20 dwell too much on the CASM itself, because seven though
 21 we've demonstrated the ability to provide accurate
 22 site-specific predictions of the model for other
 23 systems, for other chemicals, you might well say well,
 24 what does that mean for atrazine in Midwestern streams,
 25 and your point would be well taken.

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1 The main point I just wish to make is
 2 that in previous site-specific applications, we have
 3 done very well in terms of agreement between model
 4 predictions and measurements.
 5 And if I could...I don't have control of
 6 the slides, so if we could, just go to the next one.
 7 Oh, could you back up one? I think it skipped over
 8 one. Keep going. Well, okay.
 9 Some...some...one slide is apparently
 10 missing, but at any rate, I want to emphasize there are
 11 several different levels of organization that you can
 12 use to evaluate the model performance. First of all,
 13 the overall bioenergetics equation has been well
 14 accepted and recognized and used to describe production
 15 dynamics for aquatic organisms and others since the
 16 early 1970s when these models were first developed for
 17 several lakes in the United States and else...and
 18 elsewhere. So, at that level, the model is well
 19 founded in its governing equations.
 20 When we look at the generally accepted
 21 relationships, nonlinear relationships, between light,
 22 temperature, and nutrients as it affects growth, if we
 23 look at how variability in the environmental data that
 24 drive, for the Midwestern stream, for example, that
 25 does generate those nonlinear responses. So, at that

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1 level of model performance, you can...the model does
 2 what it ought to do.
 3 So, for the model performance, the
 4 equations are well founded.
 5 Next slide, please.
 6 Again, this just represents one of
 7 the...probably the most detailed site-specific
 8 application of the CASM, in fact, one of the most
 9 detailed site-specific applications of any aquatic
 10 systems model that I know. It just happens to be for a
 11 Japanese lake and shows the model data comparisons for
 12 several phytoplankton, one aquatic plant, and some
 13 zooplankton.
 14 If we can summarize those transients,
 15 that means it's the sort of thing that people want to
 16 see when they're looking at model performance, is
 17 comparison of the time transients with what you
 18 observe.
 19 We can also summarize that in the next
 20 slide, just very simple ratios of what the model
 21 predicts versus what's observed. If the value is 1,
 22 it's perfect agreement. Deviations from 1 above or
 23 below indicate the model is over-or underestimating.
 24 This is looking at both annual and peak
 25 production for a variety of phytoplankton, one

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1 macrophyte, and some consumers, and, again, the...those
 2 of you that are familiar with the use of these kinds of
 3 ecological models might suggest that that's not a bad
 4 performance.
 5 Next.
 6 Okay, but what does that mean with
 7 regard to a generic stream model? And I brought this
 8 slide up yesterday and perhaps didn't spend enough time
 9 on it, but what I wanted to drive home was that given
 10 the uncertainties in the assumptions, the
 11 specifications of the model, food web, the derivation
 12 of the supporting bioenergetics parameters, the
 13 environmental forcing functions of light, temperature,
 14 and nutrients, patching this all together for generic
 15 application and launching it provides us with model
 16 results that are reasonable for values that have been
 17 reported for a Midwestern stream.
 18 It's...we don't get ten orders of
 19 magnitude high or ten orders of magnitude low. We're
 20 sort in the ball park with regard to quantity for the
 21 average plant biomass, for example.
 22 It does provide other observations,
 23 maybe more qualitative in nature, that are consistent
 24 with observations that we make in the systems. You
 25 know, it's dominated by diatoms, then chorified, so

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1 it's in blue-greens.
 2 If we look within the various plant
 3 guilds, we see there's one or two dominant populations,
 4 several common, several rare. There's variations in
 5 the population-specific timing of peak production.
 6 If we look at average consumer biomass,
 7 benthic invertebrates, 1, about 10 percent of
 8 parphyton. You know, that's not bad.
 9 Fish production sort of equal to benthic
 10 invertebrates. Well, J.D. Allen reported those sorts
 11 of observations, you know, a long time ago.
 12 Independent...or in addition to the
 13 performance of the biological populations, if we look
 14 at some of the manifestations of physical-chemical
 15 attributes that are influenced internally by the
 16 production of the...of the model, you know, plants take
 17 up nutrients, die, decompose. Nutrients are renalized
 18 back in the system. They respond to varial...temporal
 19 variations in...in loadings.
 20 We see seasonal shifts in NNP limitation
 21 predicted by the model that are consistent with what we
 22 observe in these systems. The dissolved oxygen
 23 concentration is predicted by the model, are consistent
 24 with what we observe. We see the relative importance
 25 of DOC versus POC, seem to map onto patterns that are

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1 reasonable for these kinds of systems.
 2 So, in developing a generic model, it
 3 generally seems to describe reasonable production
 4 dynamic for a stream. So, if...from that perspective,
 5 I think we've demonstrated its credibility.
 6 If you're going to layer on the effects
 7 of atrazine, we ought to have something that's
 8 ecologically credible to do it, and I think that was
 9 your concern, and I'm hoping that I'm providing you
 10 with at least some confidence that, in fact, it is.
 11 Next slide, please.
 12 So...I'm sorry, that...there's...oh, and
 13 this is just some of the detailed studies, limited,
 14 admittedly, and we're, you know, still in the process
 15 of accumulating data to just see how generally the
 16 model results are. This shows average values for
 17 parapyton compared to other similar systems
 18 throughout. And, again, that 14 compares not too bad
 19 with 12, 6, 20 to 25, you know. So, it's...it appears
 20 to be a...a reasonable representation of generically
 21 for these systems.
 22 Next.
 23 If you look beneath the...those...those
 24 curves of community structure, again, this shows, for
 25 the parapyton, it's a log scale in terms of grams

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1 If you assign each of the model
 2 populations the 10th percentile estimate...and these
 3 have been updated somewhat recently...you get a greater
 4 response and a different, you know, a higher LOC. Not
 5 surprising.
 6 Next slide, please.
 7 Again, recall the reference simulation,
 8 those populations of parapyton. So, what happens if
 9 we expose them to atrazine?
 10 You might expect, based upon our
 11 understanding of the ecology and the relative
 12 sensitivity, that some populations might not be
 13 impacted much, some might be highly impacted. Given
 14 release from competitive interactions, you might even
 15 see some populations increase.
 16 And that's exactly what we see in
 17 the...in these simulations using the CASM atrazine
 18 model. And it's, importantly, it's these kinds of
 19 responses that go into the calculation of the SSI
 20 which, by the way, is weighted. Its weighted according
 21 to the biomass of each of the contributing populations,
 22 and it's weighted by...to sensitivity vis-a-vis the
 23 EC50 that's assigned to the model population.
 24 Next slide, please.
 25 So, with those sorts of potential

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1 carbon on the y axis through time. We see these
 2 temporal transients where populations differ in their
 3 time of peak production.
 4 They also...again, this is just showing
 5 temporal variability in the summary I mentioned before
 6 about having a...a few common and a few rare species,
 7 but it has relevance in terms of expression of toxicity
 8 data which, on the next slide, again, Russ and his
 9 really interesting analysis emphasized the variability
 10 in the population specific atrazine responses, and he
 11 chose to do this and, if I recall correctly, I think
 12 what he mentioned was a...a...a fairly extreme, you
 13 know, assessment of that variability.
 14 Another way to do that is to recognize
 15 the variability within each of the Taxa that are tested
 16 and ex...you know, explore the implications of that
 17 variability by looking at population-specific
 18 statistics.
 19 That still allows us to retain what we
 20 think is a very important design feature of the model,
 21 namely, the population-specific sensitivities
 22 represented by the various EC50s assigned to the model
 23 populations but at the same time, then, allows us to
 24 look at implications of uncertainty associated with
 25 those estimates as well, and we've done that.

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1 dynamics for each of the model populations, how does
 2 the SSI respond through the model year? Here we're
 3 looking at, again, different expose...magnitudes of
 4 exposure. If we go from the right panel towards the
 5 left...a little backwards here...we're looking at
 6 exposure, constant exposures of varying magnitudes for
 7 1, 10, and, I believe, 20 days, and you can see the
 8 implications of longer, higher exposures in deviations
 9 of the SSI value from 1 which, of course, is the top of
 10 the slide.
 11 So, through time, if we look at the
 12 left-most panel, we see an impact early on and for some
 13 of the higher exposure concentrations. So, they're
 14 pretty dramatic, so it's not...not surprising that we
 15 see an effect, although if you look at the scale, I
 16 believe it's just going down to about...oh, I
 17 can't...is it 0.6? Is that...reading from here without
 18 my gla...0.5 without my glasses, and then we get some
 19 indication of...of recovery through the year.
 20 So, the behavior of that overall index,
 21 while I'd agree it's difficult to summarize by a number
 22 like the average, we see that the dynamics are
 23 consistent with what we, you know, believe is
 24 reasonable for a reversible exposure to atrazine and
 25 is...provides some features that we can address in the

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1 context of overall stability theory with regard to
 2 magnitude of impact, how fast it recovers, and how
 3 closely it recovers to the original community.
 4 Next slide, please.
 5 This might sound glib, but I think it's
 6 key. Calibration is the validation. What we're doing
 7 is using a model and converting from...converting the
 8 Brock scores from a concen dura...concentration
 9 duration space where we saw everything fairly clouded
 10 together. When you run those through the model with
 11 all its, you know, assumptions and whatever, we
 12 generate...you know, we're able to parse those scores
 13 out in more of an exposure-response kind of a
 14 relationship.
 15 It would be possible, if the model were
 16 completely, you know, invalid or not useful, it could
 17 completely scramble all those points. It doesn't. You
 18 know, it consistently has the higher SSI values
 19 associated with the higher Brock scores and vice versa,
 20 and that, as Russ mentioned, that is really the...the
 21 critical characteristic.
 22 Using an ecologically realistic generic
 23 model, we're able to translate complex exposure
 24 scenarios that you can't do with a regression equation
 25 or...or other methods that don't allow you to consider

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1 populations of plankton, the same kinds of changes that
 2 you see in the system.
 3 In fact, I didn't point out, but in this
 4 particular example, if I'm reading the graph correctly,
 5 one of the least sensitive populations was a blue-green
 6 alga, and if you look back at those...that four panel
 7 of...of CASM responses that I showed you, the one that
 8 changed very little was a blue-green alga, you know,
 9 and...and that has to do with its sensitivity to...to
 10 atrazine.
 11 So, that's obviously not a definitive
 12 study but at least suggests that we're capturing...or
 13 we're...we're getting the...the correlations between
 14 the community SSIs generated by the CASM atrazine
 15 model
 16 for reasons that are...at least appear to be
 17 mechanistically consistent with what we see in at least
 18 one of these studies, and this may provide the
 19 opportunity to look at more.
 20 And that might be it. Oh, some of you
 21 might not be familiar, actually, when we're talking
 22 about these micro and mesocosms exactly what kind of
 23 physical systems we're talking. It's not necessarily a
 24 beaker on a desk but some of these are fairly large
 25 outdoor systems with...you know, they're...they're
 25 intended to be physically realistic mimics of systems

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1 day-by-day-by-day variations which the model does into
 2 a category of Brock scores.
 3 And as Russ rightly emphasized, that's
 4 really the purpose of what we're doing. I'm just
 5 trying to emphasize that. It's a...we're doing it
 6 using a defensible ecological and toxicological
 7 approach. Whether you want to call it valid or not,
 8 I'll leave that up to you.
 9 Next slide, please.
 10 If, in fact...and this is a point well
 11 taken...if we look inside or take a closer look at some
 12 of these studies, we find out that there are population
 13 changes that are at least qualitatively similar to
 14 changes that we see within the model. Okay, while we
 15 haven't done the site...or the cosm-specific
 16 application that you suggested, which might be a
 17 valuable exercise, nonetheless, we can look and see if
 18 we seem to be getting the correlation between SSIs and
 19 exposures and Brock scores for the right reason.
 20 And so, if we look at one of the
 21 studies...it's a category 5 effect...next slide,
 22 please...we see that...and this is the publication that
 23 reports that study...we see the sort of thing you see
 24 in CASM. You see changes
 25 relative...differ...differential changes in those

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1 just as the model is intended to be a mathematically
 2 realistic description of it.
 3 Next. Sorry for taking up so much of
 4 your time. Next slide. Continue.
 5 Oh, and another point is, you know,
 6 we're emphasizing the utility of the model in terms of
 7 calibrating it to micro and mesocosm studies, and I
 8 think that's really a...the...the...the heart of the
 9 application, but it's not the first time the model has
 10 been calibrated to other toxicological benchmark data.
 11 Here, the same version for one of the Japanese lakes.
 12 In this case, the...the modeled endpoint is
 13 concentrations associated with a 20 percent reduction
 14 in zooplankton correlated to the no observed effects
 15 concentration reported for several chemicals, including
 16 atrazine.
 17 And you can see in this case the model
 18 is biased. It's saying there's a 20 percent impact on
 19 zooplankton when the benchmark says there's no effect.
 20 However, it's a consistent bias, and we can use this in
 21 a decision making process as long as it's...as long as
 22 the bias is consistent. We know how to adjust. We
 23 know how to interpret the results of...of applications
 24 in this model and other contexts, and this is done
 25 across a variety of different chemicals with very

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1 different chemical characteristics and toxicological
2 characteristics.
3 I keep saying that's the last...okay,
4 so, again, I...I offer that information because the
5 questions concerning model evaluation and performance,
6 I think, are critical to evaluating this overall
7 procedure, and I wanted to offer that background
8 information to help you in your deliberations.
9 Thank you.
10 DR. HEERINGA: Thank you very much, Dr.
11 Bartell. A lot of information presented. Any
12 questions from the panel that would like to follow up
13 for clarification? Yes, Dr. Young?
14 DR. YOUNG: This is very interesting,
15 but let me give an example of...of concern I have. I
16 know if you go into the laboratory and grow an insect
17 at a constant temperature and then you go into the
18 field and you have variation about that temperature, it
19 grows more rapidly than it will at a constant
20 temperature.
21 So, the...and so, with that as
22 background, and I know it's limited, but if I have two
23 peaks at separate parts in time and I...or and contrast
24 that to one which, on average, gives the same amount of
25 atrazine, is it, in fact, the same, and do we know

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1 validated in any way?
2 DR. BARTELL: Steve Bartell again.
3 The...as I mentioned, the toxicity effects factors are
4 recalculated daily for each of the model populations in
5 response to daily changes in atrazine concentration.
6 So, whatever the complexity of the chemograph that
7 would feed that, it would be reflected in the
8 calculation of toxicity data.
9 But you're right, we...other than
10 looking at some of these qualitative comparisons
11 between what the model says atrazine ought to do,
12 we...we don't have a...because of the generic
13 application of the model, we don't have a gen...the
14 generic data set we have for atrazine of the cosm data.
15 Okay?
16 We don't have a site-specific
17 application of okay, here's the site-specific reference
18 simulation. We add atrazine. You know, we measure the
19 effects. What does the model say? We don't have that.
20 DR. HEERINGA: Yes, Dr. Ellsworth?
21 DR. ELLSWORTH: Yeah, one question for
22 you, Dr. Bartell. On the bioenergetics equation
23 parameterization, the equations are very well
24 established. What I'm wondering is about like you
25 informed me...it's been great, actually. I appreciate

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1 that?
2 DR. BARTELL: Steve Bartell again. I
3 believe the modeled effect would be different, because
4 the basic growth dynamics of the populations in the
5 model are temperature dependent, and if temperature,
6 water temperatures, are varying in the stream, the
7 growth will reflect that.
8 Now, if the mode of action of atrazine
9 is temperature-dependent, that's not reflected in the
10 model, but I don't know of any information that
11 necessarily suggests that that's the case. It's
12 really, as I mentioned in my presentason...presentation
13 yesterday, those toxic effects factors are calculated,
14 you know, assuming toxicity assay kinds of conditions,
15 and it's really a literal in...interpretation and
16 extrapolation of okay, if we believe the results of
17 these toxicity tests, how do they overlay upon a
18 dynamic aquatic system.
19 DR. YOUNG: Young again. Well, I...I
20 switch from temperature to atrazine. Okay? So I have
21 now two peaks of atrazine, but the area under the curve
22 would be the same for both. Okay? So, basically, an
23 organism has a time perhaps to recover or something.
24 So, are those types of things considered
25 in the model, and have those been bench proofed or

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1 that, but the question I have is on these parameters,
2 are they site-specific? In other words, are they
3 latitude specific?
4 Are they, you know, do they...do they
5 vary? And if they do, is there any kind of sensitivity
6 analysis that's been done in terms of those parameters
7 and how they would impact something like this SSI index
8 or which ones are the most key parameters in terms of
9 controlling an SSI?
10 DR. BARTELL: Yeah, Steve Bartell. In
11 answering the first part of your question, we do assume
12 that the physiology of the organism is defined by its
13 bioenergetics parameters, you know, the base rates are
14 essentially independent of wherever the organism is in
15 the Midwest, for right now. If you had some
16 information that would suggest variability, that, in
17 fact, could be incorporated.
18 In a previous application, we, in fact,
19 ran the model, you know, a full-blown sensitivity and
20 uncertainty analysis, on all of the model bioenergetics
21 parameters. We had constructed about 400 distributions
22 that we then used Monte Carlo methods to look at the
23 implications of those uncertainties.
24 The results of that analysis...and the
25 bioenergetics models either have been evaluated

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1 extensively in the literature, and, not surprising,
 2 it's the, you know, maximum photosynthetic rates or
 3 consumption rates, really the inputs, that are
 4 sensitive, especially nonlinear relationship to those
 5 inputs to organism weight and temperature and those
 6 sorts of effects.
 7 The...the sensitivities of the model are
 8 fairly well established. In this particular
 9 application, understand, you know, with the number of
 10 populations, 26 plant populations, say about maybe 10
 11 parameters or so for each population, you know, it's
 12 arduous but it's not impossible. You know, it's...it's
 13 a lot of careful work, and, you know, so there are
 14 uncertainties that...that could be addressed, but,
 15 again, the net result would be a change in the
 16 reference simulation, and because you're comparing each
 17 of the chemographs you assess to that same reference
 18 system, any bias that's there is often biased in the
 19 treatment simulations that you produce. What the net
 20 result is, you know, you still get...you still maintain
 21 that good correlation between SSI or whatever your
 22 preferred metric is and the Brock scores.
 23 DR. ELLSWORTH: Could I ask one more
 24 thing on that?
 25 DR. HEERINGA: Sure.

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1 DR. ELLSWORTH: The...I mean, I'm not so
 2 concerned here about the sensitivity of the physical-
 3 chemical factors as I am these parameterizations within
 4 the equation itself that, you know, relate temperature
 5 to photosynthesis. I mean, I don't know what those
 6 parameters, the sensitivity analysis there.
 7 Are there key parameters that would
 8 control or dominate the impact on the SSI from this?
 9 DR. BARTELL: Steve Bartell again. And,
 10 again, I would say the, you know, the key parameters
 11 are the inputs. You know, it's the consumption, max
 12 consumption rate that you're modifying, it's the max
 13 photosynthetic rate that you're modifying, and then,
 14 subsequently, the parameters that determine how those
 15 rates that are modified are then sort of the second
 16 tier of important parameters.
 17 Fortunately, there's pretty good
 18 documentation of those parameters. That's not to say
 19 they're not variability, but, you know, you've got
 20 pretty good data sets to work from.
 21 DR. HEERINGA: Question from Dr. Grue,
 22 and then I'd like to move on.
 23 DR. GRUE: Yeah, maybe I can just ask a
 24 specific question. For example, if we...if we were to
 25 pick two of the chemographs that were displayed as part

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1 of the base materials that we received, is it possible,
 2 then, to actually demonstrate the...the behavior of the
 3 different outputs, biological outputs, through time
 4 for, say, two chemographs that are very different?
 5 DR. BARTELL: Steve Bartell again. Yes,
 6 the model does output the daily values of biomass for
 7 each of the populations for both the reference and the
 8 treatment simulation.
 9 DR. GRUE: So, in the interest in seeing
 10 that, then, it is possible to...to look at that.
 11 DR. BARTELL: And...and you would see
 12 responses of the kind that I showed you in that some
 13 population up, some down.
 14 DR. HEERINGA: Thank you very much, Dr.
 15 Bartell.
 16 DR. BARTELL: Thank you very much for
 17 your time and inviting me back.
 18 DR. HEERINGA: And Mr. Brady and Dr.
 19 Irene for allowing this supplementary presentation. I
 20 think it's valuable. It's a little bit iterative, but
 21 I think that it's important to the understanding and
 22 the process at hand.
 23 So, I'd like to move on to charge
 24 question number 3 at this point, and maybe if, Don
 25 Brady, if you would be willing to read that into the

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1 record for us?
 2 MR. BRADY: Sure. Charge question 3:
 3 Please comment on the reasonableness of the general
 4 CASM atrazine model formulation and parameterization
 5 and the various options selected for the base model
 6 configuration.
 7 Thank you.
 8 DR. HEERINGA: Our lead discussant on
 9 this question is Dr. Chu.
 10 DR. CHU: First of all, thank you, Dr.
 11 Bartell, for additional information.
 12 I'm going to talk about my comments
 13 later. Dr. Gilliom and Dr. La Point will add more
 14 comments on this question.
 15 Basically, this question is about can
 16 matches in model itself and also determination of
 17 parameters. In this study, great effort, many efforts
 18 have been made in this study. Considering the scope of
 19 the study and objectives and also the limitation of
 20 available data, it's reasonable to keep the modeling at
 21 a screen level. I think it's really reasonable.
 22 Also combined with the statistical
 23 analysis and supported by extensive Molegen studies in
 24 this ecological study for atrazine contamination in
 25 Midwestern streams. This is my first point.

1 Secondly, in a CASM model, if we look at
2 the Domini equations, actually, the Domini equations is
3 quite a dynamic system. That is the first...we have a
4 set of first order ODE, ordinary differential
5 equations.

6 In this model, there is a critical
7 assumption. I would say it's an implicit assumption.
8 That means there is complete mixing. In other words,
9 the water body, lake or stream...of course, in this
10 case, it's...it's a stream...is homogenous and also
11 well a mixed lumped system. Dr. Bartell also mentioned
12 this point yesterday.

13 Also, any materials, I mean, water,
14 sediments, atrazine, and arozone into a system is
15 instantaneously mixed with those in the system. Also,
16 this homogenous ecosystem uniformly responds to any
17 change, any chances. You change the temperature, you
18 change the life condition. This is a system that
19 uniformly responds to this kind of change.

20 Generally, I mean, this type of model is
21 used for relatively stagnant water bodies, for example,
22 a small lake, a pond, something like this. But in our
23 case, we are looking at a flowing water system. It's a
24 stream.

25 For this kind of a system, generally, as

1 distinction between these major systems. I'm talking
2 about lakes and streams. One is stagnant water;
3 another one is flowing water.

4 In our case, of course, we are looking
5 at second order and third order system. In other
6 words, if we looked at a whole watershed, we are
7 looking at a part of the stream in the system. That
8 means, also, if you look at the equation, I did not
9 see...in other words, our system is not a closed
10 system. For example, if you look at a pond, like a
11 swimming pool, there's no input and output, but if you
12 look at a stream system, it's actually a part of a
13 system where you should have some input, for example,
14 from first order stream into second order, because we
15 are looking at the second and third order. And also,
16 outflow from third order to fourth order.

17 So, in the equation, we...we really need
18 to consider this kind of interactions between first and
19 second, between third and fourth, but I did not find
20 these kinds of terms in the Domini equation.

21 And the next one, actually, I mentioned
22 this point for question 2. CASM atrazine model plays
23 an important role in this study. That means a lot of
24 analysis based on this modeling. That means
25 we...especially for when we looked at some specific

1 we know, it's highly variable in space. If you looked
2 at the environmental variables for upstream,
3 downstream, they may be different. I mean, for this
4 kind of system, high variability in stream
5 hydrodynamics, atrazine concentrations, nutrient
6 concentrations, temperature, light.

7 Of course, in our case, we focused on
8 second order and third order streams. Even for this
9 kind of streams, I think the spatial variability can be
10 significant for...for some streams. It may not be a
11 uniform system.

12 This can be a limitation of the model
13 application. Therefore, I think we really need to
14 specify the applicability of the CASM model before
15 we...before we use this model to any stream system,
16 either a real system or a hypothetical one. We really
17 need to make sure this assumption is validate...is
18 valid. That means if it's okay or not, we need to
19 double check this assumption.

20 Also, I think we also need to specify in
21 the simulated system. Sometimes, I'm confused about the
22 system. There's no...I did not get a clear idea about
23 the simulated system. Sometimes, the model was applied
24 to lakes, mesocosm system, or whatever, or sometimes
25 it's applied to streams. There's...I did not find any

1 streams in Midwestern streams.

2 So, I think also another factor is this
3 model is pore-size based model. So, I really think
4 this model should be calibrated and validated before we
5 use it for prediction purposes.

6 Without calibration and prediction, we
7 don't know the...we don't know...without evaluation of
8 the model performance, the predictions and the related
9 risk assessment can be questionable.

10 So, okay, next, next about parameters.
11 Because this is a pore-size based model, there are
12 many, many parameters. How to identify and determine
13 the parameters is really a critical step. We need to
14 consider this, especially when we want to use this
15 model to solve...to look at some real stream systems.

16 It's my understanding...recall the model
17 can be a generic one, generic model, but if we use this
18 model to some specific problem, either a real problem
19 or hypothetical problem, I would say the parameters and
20 the input data are site-specific.

21 Also, another point. I looked at the
22 Domini equation for the CASM atrazine model. It seems
23 to me there is no direct relationship between hydrology
24 or hydrodynamic...or stream hydrodynamic to the model.
25 That means, as we know, the dynamics of a stream should

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1 have considerable direct and indirect effects on the
2 ecological functions.

3 However, the current model I did not
4 find...the current model does not account for these
5 kinds of effects. I mean, at least does not account
6 for this kind of effects in some ex...in some direct
7 way, you know.

8 Most parameters and the input data in
9 the model are, I would say, kind of hydrodynamic
10 independent. For example, the model does not consider
11 the effect of suspended sediments on light conditions.
12 Of course, for this kind of limitation, you can find
13 from the document, from the report.

14 As a result, there is no fundamental
15 distinction in the modeling for flowing stream systems
16 and a small pond or a small lake.

17 Also, I think about the parameters,
18 ran...we have...we have parameters for the Ohio River.
19 We may need a...I think we may need more parameters if
20 we want to look at other streams and watersheds.

21 The last comment. The last comment is
22 about...I want to talk something about hydrology.
23 Since the study focused on second order and third order
24 Midwestern streams, also this kind of...if we looked at
25 the watershed for this, the watershed should be

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1 we take what is the product of this particular exercise
2 and modeling effort to predict or extrapolate to
3 identifying vulnerable areas, and I think that
4 certainly brings in some of the things that you
5 mentioned.

6 Our second...first associate discussant
7 on this particular question is Bob Gilliom.

8 MR. GILLIOM: My...on this question of
9 the reasonableness, my main basis for judging that goes
10 back to what I interpret the role of the model to be in
11 the process which you guys have explained, and I...that
12 is to basically, using a common benchmark, fill in the
13 time domain of exposure and calibrate it or reference
14 it, I will say, to the microcosm and mesocosm study
15 results which goes back to the Brock scores and so
16 forth.

17 So, I understand it's not being depended
18 upon to, you know, match reality at every site or
19 anything like that, but it is...it is meant to
20 realistically fill in the time domain and process a
21 particular chemograph through to give an equivalent
22 index to compare among sites, the Steinhart index.

23 And I guess where this is going is that
24 my...I guess my remaining kind of gap in that is...is
25 not quite knowing how to judge that because of not

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1 relatively small. If we looked at a hydrograph of such
2 a small streams or small creeks, generally, we can find
3 generally, though, the flow is stable, and we have some
4 peaks. If you have some variable, we have some very
5 short duration peaks. There are many peaks in there.

6 After a certain time, back to base flow. There, if you
7 have more input there, we can have more...more peaks.

8 Also, the duration of a peak may be less
9 than 24 hours. That means less than the daily
10 simulation time step. So, I'm just curious how to
11 consider this kind of short-term hydrologic information
12 in the ecological modeling, data considered in the
13 ecological modeling.

14 Also, this kind of effect, I think,
15 maybe this...this problem is about the monitoring. I
16 think these effects should be considered in postmortem
17 study and also modeling study.

18 Yes, thank you.

19 DR. HEERINGA: Thank you very much, Dr.
20 Chu. I think, you know, your comments with regard to
21 the hydrology, I think that's...all of these are
22 complex issues. That's sort of the next step, at least
23 as I see it from my naive perspective, and, clearly,
24 something that will need to be addressed by the panel
25 as we get into the third component, and that is how do

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1 having a really solid understanding of beyond just the
2 post-comparison of the index or the model scores and
3 the mesocosm/microcosm studies. I don't have a solid
4 index of the sensitivity to these different shapes yet,
5 I guess.

6 And that is just back to this whole
7 issue of are the...do we have enough confidence that
8 the processes that are affecting things over time
9 adequately are going to represent this processing of
10 the chemographs, which is what it all comes down to, to
11 feel confident that your benchmark is going to be
12 translated from site to site to site to site.

13 And beyond that, I don't know enough
14 about the details of the model to comment, so I would
15 just leave it as a bit of discomfort on that still,
16 because it's...it's been difficult, for me anyway, to
17 parse out how sensitive the model is to those different
18 shapes and timings of exposure.

19 I'll leave it at that.

20 DR. HEERINGA: Dr. La Point is the
21 second associate discussant.

22 DR. LA POINT: I concur with what Dr.
23 Gilliom was saying, and just to read off here, CASM is
24 a bioenergetic model which I really look for and, I
25 think, are ultimately going to be very...and this one

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1 is important. The work by Bartell and DiAngeles has
 2 just been super in developing these.
 3 It's an approach to understanding how
 4 exposure to chemicals, including atrazine, can affect
 5 populations in a community, and the description by Volz
 6 for this one specifically, getting to the CASM atrazine
 7 formulation parameterization, lists phytoplankton.
 8 There are two diatom populations, four chlorophyte
 9 populations, four sanophyte populations, and then
 10 diatom populations, three of those, three chlorophyte,
 11 and the paraphyton, several others, and then five
 12 macrophyte plant species. And those are the list of
 13 species from the upper Honey Creek in Ohio.
 14 And the question gets at how...gets at
 15 exactly what's been stated a couple times or asked a
 16 couple times now, is how the parameterization within
 17 the model influences overall model output relative to
 18 the chemical of concern, atrazine.
 19 Now, this morning's Dr....yeah, I guess
 20 it still is morning...Dr. Bartell's expansion of what
 21 Dr. Erickson presented has been excellent, and that's
 22 very good help in seeing how this can be applied, and,
 23 ultimately, I think it's very useful, and maybe all it
 24 needs is a bit of an explanation and some examples such
 25 as we had this morning.

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1 Much of the development of the model
 2 gets back to actually one of the earlier question or
 3 question number 2. Much of the development for this
 4 model comes from the data and results presented in the
 5 Elterra report. That's Brock, et al., 2000.
 6 Several of those micro and mesocosm
 7 tests had, as outputs, not species changes but
 8 chlorophyll A as a surrogate, for instance, and as
 9 we've seen in many of the examples today, even the ones
 10 that Dr. Bartell presented and are given in the...in
 11 the readings we had, I'm convinced this model works
 12 extremely well with standing water systems because of
 13 the phytoplankton and the paraphyton, and that seems to
 14 be a lot of the examples.
 15 And part of that, again, gets to the
 16 size contribution or size influence that smaller
 17 organisms generally are the more sensitive but also are
 18 generally the ones, that if the properties are there,
 19 can recover the most quickly, so they tend to track
 20 most carefully what happens with...we were talking
 21 about the hydrograph, you know, and the pulses of
 22 atrazine. They'll be the ones that are more critical.
 23 And so, we think...we know that from a
 24 lot of the mesocosm work. The question is...and it
 25 seems now from what we see on this that the CASM

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1 atrazine model is tracking those, from some of the
 2 examples that Dr. Bartell presented today, and so,
 3 that's altered my view of this, and...because I'm a
 4 little bit conflicted. I really like CASM as an
 5 energetic model, and I think it will and is probably
 6 appropriate.
 7 I think the discomfort...and I can't say
 8 it any better than Dr. Gilliom did...is that it would
 9 be nice to see some of the inner workings, some of the
 10 parameters and how...how much, as they vary, whether
 11 they maybe swamp out some of the aspects of atrazine,
 12 the time exposure for atrazine. So, how...if they do,
 13 what kind of duration response...to what kind of
 14 duration response is the model appropriate, you know,
 15 what are the limits that way in the sense of how long
 16 that exposure lasts, can it be picked up with changes.
 17 So...and that...other than that, though,
 18 I think the CASM atrazine, I think it's going to be a
 19 good...a very good model for this, to tell you the
 20 truth.
 21 That's all I have.
 22 DR. HEERINGA: Questions from...or
 23 comments from other members of the panel on this
 24 particular question, reasonableness of the general
 25 model formulation and its parameterization. Its

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1 parameterization, we mean not only parameterization in
 2 the differential equations but also the values of the
 3 parameters that are supplied to us.
 4 Dr. Portier?
 5 DR. PORTIER: I want to...I want to talk
 6 a little bit about the issue of reasonableness of the
 7 baseline parameterization, so I'm going to even worry
 8 about the atrazine hydrograph right now. I want to
 9 talk about the baseline case that we car...we compare
 10 it to.
 11 When you look at the CASM atrazine
 12 model, I see kind of two kinds of parameters, and I
 13 think of them as what I'd call community scenario
 14 parameters and then input scenario parameters.
 15 So, these community scenario parameters
 16 are things like all the bioenergetic terms, all those K
 17 terms and all this other stuff in the differential
 18 equations, all the rates. And then, I'd also include
 19 in that these things like T0, Tmax, the...the upper and
 20 lower bounds for...I guess those would be light
 21 effects. There's also some temperature and nutrition
 22 effects, and I'll kind of combine those in as these
 23 community scenarios.
 24 We haven't really talked a lot about
 25 these input scenarios, kind of what time series go into

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1 this. And the time series, I'm talking about light,
 2 temperature, N...I guess this would NPsilican
 3 concentration levels.
 4 My understanding of the base scenario,
 5 this time series is fixed for the whole area of
 6 concern, this whole...all Midwestern streams. We kind
 7 of have one time series scenario that goes in, and you
 8 run through the simulation, and you get a picture of
 9 what's going on.
 10 I'm seeing some heads saying yes, so at
 11 least maybe that's a confirmation that I read this
 12 right.
 13 And then, once you've got that baseline,
 14 then you're going to put the atrazine chemograph impact
 15 on top of that. Right?
 16 So, the concern I have is that these,
 17 the input scenarios, we haven't really talked about how
 18 much does the light time series across the growing
 19 season change across the whole Midwest. We're talking
 20 Nebraska to Ohio. We're talking southern Michigan to
 21 Arkansas. So, there's...that's a big chunk of the
 22 country to have one time series for temperature, one
 23 time series for light, and then site-specific nutrient
 24 concentrations that we haven't even incorporated.
 25 So, the...I think there are...there's

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1 some ability in the modeling to incorporate some of the
 2 more site-specific stuff in the...in the site
 3 characterization, the utilization we're going to have
 4 later. So, I...I kind of offer that as a maybe a
 5 criticism of the reasonableness of using one base
 6 parameterization for these kind of input scenario time
 7 series for the whole comparison across the whole
 8 region.
 9 DR. HEERINGA: Yes, Dr. Effland?
 10 DR. EFFLAND: I don't know if this
 11 question directly relates to the particular charge
 12 question, but I...it's something that I'm hearing
 13 different, at least from my own...in my own head, I'm
 14 hearing different things as far as this model is a
 15 generic model, and then I'm hearing that it's been
 16 calibrated or the parameterization is based on a very
 17 specific stream, and then it's being used from the
 18 sub...sub-humid far part of the Midwest to the humid
 19 part, eastern part, of the Midwest.
 20 And I...I'm just...I guess I'd like a
 21 clarification on how transportable is...is this model
 22 with the current parameters. Can it be...can it be
 23 moved around the way that you intend to do it or...I
 24 thought I heard from Dr. Bartell that if we were going
 25 to take it to another area, we'd have to...to calibrate

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1 it to the parameters, let's say, the nutrient
 2 parameters of that particular stream.
 3 And I...I guess I'd just like to hear
 4 whether...is it a generic model, or is it more site-
 5 specific, or we don't know, or...or where...where does
 6 EPA stand on that, I guess?
 7 DR. ERICKSON: This is Russell Ericson.
 8 The...in my mind, for this methodology to be at all
 9 feasible, this model has to be broadly...generic and
 10 broadly applicable. Okay, so that we...we...and again,
 11 given that we're only interested in the...its
 12 extrapolations relative to time, the basic assumption
 13 is that even though this has the input parameters for a
 14 specific stream in Ohio, that the time relationships
 15 would be similar for other streams throughout the area.
 16 And, in fact...and the whole point of
 17 the sensitivity analysis and...which is not complete
 18 yet but will...but is...but the whole point of the
 19 sensitivity analysis that I showed you so far is to
 20 test whether the model results are sensitive to those
 21 site characteristics so to basically demonstrate that
 22 we don't have to worry about putting in site-specific
 23 characteristics to this model.
 24 And, again, that it's on...this is only
 25 related to the time extrapolations are not sensitive to

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1 the site...site characteristics.
 2 Now, whether we've gone through all the
 3 sensitivity analysis that we should have...and we
 4 haven't, and that's the issue as far as defining more
 5 sensitivity analyses, the ones that I've shown so far
 6 with respect to temperature, light, and nutrients would
 7 suggest that the extrapolations that we're interested
 8 in are not sensitive to these site characteristics, and
 9 so, therefore, it does not matter whether we put in the
 10 site characteristics for a particular in terms of
 11 nutrients, light, and temperature, and, in fact, that
 12 would cause a breakdown of the whole methodology to
 13 some degree, because then we would have to re...I like
 14 the word reference rather than calibrate, and I think
 15 Dr. Gilliom suggested that...that referencing the model
 16 to the microcosm/mesocosm study, we would have to re-
 17 reference it for every set of site characteristics
 18 and...and recalculate what that...the model LOC would
 19 be for those site characteristics.
 20 So, the viability of this, to me...I
 21 mean, that's doable, but it would make it more
 22 complicated. The viability of the method requires that
 23 it be broadly generic.
 24 Now, there might be, for the
 25 southeastern United States with atrazine applications

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1 to sugar cane areas, we might decide that, you know, a
2 different model configuration would be used down there
3 or for...for other broad set of characteristics, but
4 the...the desire is to...to have this broadly
5 applicable with a single model, single model, single
6 model LOC such that, again, the time extrapolation
7 elements are broadly applicable and that the site
8 characteristics don't really matter.

9 And so, whichever site characteristics
10 we put in are still applicable to a broad category of
11 sites, and it doesn't matter whether we picked as the
12 base the Ohio...this Ohio stream or some Nebraska
13 stream as far as the characteristics, that we would be
14 getting the same answers in terms of...of the...of the
15 time extrapolations.

16 Does that help? I mean, it is...it's
17 supposed to be generic, and it's supposed to...ideally,
18 we should broadly apply it to a broad region without
19 having to put in site characteristics.

20 DR. EFFLAND: Okay, I guess.
21 Then...then, if it is generic, why is it that you're
22 saying you have to modify it for sugar cane? I guess
23 I...I...

24 DR. ERICKSON: I would hope that we
25 don't have to, but we still have to push the

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1 processes in...in a simplification effort?
2 And I...and I don't know if they are
3 that insensitive or not and whether that's a way
4 to...but from my ex...my experience with fate in
5 transport models, a lot of those runoff models are
6 driven by the curve number, and...and the curve number,
7 even though it's a process model, the curve number is
8 still built in there, and so, if they're sensitive to
9 that and a lot of other things so you can collapse
10 those things down, I think it's what EPA did quite a
11 while ago when they looked at what's the...what's the
12 one called? GENEC? The generic EEC model that's used
13 for...for ponds where they took PRZM exams and ran it a
14 million times or whatever and then collapsed all that
15 information.

16 So I guess I'm just wondering is
17 that...is that kind of where you're going with this, or
18 is it still going to be a...a complex process model?

19 DR. ERICKSON: Well, I guess, if I
20 should respond to that, I guess there...there's two
21 issues there in my mind. One is...is that even if it's
22 not sensitive to like...let's just take one
23 factor...it's not sensitive to the nutrient status of
24 the body of water, and so, there's a very low
25 sensitivity to the nutrient status of water, not that

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1 sensitivity analysis to demonstrate that, and...and the
2 sensitivity analysis does need to get into the...what
3 this actually question is talking about, the model
4 formulation and its parameterization. So, the
5 bioenergetics parameters, the...the community
6 structure, how sensitive are the...are the results to
7 that, and those are the sensitivity analyses that are
8 still to be...to be done.

9 But, I mean, from my own viewpoint,
10 I...I hope and I think the feasibility of this, the
11 viability of this method would be increased by
12 demonstrating that it's not sensitive to those things
13 so that we apply it nationwide, and it's...it's
14 unfortunate to associate...to call it, again, a second,
15 third-order Midwestern stream, but...because it is
16 meant to be...be broadly generic and applicable to a
17 variety of...variety of systems and a variety of
18 regions.

19 DR. EFFLAND: Okay, so one more comment
20 and I'll...and I'll be quiet.

21 If a lot of the parameters are not
22 sensitive, does that mean you can...I think Tim
23 mentioned reductionist. Can you...can you collapse a
24 lot of the processes? Because this is a...still, it's
25 a mechanistic model. Can you collapse a lot of those

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1 one water is not more productive than less productive,
2 but, again, the time dependence of the toxicity
3 relationships are the same whether it's in a productive
4 water or an unproductive water.

5 So, the absolute model outputs
6 would...would differ, but these time relationships
7 don't, and...which is what we're interested in, and
8 even if you demonstrate that lack of sensitivity, you
9 might...it...you might still need all the processes in
10 the model to develop the time dependencies. Okay?
11 Because you're looking at a...a range of sensitivities,
12 so you need a variety of plant species, and you need
13 the all having the bioenergetics parameters and their
14 interactions as far as generating the overall time
15 dependencies of the models.

16 And so, the...the lack of sensitivity to
17 certain parameters doesn't necessarily support
18 simplifying the model, but that does not say that the
19 model can't be simplified by further examination of
20 what...what processes are important to the...to the
21 time dependence and the...and that I can't answer. I
22 mean, that...that...I suppose there's...there's
23 potentials there as far as demonstrating looking at
24 what is the minimalist model that could be used and
25 still produced the similar time dependencies.

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1 As I mentioned earlier, a lot of
2 the...this is driven by things that we do know
3 empirically well, that is, the...the toxicity through
4 time relationships for any particular species, and the
5 model is being driven by adding up those responses
6 across the species and...and...and then su...and then
7 putting them into the bioenergetics equations to see
8 how the populations change.

9 Now, if...if the...there...there...there
10 could be some...I suppose there could be some
11 simplification in asking the question of what...what
12 the model has to...what...how the model has to process
13 the toxicity information to...to produce the...the time
14 dependencies, but like I said, those are two...to me,
15 those are two different issues.

16 Lack of sensitivity to something like
17 nutrients doesn't really mean we can simplify the
18 model, but that doesn't mean that there are other ways
19 in which the...the model...it might be able to come up
20 with a simpler process model to do that, but it would
21 require looking at...at different alternatives to...to
22 processing that toxicity information.

23 DR. HEERINGA: I want a quick comment
24 from Dr. Grue and Dr. Portier, and then I'd like to
25 move on, because I do have a serious concern that we're

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1 going to spend our session here on the model and not
2 get to the study and the application. So, Dr. Grue,
3 please.

4 DR. GRUE: Just...just a couple points.
5 Actually, I think the ability of the model to be
6 adapted to other conditions elsewhere in the U.S. is
7 actually a plus, not a negative, and I think that's an
8 important point.
9 Related to the parameterization...and I hope what I'm
10 going to mention here are actually parameters...but the
11 two things that stand out to me of concern is, one, why
12 12 months? And, two, why the carrying over of the
13 residue levels from an initial to January and then a
14 post back to the end of December? DR.

15 ERICKSON: I guess I don't understand the second part
16 of that question. What are you talking about, the
17 carryover of the residues?

18 DR. GRUE: My understanding was that
19 related to the effects portion, wasn't there the
20 decision made to carry the...in terms of getting
21 residues for 12 months, because the study was only
22 carried on from, what, day 105 to some period of time,
23 what residues are you utilizing for the time period in
24 which you do not have measurements? Because you're
25 running your model on a 365-day system.

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1 DR. ERICKSON: Oh, so, you're talking
2 about the actual field chemographs, about how residues
3 are filled in or...or are you...there's two separate
4 parts to this. One is...one is how do we develop a
5 model LOC based on the microcosm/mesocosm studies.

6 Now, the model is its own entity,
7 and...and if we say that we want to simulate a
8 microcosm/mesocosm exposure, we're not simulating the
9 mesocosm, but we're applying the microcosm/mesocosm
10 exposure to the model. We have a single model, and I
11 think this refers to an earlier question.

12 We are not modeling stagnant and flowing
13 water. We are modeling just this...this configuration
14 of the model which is described as a...a Midwestern
15 stream, and...and that's the model that's always used.

16 But what we ask of that model is that if
17 we impose on that model the microcosm/mesocosm
18 exposures, what model effects do we see? And then,
19 that's what we correlate or reference to
20 the...the...the Brock scores.

21 But to do that, there's...we have to
22 decide well, where in the model simulation do we start
23 that...that exposure, and day 105 was picked as being
24 sort of the start of the growing season and when
25 atrazine exposures were...were...were done, and for

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1 those simulations, it's zero everywhere else, because
2 the...we're just saying what would be a...a 5-week
3 exposure to 50 ppb, what would the effect on the model
4 be given the starting date and no other exposures
5 to...to best simulate the microcosm/mesocosm.

6 And so, there's no...the only issue
7 there is what...what...what date to start out.

8 Now, why a 365 day simulation? It's
9 because to...to provide...I mean, we could have started
10 at, you know, with some initial conditions as, you
11 know, like day 90 or something, but the...but it was
12 just...it was to run an annual simulation through the
13 whole season, starting...through the whole growing
14 season, and it was just convenient to, you know, go and
15 start well, what might initial conditions be at day
16 zero, but it wouldn't do much difference if we had
17 started later with initial conditions compatible with
18 like March. We would have resulted in something, you
19 know, very, very close to it.

20 With the field chemographs, are
21 you...were you concerned about how we fill in the gaps
22 with the field chemographs or...or am I completely
23 missing your question?

24 DR. GRUE: Well, I understand how you're
25 filling in the time gaps among the four-day

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1 measurements in the field.
 2 DR. ERICKSON: I mean early and late,
 3 yeah.
 4 DR. GRUE: But I...but I'm still not
 5 clear on...on how you're...what...what atrazine levels
 6 you're putting in on your 365, because my understanding
 7 is if...even if you run the model for 365 days and you
 8 only have an exposure period of day 105 to some period
 9 of time, and the SSIs are averaged across that 365-day
 10 period, which I believe somebody else pointed out
 11 here...
 12 DR. ERICKSON: Exposures are zero
 13 otherwise.
 14 DR. GRUE: Are you...are you diminishing
 15 the potential impact of atrazine, because you're
 16 focusing your...you're averaging across several months
 17 where there's no exposure versus the six months or five
 18 months, four months, whatever it is, where the...the
 19 community is actually being exposed?
 20 DR. ERICKSON: Yeah, you're quite right.
 21 I mean, the...the...the...yeah, we do put in zeros
 22 otherwise. Now, there are residual effects. So, after
 23 the exposure, the SSI is still perturbed, so it's
 24 not...the SSI perturbation doesn't go back to zero, at
 25 least not immediately, except for...and...but prior to

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1 105, we wanted an index that meant the same thing over
 2 the whole growing season.
 3 And so, we went through...to the whole
 4 annual index, but to the extent that there are no
 5 exposures early in the season, that...that...that...the
 6 results cancel out.
 7 DR. GRUE: Maybe just one really
 8 quick...quick followup on that. But it was presented
 9 yesterday that...that the...the concentrations were
 10 being extrapolated out from the end of the study, the
 11 end of the data period to the end of December, and then
 12 the beginning concentration was being extrapolated back
 13 to the first of January. Is that not correct, or did
 14 I misunderstand something?
 15 DR. ERICKSON: In developing the
 16 reference model LO...reference to the
 17 microcosm/mesocosm, no, the...from the beginning to the
 18 end and early in the season, late in the season, it's
 19 zeros, because that's our calibration or reference
 20 calculations. For the chemographs, the issue you heard
 21 there was for the field chemographs to which we're
 22 applying this, and to the extent that the...the...the
 23 idea is that the chemographs should, again, have 365
 24 days of data, and then, where you don't have data, the
 25 question is...is how to extend it.

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1 the start of the exposure, yeah, basically, the...the
 2 index...the index is being decreased because we're
 3 averaging in early in the year before there's any
 4 exposure. The reference and exposed systems are the
 5 same before the exposure, so the index deviation is
 6 zero. The...we are averaging those zeros in to
 7 decrease the index.
 8 But remember that that shift in the
 9 index is constant over all the simulations, and because
 10 we reference the...the index to the microcosm/mesocosm,
 11 it's just that we're comparing a smaller...we...we end
 12 up with a smaller LOC.
 13 Now, previously, we had been
 14 start...doing the averaging starting at day 105, and
 15 so, then instead of an LOC of 4, it would be maybe 6,
 16 but you would end up with the same result, because
 17 it...it cancels out.
 18 And the only reason...and I...this
 19 is...I was the one who did that, was because in the
 20 sensitivity analysis, we want to explore earlier
 21 starts. And so, we wanted to compare everything on a
 22 consistent basis. So, we couldn't start the index at
 23 the start of the exposure, because we wanted to have
 24 a...an index that meant the same thing for each of
 25 the...whether we started the exposure at day 90 or day

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1 And...but that was...that's a question
 2 that's still, again, needs some resolution, because if
 3 you have an exposure...if your first measurement is an
 4 exposure, a significant exposure, is that really
 5 occurring early in the year? So, I think that issue
 6 has to do...should be divorced from what I was talking
 7 about with the microcosm/mesocosm as saying when you
 8 have a...an absence of data in a chemograph to which
 9 you're applying this method, then there has to be a
 10 decision process on whether it's gaps in the middle at
 11 gaps at each end. You have to have a reasonable
 12 decision process to...to fill those in.
 13 And...and...and, obviously, there was an
 14 issue yesterday as far as how those need to be filled
 15 in, but it's a separate issue.
 16 DR. HEERINGA: Okay, Dr. Portier had a
 17 quick comment, and I'd like to move on to the fourth
 18 question. DR. PORTIER: I just...as I
 19 was thinking about my comments and...and everything,
 20 one of my concerns is a little bit with semantics. You
 21 know, we talk about the model, but, really, we have a
 22 CASM atrazine model which has base conditions for the
 23 simulations. Then there's the computing of the SSI
 24 under the base and the atrazine load conditions, and
 25 then, we average, and we...so, we compute the SSI time

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1 series under these, we compute the differences, and we
 2 average those differences.
 3 Now, the model is sensitive to inputs
 4 and base conditions. Right? We know you change the
 5 loads, and you're going to...I mean, you change the
 6 light, you're going to change the model results. What
 7 is...what is not sensitive is how we take the model
 8 results and integrate it through the SSI, summing up
 9 the averages of the differences.
 10 So, to say that the model isn't
 11 sensitive is probably wrong. It's the...it's what we
 12 do with the model that isn't sensitive to the baseline,
 13 and...and that's where my confusion is.
 14 And I would say that there's a third
 15 component to this, and that's how we use that average
 16 SSI difference index in making a decision on LOC. So,
 17 we kind of get three components to this model. One is
 18 a biological model, one is a statistical averaging
 19 model, and then one is a decision rule model. And so,
 20 I get confused on the components.
 21 So, let's go to the next part of the
 22 model.
 23 DR. HEERINGA: I think that...I mean, a
 24 lot of these issues are going to be coming out in later
 25 questions when we talk about application and decision

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1 analysis.
 2 DR. RANDOLPH: Thank you. J.C.
 3 Randolph.
 4 The comments I've written, of course,
 5 were done before some of the recent comments and
 6 clarifications by both Dr. Erickson and Dr. Bartell, so
 7 I think some of the things I'll mention have almost
 8 certainly been addressed by them, and as, accordingly,
 9 this may move it along a bit.
 10 As discussed in the EPA white paper, the
 11 sensitivity analysis has at least three potential
 12 benefits, and I'd like to explore each of those. The
 13 first, if relative effects are sufficiently similar
 14 across a range of possible model configurations, the
 15 need to independently justify specific options for
 16 model configuration is reduced. Okay, so, obviously,
 17 desirable outcome.
 18 The methods...the areas of method
 19 development that were part of the sensitivity
 20 analysis...and I think most of these have been
 21 mentioned previously...include four different factors
 22 that I'd like to comment on. The first of these is the
 23 selection of the model effects index.
 24 The sensitivity analysis contrasts the
 25 multiplication factors which EPA approach is used for

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1 and use of these tools, too, so that's a good comment.
 2 I would like to try to address charge
 3 question number 4. I'm here doing the arithmetic in
 4 terms of numbers of questions, time allotted, down
 5 time, and we have about 45 minutes on each of these
 6 questions.
 7 And so, we're...we're sort of exceeding
 8 that average for some differential equation that...a
 9 positive coefficient on the time, and what I'd like to
 10 do is to have Mr. Brady read charge question 4 into the
 11 record and see if we can address that before lunch. If
 12 not, we'll return.
 13 MR. BRADY: Okay, this is Don Brady.
 14 Charge question 4: Please comment on whether the
 15 described sensitivity analyses are suitable for
 16 characterizing uncertainties associated with the choice
 17 of options for configuration of the base model and the
 18 input variables. What additional sources of
 19 uncertainty alternatives should be examined in this
 20 analysis? Please comment on whether the sensitivity of
 21 results to the slope of the toxicity curve as well as
 22 the EC50 should be examined to address possible effects
 23 on responses to short pulses.
 24 DR. HEERINGA: Dr. Randolph is our lead
 25 discussant on this question concerning sensitivity

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1 two alternative indices, something called ABP and
 2 another one called MXS...I could not find the actual
 3 names for what those abbreviations meant...with the
 4 effects index for the base model configuration.
 5 Although the ABP results in a lower LOC and the MXS
 6 had
 7 a higher LOC, the conclusion was that the
 8 multiplication factors, again, as defined by the EPA
 9 approach, for all of the model configuration were
 10 approximately the same and, thus, the conclusion that
 11 the choice of the model effects index doesn't affect
 12 the results of the analysis.
 13 The second one was the start date for
 14 model simulations of the microcosm/mesocosm
 15 exposures.
 16 Obviously, the first significant atrazine exposure will
 17 vary according to both rainfall and agricultural
 18 practices. The start date for the model exposure was
 19 selected as day of year 105 or April 15th. Start dates
 20 for 15 days before and 15 days after the base choice
 21 were tested, and there was found to be little
 22 sensitivity to the results in the choice of these start
 23 dates.
 24 I guess I had, are these...this span of
 25 dates starting with April 15, going back 15 and going
 forward 15, are these dates really representative for

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1 precipitation patterns and agricultural practices
 2 are...are variable in the region?
 3 So, I think the approach may be fine,
 4 and the question I had, is that window quite...quite
 5 long enough?
 6 The third one. Environmental driving
 7 variables, nutrients, which I believe included
 8 nitrogen, phosphorous, and silicon; temperature; and
 9 light, the assumption using the base model
 10 configuration with physical environmental data, I think
 11 there's some questions about. The sensitivity analysis
 12 altered nutrients, increasing or decreasing by a factor
 13 of 2. Temperature was increased or decreased by 5
 14 degrees Celsius, and light was doubled or halved.
 15 I thought, rather surprisingly, the
 16 multiplication factors, again, as the measure used by
 17 the EPA approach, were never more than 20 percent
 18 different from those in the base model configurations.
 19 As was mentioned yesterday and has come
 20 up several times subsequently, various interactions
 21 among these physical environmental characteristics
 22 apparently were not investigated, an the question there
 23 is what happens when you get various combinations, for
 24 example, doubled nutrients, higher temperatures, and
 25 higher light, as just one example.

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1 The fourth one is the EC50 selection.
 2 Ten alternative sets of plant EC50s were randomly
 3 selected from a log normal distribution with a medium
 4 of 100 g/L concentration. Mean and standard deviation
 5 and multiplication factors for the alternative EC50
 6 plant sets were compared to the multiplication factors
 7 for the base model configurations.
 8 The result showed greater deviations
 9 from the base case, but as found in earlier analysis,
 10 were not greatly different.
 11 Second benefit of the sensitivity
 12 analysis, again, as discussed in the white paper, a
 13 lack of sensitivity of results to a range of
 14 possibilities in the simulated system increases the
 15 confidence that extrapolations among the natural
 16 systems would also not be highly sensitive to system
 17 properties.
 18 I think this is a reasonable assumption.
 19 Perhaps it's a wish, and it's something that I think
 20 should be explored a little further. It's discussed.
 21 We've had comments, particularly from Dr. Erickson,
 22 that expanded on it, but, again, I'd like to see that
 23 explored a little more fully.
 24 The third benefit and a very obvious
 25 one, sensitivity analysis will pervor...will provide

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1 some quantitative information on certain sources of
 2 uncertainty which can inform risk management decisions
 3 for assessments with exposure near the LOC. Well,
 4 sure, great idea, good outcome.
 5 Questions that are, again, part of the
 6 charge question, what additional sources of uncertainty
 7 alternatives should be examined in the analysis? We've
 8 heard from several of the...the panel members that
 9 some...some additional look at the interaction among
 10 physical environmental variables seems desirable.
 11 The final question, the sensitivity of
 12 the results to the slope of the toxicity curve as well
 13 as the EC50s should be examined to address possible
 14 effects for responses to short pulses. Again, Dr.
 15 Erickson has mentioned this, and I think that's clearly
 16 a desirable next step, further step.
 17 DR. HEERINGA: Thank you very much, Dr.
 18 Randolph, for leading off, and Dr. Effland is next.
 19 DR. EFFLAND: I'll try to make my
 20 comments brief, because Dr. Randolph, I think,
 21 summarized very well what...some of the things that
 22 we've already discussed.
 23 One of the...I think one of the main
 24 things to keep in mind is that the sensitivity analysis
 25 is an important component of any modeling exercise, but

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1 the reference as far as how we compare the results from
 2 sensitivity analysis is...is also important, and the
 3 way I understand it from...from Dr. Bartell's comments
 4 about...is it upper Honey Creek? I believe it's upper
 5 Honey Creek where this was originally parameterized
 6 for, and it also sounds like there's been some work to
 7 look at evaluating or validating the...the output
 8 related to that, and I think it would be, I guess in my
 9 mind, if those parameters can be identified, that you
 10 would want to look at other places, want to look at
 11 other site conditions.
 12 And I guess one of the...one of the
 13 questions I have actually doesn't...doesn't help you
 14 answer your question, but do you have a feel for what
 15 the sensitive parameters are from...from the
 16 initial...I've also heard that you...you're just
 17 started on your sensitivity analysis, so...so there's
 18 additional work. So, do you have a...do you have any
 19 kind of sense of what the...what the sensitive
 20 parameters are from your...your current activities?
 21 Because some things that...most of the data that I've
 22 seen doesn't...doesn't seem to show a lot of
 23 variability except maybe with the...except with the
 24 particular organisms, but...
 25 DR. ERICKSON: Would you like an answer

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1 at this point or to move along? I mean, I...
 2 DR. HEERINGA: Let's, please, just go
 3 ahead.
 4 DR. ERICKSON: Okay, yeah, this is Russ
 5 Erickson. I don't...Dr. Bartell mentioned some things
 6 that might be sensitive in terms of certain model
 7 parameters. The...the strategy I was going to more
 8 adopt in this was to actually take what you...what was
 9 implied in your comment of...of actually taking a model
 10 that describes another site and so that a lot of things
 11 are changed simultaneously and see if, by changing to
 12 disparate types of sites, there is any sensitivity, and
 13 only if...if those kind of changes showed some issues,
 14 then to further explore where those changes are arising
 15 from.
 16 But...but I don't, myself, have any
 17 information on what would...what would be those most
 18 sensitive parameters, but we could take the tack of,
 19 you know, of taking some...some of Dr. Bartell's
 20 suggestions and...and just, you know, looking at some
 21 selected parameters.
 22 DR. EFFLAND: And I...I agree, the
 23 model...the model developer is going to understand his
 24 model beyond anything that, you know, any of us
 25 can...can do outside. I think that's...I think it's

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1 worthwhile to look at what he...what he recommends and
 2 what the literature. I'm sure there's some discussion
 3 in the literature.
 4 The other...the other question, and it's
 5 not really a question, but it's a comment, and...and
 6 it's related somewhat to this, is you...you generate
 7 a...a indices, and the physical meaning...and we
 8 actually had this discussion earlier among some of the
 9 panel members and myself...the physical meaning of...of
 10 what that index, SSI, is is something that would be
 11 very difficult to explain. I...I like to use an
 12 example.
 13 I have a friend of mine that works in
 14 another part of USDA, and he always says, can you
 15 explain it to your brother? Can you explain it to my
 16 brother? You know, and...and I think that that's a
 17 very practical way to look at, you know, a very...it's
 18 a very complex system.
 19 It's a very complex set of questions,
 20 not just these charge questions but the overall risk
 21 assessment process, and...and I think that having a way
 22 to...to relate that to some sort of a physical meaning
 23 that...that people can...that...that my 14-year-old son
 24 can...could understand, I think that's a valuable
 25 thing.

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1 I don't know if you use...if you use the
 2 production of biomass and...and say that, you know,
 3 this indicator shows us something about the differences
 4 of biomass or some...you know, grams of carbon, I
 5 think, people could...could understand that, but when
 6 you talk about the indices...and I use indices in other
 7 work that I do, and one of the questions is always
 8 well, what does it mean? How do...you know, how do I
 9 understand? What's 4 versus 5?
 10 And you...you went through some analyses
 11 where you have...you have an LOC of 2, then you have an
 12 LOC of 4, and you had an LOC of 7, and...and I still
 13 don't get it. I don't have a sense of what that means,
 14 and...and if I had to go home and explain it to my 14-
 15 year-old son tonight, I think it would be very
 16 difficult.
 17 So, I...I would make that...make that
 18 suggestion as far as transparency in the...in the
 19 overall process. Other than that, I don't have any
 20 additional comments.
 21 DR. HEERINGA: Thank you, Dr. Effland.
 22 Dr. Ellsworth?
 23 DR. ELLSWORTH: Okay. Yes, given your
 24 statement, you want it to be generic and broadly
 25 applicable, I think it ties in with what my colleagues

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1 have said that we need to then, in the uncertainty
 2 analysis, account for the variability that you would
 3 expect in the community scenario parameters that Dr.
 4 Portier talked about and the physical-chemical
 5 parameters, the variability in those.
 6 So, the thing that really struck me out
 7 of what Dr. Portier said was the sensitivity analysis,
 8 thus far, has been looking at the sensitivity of this
 9 index, and to me, something real clear here is going
 10 back to that scenario earlier of if I have a 10-day
 11 period with a 50 percent change in SSI during the
 12 summer...you know, we saw Dr. Bartell. There's an
 13 order or two of magnitude difference in biomass
 14 production during that summer period. So, you could
 15 almost have an order of magnitude difference in biomass
 16 production and yet, still have the same percent SSI.
 17 And to me, that's, you know, this...this
 18 index isn't characterizing that, and that's im...I
 19 think that's important, I would think, in terms of
 20 carbon cycling. And so, if you're going to do the
 21 sensitivity analysis, I would somehow want to tie it
 22 into either a weighted combination of percent SSI and
 23 biomass, or I think you're losing a lot just looking at
 24 just this SSI.
 25 So, just kind of go through it quick. I

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1 would go to the literature, try to get all the
 2 information I could on uncertainty in these
 3 scenari...you know, the community scenario parameters,
 4 and you know. I don't...I'm just reiterating it here
 5 for the record.
 6 Get that uncertainty. Get the
 7 uncertainty in the physical-chemical parameters. The
 8 EC50 would be one of those community parameters. And
 9 then, do a joint uncertainty analysis. You know, you
 10 haven't gotten there yet, and you're heading there, but
 11 just I would encourage you to do that with the focus on
 12 something other than this annual SSI, because I don't
 13 think that's sensitive, as...as sensitive as you may
 14 want to be.
 15 All right, and that's it.
 16 DR. HEERINGA: Thank you very much, Dr.
 17 Ellsworth. And Dr. Grue?
 18 DR. GRUE: Just I'll keep this brief for
 19 the sake everybody wants to get to lunch, but the
 20 previous panel members on this question have really
 21 addressed, I think, the key points. Maybe just to
 22 reiterate a couple of these.
 23 We've already talked about the need to
 24 look at combinations of variables and...and the...the
 25 effect on model outputs.

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1 that inflection point which is EC50. A complimentary
 2 log-log will allow you to do a little bit better what
 3 was discussed yesterday, and that is to have some
 4 asymmetry about that point.
 5 And, again, the parameters of that you
 6 can choose to sort of skew the symmetry with regard to
 7 the...the curve below the EC50 and above EC, so
 8 potentially looking at not just a symmetric link
 9 function here but one that might be asymmetric.
 10 Again, I don't know what would be
 11 expected, but in terms of a key assumption in
 12 this...this dose response, using that probit link
 13 forms...you know, you assume you've got essentially a
 14 linear dose response rate on that probit, and it's
 15 symmetric about the EC50 which may or may not be the
 16 case.
 17 Other comments from panel members with
 18 regard to...I'll turn to Don Brady and Dr. Irene to see
 19 if...Dr. Erickson, have we addressed this question?
 20 MR. BRADY: I...I...Dr. Erickson, you
 21 okay?
 22 DR. ERICKSON: This is Russ Erickson.
 23 This was great. I mean, it was exactly the feedback we
 24 wanted, so...
 25 MR. BRADY: Okay.

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1 Again, I'd like to emphasize the need to
 2 look at...select some of the chemographs and look at
 3 the actual biological outputs and how those vary
 4 between chemographs.
 5 And the last point that folks really
 6 haven't spent a lot of time talking about, Dr. Randolph
 7 hit on a little bit. I think this issue of the slopes
 8 is important. We have greatest confidence around the
 9 50 mark, and as we get out to those tails, those slopes
 10 can vary. And I know you've looked at kind of the
 11 average. Well, I can't remember. It's a slope of 3 or
 12 something like that for your simulations, but I think
 13 that's very important to look at, particularly relative
 14 to your issue related to...to short pulses, and I
 15 encourage you to do that.
 16 DR. HEERINGA: I'm glad that you raise
 17 that last point about the slopes. I...I agree there,
 18 too. I think as I read this...and maybe several of the
 19 statisticians can correct me if I'm wrong...you're
 20 using a probit to form this linear regression.
 21 The probit automatically forces symmetry
 22 around your inflection point which is going to be your
 23 EC50. You might want to explore sensitivity under a
 24 complimentary log-log linkage. Essentially, the probit
 25 logistic are going to essentially force symmetry around

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1 DR. HEERINGA: Okay, panel members and
 2 audience, we are at 12:15, and what I would recommend
 3 is that we take a...a 1-hour lunch. Hopefully...I
 4 think it works, since there are restaurants and fairly
 5 close eating establishments within the building, an
 6 hour should do, and we can probably get back on track.
 7 I appreciate everybody's contributions
 8 this morning. I think it's been a very productive
 9 session. We'll finish up the fifth of the charge
 10 questions. That will be the last of the charge
 11 questions on the first major topic and then move on to
 12 the second topic, the study designs.
 13 Thank you very much.
 14 (WHEREUPON, a luncheon recess was taken.)
 15 DR. HEERINGA: Welcome back, everybody,
 16 to this afternoon's session of our multi-day meeting of
 17 the FIFRA Science Advisory Panel on the topic of the
 18 Interpretation of the Ecological Significance of
 19 Atrazine Stream-Water Concentrations Using a
 20 Statistically-Designed Monitoring Program.
 21 And I wanted to mention to the panel
 22 that there is an additional handout, a photocopy, that
 23 was set up. It's the prepared comments, I think, by
 24 Rick Roberts of the Iowa Farm Bureau from yesterday, so
 25 add that to the docket, and, members of the audience,

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1 those comments, written comments, will appear in the
2 docket for this meeting as well.

3 We're at the point where we have
4 completed the first of the four charge questions
5 related to the first of three major sets of topics, and
6 we have yet to complete charge question number 5
7 related to the CASM atrazine model, so if, give him
8 just a moment, I'll ask Mr. Brady...

9 MR. BRADY: Okay, I think...this is Tom
10 Brady. I think we're going to ask Russ Erickson to
11 read this question...

12 DR. HEERINGA: Sure.

13 MR. BRADY: ...this charge.

14 DR. HEERINGA: Okay, Dr. Erickson,
15 please.

16 DR. ERICKSON: Russ Erickson. During
17 its review...charge question 5: During its review of
18 the CASM atrazine model, the Agency found that the
19 model appears to overestimate...estimate the effects of
20 low chronic concentrations, possibly due to the way the
21 models...the model simulates population levels and
22 decline of macrophytes early in the year.
23 The Agency sees two approaches for addressing this
24 issue: exclude early-season atrazine exposures from
25 the chemograph inputs or, two, to modify the model to

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1 first question, number 1 there, in terms of your
2 approaches is that I don't think you should exclude the
3 early-season period. I think you ought to fix how
4 concentrations are handled, and there's enough data
5 both existing and that could be supplemented by some
6 relatively inexpensive monitoring, perhaps, that could
7 fill that in and realistically represent the entire
8 year.

9 I don't know enough personally about
10 what to do specifically about the macrophyte issue, but
11 it does seem like from everything we've heard that
12 that's an important part of the aquatic ecosystem to
13 get reasonably represented. So, my glib answer would
14 be it would be worth continuing to pursue this to try
15 to fix it so that the model reasonably represented both
16 the exposure and the range of effects under
17 consideration during the early part of the year.

18 I'll leave my comments at that at this
19 point.

20 DR. HEERINGA: Dr. Ellsworth?

21 DR. ELLSWORTH: The only thing I think I
22 would add to what Robert has said was, again here, kind
23 of tied in with Dr. Portier said earlier, is it the
24 index model or is it the CASM model that is showing the
25 problem, and I'm assuming it's the CASM model that is

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1 better account for the impacts of early-season
2 exposures. Please comment on the strengths and
3 weaknesses of the Agency's approaches and provide
4 recommendations for any alternatives.

5 Final point, given that the Agency identified
6 this issue during the exposure evaluat...evaluation,
7 please provide recommendations on additional steps the
8 Agency could take for quality assurance for the model
9 and methodology.

10 And I'd just like to add a brief comment to
11 this for the...for information, is that part of the low
12 concentration response has been identified to involve
13 the algorithm by which the toxicity curve is translated
14 into the model effect factors and which is in the
15 process of being corrected so that at least part of
16 this effect that was noted was...was...is already being
17 addressed by programming issues, but there still are,
18 you know, like the issues of how the macrophytes are
19 simulated early in the season and...and also the
20 general issue that still might remain of how the early-
21 season effects are handled.

22 DR. HEERINGA: Thank you for that
23 clarification, Dr. Erickson. I think with that, Bob
24 Gilliom, please.

25 MR. GILLIOM: I guess my answer to the

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1 showing the effect. Could I actually ask for
2 clarification on that?

3 DR. HEERINGA: Dr. Erickson?

4 DR. ERICKSON: It actually is both.

5 The...it is CASM effects early in the season in the
6 model, but it is translated into effects on the actual
7 index and on our...our bottom line calls regarding the
8 LOC which are...are...are affect...are affected by
9 this.

10 So, basically, what it is doing is
11 creating more effects. It's creating some effects
12 early in the year so when we compare it to the LOC, the
13 effects index is elevated perhaps beyond what it...what
14 it should be.

15 DR. ELLSWORTH: I have no...no comment
16 on that, actually. I think you're on track with that.

17 DR. HEERINGA: Dr. Grue?

18 DR. GRUE: Just some additional
19 clarification here related to this, and it gets back to
20 my earlier question. You indicated that...or EPA
21 indicated that the concentrations are essentially set
22 at zero early on, or are we back to the extrapolation
23 of the residues back from that first period? In other
24 words, what...what data are being used to set the
25 atrazine concentrations early in the season?

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1 DR. ERICKSON: Okay. This was a problem
2 that...well, first of all, the...the zeroes are when we
3 do the...do the determination of the model LOC based on
4 the mesocosm/microcosm exposure scenario simulations.
5 And so, that is zero, and so this problem doesn't
6 impact setting the model LOC.

7 Where this arises is in the application
8 of the model to the field chemographs, and where it
9 cropped up was in an example...or I don't know if it
10 was the exact same one that Syngenta showed yesterday
11 where the first measurement of the season was up around
12 2 ppb. The...and that was back extrapolated to the
13 first of the year.

14 Not necessarily that that's the
15 procedure we will end up with, but a simulation was run
16 using that procedure, and the...and these...that's when
17 these effects were detected, and...and then additional
18 simulations were run just to see how, in general, the
19 model responds to low levels, starting at different
20 types of years...of the year and with discussions among
21 all of us.

22 The issue of the macrophyte biomass loss
23 may be being aggravated by that low response effect
24 early in the year, might be an issue here, but then it
25 was also determined that the...there were...there were

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1 that, you know, efforts should be made to obtain the
2 correct information for the exposure and...and leave
3 the...leave the macrophytes into the...into the...in
4 the system. Thanks.

5 DR. HEERINGA: Yes, Dr. Ellsworth?

6 DR. ELLSWORTH: Tim Ellsworth. I had
7 one comment, actually, that was it seemed like the
8 microcosm/mesocosm data actually has kind of a hole, if
9 you will, in that long duration, low exposure profile.
10 I mean, it had 10 ppb for 260 days was kind of the
11 bottom limit on the, you know, there's almost a gap.
12 It looked to me like a little bit on the low level.

13 I know that's not exactly what you're
14 talking about here, but it seems to kind of fit. Maybe
15 there's some uncertainty about long-term, low level.
16 Maybe there's no impact, but I just...that's all.

17 DR. HEERINGA: Our last associate
18 discussant is...is Dr. Randolph.

19 DR. RANDOLPH: J.C. Randolph. I agree
20 with my colleagues right...right down the line. I
21 think do not exclude the early-season exposures from
22 the chemograph inputs, and it sounds like you're
23 already making some progress on some ways of dealing
24 with the macrophytes, and I think that's the approach
25 to follow.

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1 issues about, you know, how we handled the dose
2 response curve, and then, part of that as that there
3 was identification of...of a problem with implementing
4 the algorithms which at least contributed to this
5 prob...to this problem, although it isn't necessarily
6 the...the sole source.

7 So, when this correcting is being made
8 it...and will change...ameliorate this problem to some
9 degree which we don't know yet.

10 DR. CORBIN: Could I...

11 DR. HEERINGA: Yes, Mark Corbin.

12 DR. CORBIN: Yeah, this is Mark Corbin.

13 To kind of get at your question earlier about the
14 chemograph and the back extrapolation, this actually
15 came out in...when we back extrapolated a particular
16 chemograph at about 1.5 ppb, and we saw the chemograph
17 exceeding the SSI.

18 We went back and revisited that, and
19 when we, you know, we actually decided to carry over
20 concentrations from the previous year, in this
21 particular chemograph, that effect went away, but...but
22 it did raise the issue where we started investigating
23 these constant flat chemographs for the whole 365-day
24 profile where we saw the issue occur.

25 DR. GRUE: So, I...I agree with Bob

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1 DR. HEERINGA: Comments from other panel
2 members?

3 (No response.)

4 DR. HEERINGA: Dr. Erickson, I...I think
5 you know there's a little bit of uncertainty, because
6 you're obviously on the trail of a few other things,
7 but the comments that have been made by the panel, are
8 there questions or uncertainty about specific aspects
9 of that?

10 DR. ERICKSON: No, I'm fine with this,
11 so...

12 DR. HEERINGA: Okay. It seems like
13 there is some...an issue with these unobserved periods
14 between the...the fall termination and the spring
15 startup that obviously have some bearing and is
16 something that you're already pursuing and certainly
17 can be simulated.

18 Just a question of interest. Is there a
19 spike due to fall plowing in atrazine runoff? Does
20 anybody know?

21 MR. THURMAN: At least from the
22 chemographs we saw, there may have been one or two
23 chemographs in the...in those forty sites and multiple
24 years that may have shown a spike in the fall, but for
25 the most part, it seemed to be associated with the

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1 spring planting and not...not actions in the fall.
2 DR. HEERINGA: Any other comments with
3 regard to charge question number 5?
4 (No response.)

5 DR. HEERINGA: Well, at this point in
6 time, then, I think that we have...have fairly
7 exhausted coverage of the various aspects of the
8 application of the CASM atrazine model, and I think I
9 appreciate everybody's contributions to this particular
10 discussion, and I think it certainly sets up a lot of
11 other aspects of our discussion over the next day or
12 two with regard to the actual study design and then the
13 important question covered by 10 and 11, what does it
14 all mean or how is it all used?

15 And so, at this point in time, I turn
16 to...to Don Brady or to Dr. Ir...Dr. Brady or Dr. Irene
17 to introduce the...the next component of the review
18 here. And, again, all of this is interconnected, but
19 it's been broken up this way, so...

20 MR. BRADY: Thanks very much. Don Brady
21 again.

22 The next presentation is entitled
23 Determining the Extent of Waters Exceeding Effects-
24 based Thresholds for Atrazine. It's actually going to
25 consist of three parts when it's completed, first on

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1 portion of estimating the extent of the watersheds that
2 have waters within them that exceed effects-based
3 thresholds for atrazine, and at a later point, there
4 will be a third presentation that will discuss...that
5 will address that third issue.

6 DR. HEERINGA: Panel members, we're on
7 page...slide 59, I think, in the combined handout.

8 That's where Nelson's...

9 MR. THURMAN: Yes.

10 DR. HEERINGA: 60 right now.

11 MR. THURMAN: Basically, just to just
12 kind of give you a background, we laid out some
13 monitoring...some objectives for the monitoring study.
14 The two basic objectives, you know, how...how many
15 water...how much...you know, kind of get at how much,
16 how many, to what extent is the problem. The second
17 one is where.

18 And Syngenta has proposed a study to
19 address those objectives, and, basically, you know, we
20 said here are the objectives we need to address in this
21 study. Syngenta came back, here's the proposal we
22 have. And then there was a...we reviewed that
23 proposal, made some recommendations and suggestions
24 to
25 make sure it stayed on track to address the objectives
we have.

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1 monitoring study design and results by Nelson Thurman
2 who will be up next, then survey design and population
3 estimation by Dr. Olsen will follow Nelson, and then
4 uncertainty analysis of monitoring data by Mark Corbin.

5 So, I'd like to just turn this to
6 Nelson, if that's appropriate, Nelson Thurman.

7 MR. THURMAN: Okay, that is...this is
8 the agenda you see for our series of presentations.
9 Each one of us are going to talk and then, obviously,
10 we'll give you a chance for some clarifying questions,
11 and, hopefully, we'll be able to start to tackle the
12 charge questions today, but if not today, at least
13 first thing tomorrow morning.

14 I'm going to put this back up. If you
15 remember, Dr. Irene's talk first thing yesterday
16 morning, these were the requirements, the basic
17 requirements, that came out of the 2003 IRED for
18 atrazine. Dr. Erickson spent some time discussing how
19 we're reviewing the...the approach that's being taken
20 for taking the levels of concern we identified and
21 relating them to exposure profiles.

22 We're going to talk about how we looked
23 at the...how the monitoring study that Syngenta
24 conducted based on trying to meet some...some criteria
25 and questions we had, how that addressed the...the

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1 And so, there was a...there was a back
2 and forth that go on in terms of coming up with
3 something, a study, that we feel is going to address
4 those questions. And what I'm going to talk today
5 is...is our initial review of the results of that
6 study, how far we think we can take it in terms of
7 extending, you know, estimating extent of watersheds
8 that have streams that exceed the LOC.

9 I also want to point out...I think
10 you've heard this before...this particular part of the
11 study is focusing on flowing water bodies in corn and
12 sorghum areas of the country. There's some hydrologic
13 differences and some use differences that led us to say
14 you probably need to look at...at sugar cane, which is
15 another atrazine use crop, you need to look at sugar
16 cane separately, and there's a pilot monitoring study
17 that's been going on in that.

18 We haven't seen the results of that
19 study yet, because it's still going on. That's going
20 to be the subject for a future assessment.

21 I think some...there have been some
22 comments about static water bodies. We have more
23 monitoring data on those static water bodies that we
24 will be looking at and taking a look at as well. Once
25 again, that's not part of this...this presentation.

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1 We're focusing on the corn and sorghum areas.
 2 Just to give you a...a...a...you know, a
 3 look at what we're...the extent of atrazine use,
 4 this...the shaded area you see are areas either a
 5 county basis or, in some cases, multi-county of the
 6 crop reporting district that shows just atrazine sue in
 7 the corn and sorghum areas. So, you can see there's
 8 not much of the country where...that isn't included in
 9 this. So, one of the challenges we had, do you...do
 10 you end up with a monitoring study that looks at
 11 everywhere? Are there things we can do in terms of
 12 being smarter about what we already know about atrazine
 13 to better target that study?
 14 And I...I think you saw this yesterday
 15 in Dr. Harbourt's presentation where, you know,
 16 Syngenta first said let's look at...at areas where you
 17 had at least atrazine use greater than a quarter of
 18 pound per harvested acre. You see this cut down
 19 portion mostly shifts the use to...to the Midwest and
 20 the eastern part of the country.
 21 There was a...there's a reason for doing
 22 this, so...so it wasn't completely off. Monitoring
 23 studies, particularly some of the work USGS has done
 24 with NAQUA and some of the analysis they've done
 25 which
 25 has led to...to a model we're going to mention in a

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1 little bit shows that a large amount of the variability
 2 you see in monitoring in atrazine detections in water
 3 can be explained by use.
 4 So we already know that, based on use,
 5 we can be smarter in the way these studies are
 6 targeted.
 7 Before I go farther...and...and Chris
 8 Harbourt spent a little bit of time discussing the
 9 hydrologic unit codes and what they mean. I just
 10 wanted to give you a depiction, kind of show you the
 11 size of these watersheds in...in relative comparison.
 12 One of the things I want to emphasize is
 13 the planning began in 2003 which isn't that long ago,
 14 except when you're looking at spatial data, that can be
 15 like light years ago. And so, this is what...what
 16 we're talking about is what was the best available
 17 spatial data, best available information we had at the
 18 time whenever this study design was...was conducted.
 19 So, that's something I want to make sure
 20 you keep in mind, because there are some things today
 21 that may have led...may have led to a different
 22 approach, but this is where...where we went.
 23 The NHD, it's a hierarchical system.
 24 This is the HUC 8 which I think Chris Harbourt
 25 mentioned which is a...a fourth level down. Covers

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1 the...there's coverage for the entire country at that
 2 level.
 3 Fortunately for this study, a large part
 4 of the atrazine use area included HUC coverages at the
 5 next level down, and you're roughly looking at...at
 6 watershed at the HUC 10 or 11, looking at watershed
 7 areas that are anywhere from 40 to 100...to 250,000
 8 acres in size, and you can see that in...these will
 9 show up in the yellow and the light green, so the vast
 10 majority of areas. There were a few states where the
 11 scale wasn't available at that scale, and you see some
 12 of these areas where you have larger watersheds, Texas,
 13 Oklahoma, Arkansas, and some of these other states.
 14 Larger HUC sizes were used.
 15 And I already mentioned we already knew
 16 something about use intensity and influence it would
 17 have on atrazine concen...on atrazine concentrations in
 18 water. The idea of this study was we're looking to see
 19 whether there...there's a potential for...for, you
 20 know, exceeding ecological levels of concern. The idea
 21 is let's target the areas where you have a higher
 22 likelihood of it...of it occurring to see whether
 23 there's a problem and to what extent there might be a
 24 problem, those areas.
 25 I mentioned use and use intensity, but

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1 there are a number of other factors that may add to
 2 that. So, if we start with use...and this is a map, I
 3 think...actually, this map was probably supplied to us
 4 by Syngenta, but...and we've got various maps along the
 5 same line. What you see is the dark blue is the
 6 highest use intensity for atrazine. Going down through
 7 the color spectrum, the yellow is the lightest use
 8 intensities.
 9 You can see in the...in the Midwest,
 10 upper Midwest here, you do see where your highest use
 11 intensities tend to be for atrazine. So, if we start
 12 with nothing else, then you would probably end up with
 13 some...some monitoring sites targeted in this area of
 14 the country.
 15 The other...the one thing I do want to
 16 point out, and I think you heard a little bit about it
 17 in Syngenta's presentations yesterday, there is a
 18 degree of uncertainty whenever you're involved in the
 19 use estimates. They're based on surveys, and surveys
 20 don't cover everything.
 21 There's a whole lot of counties in
 22 this...in the United States, and the surveys don't
 23 necessarily give you multiple samples in every county.
 24 So, there is going to be some uncertainty whenever you
 25 go from the surveys which are compiled in crop

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1 reporting districts and try to go down to a county
2 level for the finer detail.
3 So, there is going to be a degree of
4 uncertainty involved in those survey estimates, and
5 that's something we need to keep into account whenever
6 we're...we're taking a look at both, you know, how
7 effectively can you target a vulnerability assessment
8 and how do you interpret that. So, these are things
9 that needed to be taken into account as we went along.
10 And it's one of the things when we start
11 looking at some of the...particularly some of the
12 analysis Dr. Olsen will talk about. That...that's an
13 issue that we've looked at and we are...we are
14 considering.
15 We also know there are other factors
16 that influence the vulnerability of that based on just
17 use, so the...the question that I think Syngenta tried
18 to explore...and they've looked at a number of...of
19 factors along the line, and I think in one of the 2004
20 documents we...we provided to you that they submitted,
21 you see a lot more of their detail analyses and the
22 various things they looked at.
23 They looked at various soil properties,
24 hydrologic and landscape components. They looked at
25 weather, particularly looking at not just amount of

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1 possibly identifying vulnerable watersheds, because it
2 integrated use with these...these other vulnerability
3 factors. So, that was...I think we maybe were
4 attributed for saying this is the way to go, but I
5 think it was more of a recommendation, because what
6 happened next was...well let me just give you
7 the...this slide you saw yesterday from Dr. Harbourt.
8 It's just up there.
9 One thing I wanted to...to point out is
10 the darkest blue is the highest 20th percentile of
11 exposure...I mean, the highest 20 percentile of
12 watersheds based on the WARP estimates. We're looking
13 at basically just as a relative ranking, not in terms
14 of absolute, you know, absolute numbers.
15 But as you can see, if you compare that
16 to, I think it is, slide 60 on your...on your handouts
17 which...basically, whatever that one that shows the use
18 intensity two or three slides back, if you compare
19 that, you can see how these compare, because that was
20 based on watersheds and this also looking at
21 watersheds.
22 So, you see a lot of the same areas are
23 covered, but there are some other areas that were
24 pulled in. So, it does look like the WARP
25 charact...charact...may have captured some more

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1 precipitation but the intensity and timing of the
2 rainfall, land use cropping, agricultural management
3 practices, the whole suite of...of data that...that
4 might target, and they were looking at a number of, you
5 know, additive, principal component analysis, a whole
6 lot...cluster analysis, a whole lot of factors.
7 Along the same time, U.S. Geological
8 Survey was finishing their development of...of a WARP
9 model which stands for Watershed Regression for
10 Pesticides. I think the water...the model was in final
11 draft stage in 2003 and actually may have been
12 published in 2004.
13 Its based on atrazine monitoring data
14 that is collected in the NAQUA program. They took a
15 look at nationally available coverages that help
16 explain potential for runoff and potential for atrazine
17 in there, and they looked...these are the factors you
18 see here listed, are the ones that turned out to be
19 significant.
20 There are a number of factors that they
21 looked at. I think we referenced the...the WARP...the
22 WARP publication out of USGS where you can take a
23 look
24 at that development.
25 But we recommended that...that Syngenta
take a look at this WARP model as an additional way of

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1 interactions between use and the other vulnerability
2 factors.
3 One of the reasons we thought this might
4 be good is that there is a separate drinking water
5 monitoring study that's been conducted, and those
6 drinking water intakes that...that tend to have
7 high...the highest concentrations in...in various
8 compliance monitoring, when you map those, a lot of
9 those fell into this...this high vulnerability tier
10 here. So, at least on our initial eyeball, it looked
11 like this might be an approach worth investigating.
12 Which is exactly what Syngenta did, and
13 Williams, et.al., that...that document that's included
14 in the background document, compared this with some
15 other approaches that Syngenta was evaluating. They
16 had a wealth of atrazine monitoring data, not just
17 NAQUA, but they also had additional state university
18 monitoring studies. They had a number of monitoring
19 studies that Syngenta or their precursors had...had
20 covered over the years.
21 Covered a lot of the...you see
22 monitoring sites in...in a lot of different...different
23 watersheds. They broke it down in terms of let's look
24 at those stations that had at least...that had some
25 detection above 3 g/L and stations that never had a

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1 detection above 0.1 g/L, and...and the question
2 they...they evaluated in this, when you look at these
3 various ways of identifying vulnerable watersheds,
4 which approach best grouped together these stations
5 that had detections greater than 3 while not including
6 the stations that had detections less than 1 g/L. So,
7 that was the evaluation.

8 There's more detail in the...in both
9 their write-off, and I think we've tried to re-
10 summarize that in the white paper we presented. I'm
11 just going to give you the bottom line.

12 The bottom line here is that upper 20th
13 percentile WARP identifies...identifies WARP greater
14 than 80th here was the...did the best job of...of
15 capturing sites that had detections above 3 g/L while
16 not pulling in sites that had...had detections less
17 than 0.1 ppb. So, once again, it was not just let's
18 pick one and run with it, how does it work, and this
19 was a test that was done at the time...time to see how
20 well it did with available monitoring data.

21 It provided us with a little bit more
22 confidence that if we target this area, we're likely to
23 target water...water bodies in the monitoring study
24 that...that had elevated concentrations of atrazine.

25 And so, in that regard, that was where

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1 sites, there were 7 sites that, in the original 40,
2 that didn't meet the criteria for...for selection, and
3 so, they moved into those over-sample sites.

4 There are some inherent assumptions with
5 the...with the...the approach for selecting the...these
6 sites, and these are assumptions that we are trying to
7 evaluate when we look at some of the sensitivity
8 analysis Mark Corbin will...will go into later. You
9 know, we're going to...we're taking a look at these.
10 These are things you need to take into account whenever
11 you...you provide interpretation and...and go from that
12 sampling of 40 and extrapolate it back to what it means
13 to your larger population.

14 One of the assumptions is that
15 it...there's a...it reflects watershed vulnerability
16 over time, and...and you know there's going to be year-
17 to-year variability in use intensity. There's going to
18 be changes in cropping patterns over time. These are
19 all things that you need to take into account.

20 And you'll see some...some of the
21 comparisons in Dr. Ol...Dr. Olsen's presentation where
22 we're...we're taking a look at that in terms of how
23 much variability you're seeing, how does that
24 infect...affect the population of vulnerable
25 watersheds, and what does this mean when we're trying

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1 it ended up. What you ended up here with is you've
2 gone from the entire area of atrazine use to an area
3 that was identified based on WARP as being the most
4 vulnerable. This included...this consists of 1172
5 watersheds. Most of them were in the HUC 10 size
6 that...that you saw. There were a few down here in
7 Texas that were actually HUC 8 size which is a little
8 bit larger, but at least at this point, there was a
9 tier population, and this is the population that would
10 be represented by the monitoring itself.

11 The next step is okay, you have a
12 vulnerable tier. You have this vulnerable tier,
13 let's...let's...you need to get a representative
14 sampling. Dr. Olsen is going to go into more detail in
15 terms of how the sampling was...the sample design
16 was...was conducted. It was spatially balanced and
17 with probability selection based proportional to use.
18 That's all I'm going to give you right now. Dr. Olsen
19 will explain it in more detail.

20 What I wanted to show you here is these
21 are all the 40 sites that were ultimately selected.
22 There were, I think Chris Harbourt mentioned, there
23 were a number of sites that were selected as over-
24 sampling. As...as it turned out, by the...by the time
25 they went out and inves...and looked for monitoring

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1 to...to interpret that.

2 Once again, it's worth pointing out WARP
3 used the best available spatial data they had at the
4 time, and this is national coverages. Soils are near
5 and dear to my heart. At the time, STATSCO was the
6 best national coverage of soils, although we are
7 nearing a point where county-level soil data, the SERGO
8 data, cover a complete, there are still some...there
9 are still a few holes that need to be filled in.

10 There were a whole lot of holes in the
11 original development of WARP, so you couldn't use that
12 information, because it just wasn't available at the
13 time.

14 There may be some local...local...some
15 factors that are important in explaining the
16 variability in a local scale that were not captured in
17 WARP, so these are some of the things we need to look
18 at. You know, and even at a HUC or 10...HUC 10 or 11
19 scale, you know, 40,000, 150 to 250,000 acres, there's
20 going to be a lot of variability within that...within
21 that, so some of the sub-watershed factors that may
22 influence are...are things that we need to look at.

23 You know, these are assumptions that
24 Tony Olsen's going to evaluate furly...further in his
25 discussion, and you're going to see it in some of the

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1 sensitivity analysis, and then as we get into what will
2 probably be the next day's discussion on looking at
3 WARE, we're going to go into a little more detail on
4 that.

5 You get the watersheds developed, and
6 you still need to find sites to...to monitor. I'm not
7 going to go into a whole lot of detail on this, because
8 you heard a lot of this yesterday in terms of going
9 from the watershed to a monitoring site.

10 And I'm going to go through a few points
11 just to highlight some of the issues and some of the
12 rationale for there and some of the implications of
13 that.

14 You know, essentially, what we...what we
15 said to Syngenta is that okay, you...we want to make
16 sure...and this was the philosophy that was used in the
17 study. We're targeted to watersheds that are
18 vulnerable. Use the same type of philosophy to target
19 sites for monitoring and look in areas where there's a
20 higher potential for...for atrazine, elevated levels of
21 atrazine in water.

22 So, you're...you basically want to look
23 at...at sub-watersheds where you have high row crop
24 densities and, in particular, high corn and sorghum
25 density, because that's going to be reflective of

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1 take a look at. Syngenta has been doing some
2 additional site work, and we've been doing some looking
3 to try to take a look at how do you explain that and,
4 then, how do you address that subset of...of
5 watersheds. And these are things that you'll see in
6 our discussion.

7 We separated those out right now,
8 because we're trying to figure out how do you address
9 that, and to what extent does that apply to the larger
10 population.

11 And once again, this was discussed
12 yesterday. I am not, you know, I'm not going to go
13 into too much detail. You know, the idea was
14 they...they looked at the red numbers you...the red
15 stream segments you see are those stream segments from
16 this, you know, this set of streams.

17 These are the segments that met the
18 criteria for...that...that were described. They were
19 randomly numbered and, in the field, started at number
20 1 and then work upstream to make sure, because, you
21 know, to be honest, the best data they had spatially
22 was 1992 national land coverage data on row crops. A,
23 you get a lot of land change, land use change between
24 1992 and 2003, and, B, there is a...a bit of
25 uncertainty in the NLCD in terms of identifying land

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1 atrazine use. You want to minimize the...the influence
2 of...of urban drainage.

3 Essentially, when you start looking
4 at...at...at the stream size criteria, the general idea
5 was let's avoid intermittent streams, and let's avoid
6 large rivers, and, you know, that's easy to say, but
7 then you start saying well, what criteria do you
8 actually develop that gets you there?

9 And this was a...a...more of a...I think
10 there was a lot of back and forth discussions and
11 research, and this was the criteria that you...you
12 heard...heard yesterday, and the intent was to try to
13 do that. And, you know, so what this does is it
14 does...it...the effect was you ended up with second and
15 third-order streams that...that were identified for the
16 monitoring study.

17 And so, when we were looking at this,
18 that, at least for...for this point, that's, you know,
19 the result's reflective of what you see in second and
20 third-order streams.

21 The intent was not to sample
22 intermittent streams, but as...as you've already noted
23 and we noted in the results, there are at least three
24 sites in Nebraska where it appears that...that that may
25 have been what happened. So, it's something we need to

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1 use at a specific scale, so you...they needed to go out
2 and make sure that these are conditions that are...that
3 actually existed.

4 And so...and if you've ever done any
5 water monitoring, you also know accessibility to the
6 stream is...is key, and when you're looking at 40 sites
7 and...and a 4-day interval, accessibility probably
8 becomes more...more of an issue. So, that was, I think
9 as you heard Dr. Harbourt mention yesterday, it turns
10 out that for most of the sites, that they couldn't find
11 any...it was accessibility and not change in key
12 factors that...that led to not monitoring in that
13 particular watershed and going elsewhere.

14 You heard a lot about this yesterday. A
15 couple things I just want to point out. They were
16 monitoring...the monitoring was conducted in multiple
17 years. Not only is each site unique, but each year is
18 unique. You can't do a field study and control the
19 weather and particularly when you're looking at a
20 watershed scale.

21 So, there were some conditions put into
22 the monitoring study. We're going to conduct...they
23 needed to conduct it for at least two years. If the
24 weather conditions during the monitoring period were
25 either abnormally low rainfall or abnormally high

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1 rainfall, then you probably needed to go to a third
 2 year, and there were a few that we looked at that
 3 seemed to fall into that category.
 4 At the same time...and you're going to
 5 hear this more in Dr. Corbin's talk...I think we've
 6 learned a lot more about the...the...the...how to...how
 7 to address that issue and, as it's kind of a common
 8 sense approach, it's not so much on a year...yearly
 9 comparison or even a monthly comparison. It's more of
 10 timing the rainfall during the...the season of
 11 application that...that's critical there.
 12 The 4-day monit...sampling interval is
 13 intensive, and you're not going to find much in the way
 14 of...of monitoring out there that...that's sampled that
 15 intensively. You also heard that...note that, you
 16 know, in a quarter of the sites, flow...flow-triggered
 17 autosamplers were...were installed.
 18 The idea between that...between that
 19 type of intensive monitoring was that one of the
 20 questions that needed to be considered in this
 21 stud...in this study was how frequently do you need to
 22 sample to capture both the magnitude and duration of
 23 atrazine exposure so that you could then use that
 24 to...to...to determine where there's a level of concern
 25 triggered, and that's one of the things Dr. Corbin,

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1 g/L, and we had a few that started getting above 50,
 2 and there was a site in Indiana that you heard
 3 mentioned that, on the 4-day grab samples, 208. If you
 4 looked at the autosampler at the same time, it was
 5 around 240.
 6 But the...the point of this is it's not
 7 just the magnitude, but it's also the duration. And
 8 so, when you start looking at analyzing the results and
 9 analyzing the chemographs, you need to look not just at
 10 the magnigude but at the duration and, as it turns out,
 11 the frequency at which these...these peaks occur.
 12 Just as...and this is more of a general,
 13 you know, taking a look at what I described as a
 14 distinguishable peak, and at this point, it was
 15 anything...just as a rough, there was nothing magic
 16 about 1 g/L; it's just that's the cutoff we decided to
 17 take a look at, and...and you see that we had...there
 18 was 86 years of sampling that covered those 40 sites,
 19 and...and in most of those years, there were three or
 20 more peaks, separate peaks, that went to greater than 1
 21 g/L.
 22 So, generally what we...what we saw in
 23 these streams were that you had multiple peaks of...of
 24 atrazine occurrence. Most of these were very short
 25 lived, and there is a...in the white paper we

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1 Mark Corbin, is going to...to present some of the
 2 initial analysis we've done.
 3 You've heard some of Syngenta's analysis
 4 earlier in terms of sample frequence and...and, you
 5 know, how many samples are adequate, and that's
 6 a...that's a question we have, because it goes beyond
 7 interpreting just these 40 sites but interpreting
 8 additional monitoring in...in other parts of the
 9 country.
 10 I'm going to just give you a very brief
 11 summary of...of the results of the...of the monitoring
 12 results themselves. And, you know, a traditional
 13 interpretation of a monitoring study is what
 14 were...what were your peak detections and how often did
 15 you...did you find them.
 16 And if you go back to the IRED where we
 17 basically...the conclusion the Agency made based on the
 18 wealth of...of studies looking at the
 19 microcosm/mesocosm studies is that concentrations
 20 between 10 to 20 g/L over some period of time appeared
 21 to be, you know, reflect a level of concern.
 22 Well, we had, basically, 80 percent of
 23 the...of the sites, of those 40 sites had at least one
 24 detection greater than 10 g/L, and a little bit over a
 25 third of them had at least one detection more than 20

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1 presented, there's a...there's an appendix...I think it
 2 may be Appendix 2...that plots those chemographs for
 3 each of the years at the same time as it shows you the
 4 planting periods and also shows the rainfall in
 5 relation to that so you can take a look at it, you
 6 know, from at least visually, take a look at...at that,
 7 and I think those tend to be more helpful in this case
 8 than just looking at...at statistical or tabular
 9 summaries.
 10 For most of the cases, those elevated
 11 concentrations generally didn't span more than three
 12 sampling periods, so they generally didn't span more
 13 than a four-day period.
 14 There were some notable exceptions that
 15 we're going to talk about in a little bit more detail
 16 and you've already seen to some...to some extent.
 17 This gives you an example.
 18 It...I'll...what we're looking at. This particular
 19 site which was in Indiana had...had two...two
 20 detections that...that went above 20 g/L, and you can
 21 see this was the widest duration of...of...of exposure,
 22 of elevated exposure that went about three sample
 23 periods.
 24 I want to explain a little bit about how
 25 those chemographs were...were interpreted. The CASM

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1 model used, by default, a stair-step approach. It's
 2 interesting, because I think I remember my basic
 3 comment was, you know, when we're interpreting
 4 chemographs and we're interpreting in a four-day
 5 period, you know, 4-day grab samples, I think my
 6 comment to Syngenta at the time was you need to think
 7 about how you interpret those, and a linear approach
 8 which I sometimes call the connect the dots approach, I
 9 would say, is not the right model for interpreting
 10 chemographs, and the reason being is even at a sampling
 11 intensity as intense as one every four days, you
 12 basically have a one-in-four-day shot of monitoring on
 13 the day that you're going to have your highest...your
 14 highest exposures.

15 Although I don't think it made it into
 16 the white paper, but...because I think we continued to
 17 do analysis after we got that paper out...in fact, I
 18 think they pulled it out of our hands to get it out on
 19 time...we...we took a look at...at the occurrence of
 20 the sampling periods, and we took a look just as one
 21 way of evaluating how close it came to maybe
 22 capture...capturing your highest loads.

23 We looked at those sampling periods that
 24 occur where you had a rainfall that either occurred the
 25 day before or the day of sampling, because at that

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1 extrap...extrapolate to January 1st and...and then all
 2 the way to the end, and except for maybe two sites, you
 3 had very low concentrations, and it really made no
 4 difference, and I think the two site...one of which led
 5 to us finding well, hey something's going on here that
 6 doesn't make sense. We had elevated...it had
 7 concentrations maybe within about a fraction of a g/L.
 8 And one of the reasons we did that is
 9 because we do know from available monitoring is that
 10 you're not necessarily going to have zero concentration
 11 of atrazine in the early season. In some areas where
 12 you do have maybe a baseload contribution, you may very
 13 well see some atrazine levels above...higher than that.

14 In fact, in some of the Heidelberg
 15 College data that was used in the initial evaluation,
 16 you will see some earlier season spikes of atrazine.
 17 So, there was a reason for doing that, you know,
 18 and...and it was basically we want to take a look at
 19 that. We know there are some other monitoring data out
 20 there that will have that earlier season concentration.
 21 So, it was let's take this approach for this particular
 22 data even though the monitoring, for the most part,
 23 started April 1st in most of the sites.

24 One other thing I want to point out is
 25 that even though you have these two spikes above 20,

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1 point, we didn't really know what, you know, the
 2 timing. And I think we found roughly anywhere from
 3 two-thirds to three-fourths of the sampling periods
 4 would have missed the peak based only on that eyeball.
 5 And that doesn't necessarily mean that that was when
 6 the...the peak occurred, because you may have some up
 7 higher in the watershed impacts going on, but it looked
 8 like you may have missed that.

9 I think the approach that Syngenta came
 10 back with, the stair-step approach, was the
 11 acknowledging that this may not be the...the highest
 12 peak. We don't know what the highest peak is at this
 13 point, here's some approaches, and you saw some
 14 presentation yesterday, I think, from Dr. Hendley
 15 that...where Syngenta has taken some approaches of
 16 trying to...to see how best to interpolate in between
 17 the...the sampling event and apply it not just to 4-day
 18 samples but to...to other monitoring that are
 19 less...less frequent.

20 Mark Corbin will be doing this a little
 21 bit more in his presentation, the sensitivity analysis,
 22 and you can at least, in our paper, you've seen some of
 23 the initial approaches we're taking.

24 This was a case...and the other thing I
 25 want to point out is yes, we did back

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1 the...the CASM atrazine and the SSI was 2.2 which was
 2 below the 4 percent level of concern. So, this was not
 3 a site that would have exceeded the level of concern.

4 This is that Indiana 11 site that...that
 5 was discussed yesterday. This is the sampling of it
 6 that had the 208 g/L. This also shows the...the
 7 autosampler concentrations that were...that were
 8 measured over a period of time.

9 And this is a little misleading, because
 10 this isn't six days of...of ex...extrapolation. This
 11 is still a 4-day period here. Excel, in its warped
 12 sense of humor, decided to expand the days out, so
 13 there...there are three 5/13s in...in this, but it does
 14 kind of show you that this was the first, second, and
 15 third autosamples, so you can see that there was
 16 a...the spike did happen fairly quickly.

17 There's other point that the, you know,
 18 this is an issue where...where the autosamplers picked
 19 out the 20 g/L spike that was not...that
 20 hap...occurred in between the...the monitoring, the 4-
 21 day grab samples. So, you can get an idea of, you
 22 know, the frequency of sampling and what you get there.

23 If you take that 4-day stair step here,
 24 Indiana 11 exceeded the...the level of concern. There
 25 were some discussions about the early...early season

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1 influence and such, but do you...when this exceeded was
2 an earlier version of atrazine that was of the CASM,
3 actually the CASM atrazine model that was insensitive
4 to those early days. So, this basically exceeded,
5 based on that 4-day...4-day stair step and that 208
6 g/L.

7 So, one thing we looked at was it
8 looked, you know, a level above 200 ppb for about 4-day
9 may be, you know, something that gets you for a single
10 spike. If you were to look at this as being your
11 highest day, 204 day, come down here. You know, at the
12 end of that day, you're around 100, and then do the
13 stair-step from 100, and this actually drops below
14 the...the level of concern.

15 So that was an issue of why we called
16 that kind of exceeds but marginally exceeds whenever we
17 were discussing that in one year.

18 Two sites in Missouri exceeded the LOC
19 in...in each of the years of sampling. I want to
20 show...put these up as an illustration, because what
21 you see is not just the magnitude, but you also see
22 there's an extended period of time where you have
23 ...you have elevated levels of...of...of atrazine, and
24 this particular site exceeded the 4 percent LOC, and it
25 wasn't...and what it's pointed out to us is, once

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1 in terms of interpreting the results of this,
2 interpreting what does it mean whenever you're trying
3 to evaluate impacts in intermittent streams.

4 So, at this point, when you see the
5 analyses are going on, these three sites are being
6 treated as a separate category for...for the population
7 estimates and in terms of what do we do with those.

8 To kind of summarize, when we're
9 evaluating those monitoring chemographs, there's three
10 questions we need to take a look at and three questions
11 we've been trying to evaluate. First one is how well
12 do those chemographs cap...capture the magnitude and
13 duration of exposure, since it is both that are
14 important?

15 Some of the sensitivity analyses that
16 you'll see, that's...we've been focusing on trying to
17 address that...that question, not just...once again,
18 not just for the results of these 40 watersheds but
19 then taking a next step at other monitoring data.

20 What is the minimal sampling frequency
21 that you might need to adequately capture the magnitude
22 and duration? I think Syngenta's done some analysis
23 and made some suggestions, and we're taking a look at
24 it from that result as well.

25 The second question is if the...if we've

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1 again, the importance of not just the magnitude but the
2 duration.

3 This is the Missouri 1 site, a second
4 site, and you can see it's an early season spike, and
5 then you do have a fairly extended, roughly a month, of
6 samples that were greater than 20 g/L.

7 So, that was as we started taking a look
8 at the sites and taking a look at the chemographs and
9 saying what do they tell us about the likelihood of
10 occurrence. This information on magnitude and duration
11 became a very important factor as we're taking a look.

12 And it leads us to the three Nebraska
13 sites, those three sites from southeastern Nebraska
14 that had a number of missing grab samples based
15 on...because of low flow conditions or...and we take a
16 look at that. If you looked at just doing a straight
17 stair-step interpolation across until you get your next
18 sampling event, what you see is these red areas are
19 areas where the last measured concentration would
20 extrapolate until the next time a sample is taken.

21 Extrapolating that across, then, you
22 ended up exceeding the...the 4 percent SSI. If
23 you...you know, the big question is, what do you do
24 about the time in between? I think, as Syngenta's
25 noted, you probably need to do something different here

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1 got some confidence that it's doing an adequate job at
2 capturing magnitude and duration of exposure, the
3 question is, do those field exposures exceed the level
4 of concern for the aquatic community effects? This is
5 something you'll see in the results of our paper where
6 we basically took the chemograph and ran it through
7 CASM to see whether or not it exceeded the 4 percent
8 LOC.

9 The third question...and this is the
10 question that...that Dr. Olsen will...will address in
11 his presentation is, how do those results relate to
12 the...to the larger population of vulnerable
13 watersheds? And that, Tony will take that up, so I'm
14 just asking the question at this point.

15 After we did the analysis, ran the...the
16 chemographs through the...through the CASM atrazine,
17 we

18 came up with five separate categories for the...for the
19 40 watersheds. We had 2 sites in Missouri that
20 exceeded the LOC in multiple years.

21 We had the 1 site in Indiana that
22 exceeded the...that either exceeded or was marginal,
23 depending on...on how you interpret the chemograph. In
24 one year, it didn't exceed. In the second year, I
25 think Syngenta presented some preliminary results. We
26 haven't seen those results yet, so we'll be taking a

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1 look whenever they...they get in in terms of what
 2 happens in that third year.
 3 The three Nebraska sites that had some
 4 low flow and missing samples, we need to look at that
 5 in terms of how do you...how do you interpret the
 6 results of...in those cases.
 7 You heard some discussion...I think Dr.
 8 Erickson has talked about the multiplication factor
 9 and...and we're trying to look at it and say what does
 10 that mean, what does that do. There were two...there
 11 are only two sites that...that had...that didn't exceed
 12 the 4 percent SSI but whose exposures would have been
 13 within 2x of the multiplication factor. That was a
 14 site in Kentucky and Missouri.
 15 There are a whole number of ways to try
 16 to take a look at...at uncertainty in...both in terms
 17 of frequency of monitoring and analytical results and
 18 weather, variability year to year of weather. We just
 19 take a look at those, because those were two sites that
 20 were...that did have elevated exposures. Still didn't
 21 look at the...didn't exceed the LOC. For right now,
 22 we're just taking a look at that separately just to see
 23 what it...what that may tell us.
 24 The remaining 32 sites were well below
 25 the level of concern in multiple years.

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1 the approach that both you and Syngenta, EPA and
 2 Syngenta, paid to trying to determine the sampling
 3 locations, I...I...to me, that's...I think that's going
 4 in the right direction. I have some concerns about
 5 some of the specific inputs and I'll...I'll make those
 6 comments, too, but I really like the approach.
 7 And I would like to also echo your
 8 comment about the availability of just spatial data.
 9 When I first got in the business of GIS in the early
 10 '90s, it was hard just to get a layer that had county
 11 boundaries on it and...and one that was consistent.
 12 Now, we have a tremendous amount, especially because
 13 the...the Federal Government has provided a lot of...a
 14 lot of pre-data which is somewhat unique globally.
 15 So, I...I would applaud that. I think
 16 that's moving in the right direction.
 17 One comment I'll make in looking
 18 at...actually, in looking at the WARP study, looking at
 19 some of what Syngenta's presented and then also yours
 20 is that there's also a concern with geospatial data
 21 in...in doing analysis with data that's collected at
 22 different scales, and as you pointed out, the STATSCO
 23 data, the soil data is at a...you didn't mention the
 24 scale, but it's at 1:250,000 scale. And so, the
 25 minimum size of a soil polygon, of a soil delineation,

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1 So, those were the categories
 2 that...that we looked at and carried into Dr. Olsen's
 3 presentation. There is another category that Tony will
 4 mention. Those seven sites that did not...that, for
 5 whatever reason, were excluded from monitoring because
 6 they couldn't find a suitable site, there are a number
 7 of ways to do this, and this is where the value of
 8 having a statistician on the team helps, because, as a
 9 field person, I just say all right, you know, we'll
 10 just toss those seven sites out and not worry about
 11 them, but...but as Tony Olsen points out, why they were
 12 excluded becomes important in terms of interpreting the
 13 results of those studies. So, that's one that you'll
 14 hear Dr. Olsen address.
 15 At this point, I'm finished with my
 16 portion of the...of the presentation, and I'll
 17 entertain any questions.
 18 DR. HEERINGA: Thank you, Nelson. Any
 19 questions on the presentation that Nelson's provided us
 20 on the...on the procedures used for site selection and
 21 justification of the sort of general model for
 22 selection? Dr. Effland?
 23 DR. EFFLAND: Bill Effland. I'll be
 24 glad to start, and we'll go from there.
 25 I'd like to say that you're...you're...

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1 is roughly somewhere on the order of 1000, 1500 acres,
 2 some...somewhere in there. I don't remember the exact
 3 number.
 4 And so, the resolution that you can have
 5 with those...with that data layer is...is one thing,
 6 and there's also some other things with the particular
 7 data. The survey data, the county-level data, is much
 8 more detailed, typically at a scale of, in some cases,
 9 1...as refined is 1:12,000, in other cases, 1:24,000.
 10 So, taking a lot of this data and
 11 bringing it together into a geographic information
 12 system with different scales, there...there's a caution
 13 there, and I...and I would recommend that...that you
 14 consider that, and I know from looking at what USGS did
 15 for the WARP analysis, they converted everything
 16 into...into grid, into raster, into pixel-based data,
 17 and while that's a better way to handle this kind of
 18 differences in scale, in some cases, that may not be
 19 the appropriate thing to do with some data, because
 20 it's collected for the scale that it's published at.
 21 So...so I would make that comment.
 22 I was also looking at, I guess it was,
 23 the WARP report where they show the detections of
 24 atrazine from the NAQUA data and the other data sets
 25 they have, and maybe it was the...one of the Syngenta

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1 slides, and one thing I noticed is that there are some
2 detections in the East Co...on the East Coast in, say,
3 the Chesapeake Bay watershed, something that is near
4 and dear to my heart, because I'm a resident of the
5 Chesapeake Bay watershed, and there's a lot of
6 concerns, and there is atrazine use in there. I
7 realize it's not the Midwest, but there certainly have
8 been detections of atrazine in surface waters.

9 And so, that area is at least something
10 as far as if you're looking at runoff vulnerability and
11 those kinds of things, something to consider.

12 Another comment is New York.

13 DR. HEERINGA: Dr. Effland, I want to
14 make sure we're asking questions of clarification,
15 because we'll have chances to...to go into comments
16 and...and discourse on it.

17 DR. EFFLAND: Okay.

18 DR. HEERINGA: So if there are
19 clarification questions, yes, that's fine.

20 DR. EFFLAND: Okay, I'm sorry. That...

21 DR. HEERINGA: No, that's fine. I
22 just...

23 DR. EFFLAND: I'm...I'm...my question
24 is, why was New York in your...in your graph on page
25 65? You've got New York showing quite a large amount

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1 shifted. We were shifted in this area because of the
2 WARP and...and we went to that.

3 One other thing I would point out
4 just...your...your comment about scale is very, you
5 know, very near and dear to us, because that's
6 something we always struggle with. One of the other
7 reasons why we didn't go below a HUC 10 or 11 was
8 because we felt the scale didn't warrant. There was
9 another layer, another tier of watersheds before that,
10 a much more detailed scale, that was available for most
11 of the same areas, but it really didn't look like the
12 scale of available data warranted being able to go down
13 to that...that level of detail.

14 DR. EFFLAND: Okay, yeah, and
15 that...Bill Effland again. Yes, I agree, especially
16 because of some of the other data sources.

17 And then another...another question that
18 came up in my mind, and I didn't see it anywhere in the
19 documentation, was why...why that particular use rate
20 of a quarter of a pound, greater than a quarter of a
21 pound per harvested acre. Why...why was that selected?

22 I mean, I...I'm sure there's a whole
23 range in...in use rates, but why...why that particular
24 number?

25 MR. THURMAN: You know, honestly, that

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1 of use along the...along the Erie, on Lake Erie region,
2 but there was no...no monitoring in this particular
3 study. So, why...why was that particular area...or at
4 least it didn't...it didn't come out in your...and why
5 was that excluded I guess is my question?

6 MR. THURMAN: Excuse me. This is Nelson
7 Thurman. I think that...that if you looked on slide
8 60, you do see some...some use up in the...in the New
9 York. You can see along the lakes area of New York,
10 and then if you go on to the slide that says
11 vulnera...generally ranking vulnerability based on
12 WARP, when you started combin...that's where when you
13 look at the combination of the other factors involved
14 there. It shifted less vulnerable relative to these
15 areas in the Midwest, some of the areas that went down
16 the lower Mississippi River corridor.

17 As I pointed out, you can see WARP did
18 identify some areas of high...some areas of
19 high...high...relatively high vulnerability potential
20 along the...within the Chesapeake Bay watershed. So,
21 there was...there was a site in Pennsylvania that was
22 part of the 1172. So, there were a number of sites or
23 part of that when it came down to site selection, it
24 just wasn't one of the areas that were selected.

25 So this is one of the things that

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1 was something that Syngenta came forward and
2 said...that was something Syngenta came forward and
3 said as an initial cut, this seems...you know, let's
4 take a look at this, and...and there may have been
5 something more pertinent. I think they said it
6 represented the upper either 55th or 45th percentile
7 or...of use.

8 Nothing particularly magical about it.
9 It just cut down the area to focus roughly in half in
10 that regard.

11 I think, you know, the other thing that
12 they basically did use per harvested acre. You could
13 have done it use per acre or planted acre or use per
14 row crop acre and get a little slightly different
15 intensity. I don't think there's anything magical
16 about it. They just suggested that as a way to at
17 least narrow the initial focus of that.

18 And I would say that even if you were to
19 take a step back and did the entire...I think what they
20 said...9800 watersheds that had atrazine use, I believe
21 you would have still ended up in the same...with the
22 same 1170-some...some based on water.

23 DR. EFFLAND: Okay, thank you.
24 That's...that answers that.

25 And one other...one other question, and

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1 maybe I misunderstood your explanation, but in WARP,
2 there's an overland flow component in the...in the WARP
3 model, and then in your table on...on...I have page 70,
4 on slide 70...I'm not sure that's the
5 number...evaluating vulnerability approaches
6 table...no, that's not the...they're not the...they're
7 not exactly the same. It's back. It's back a few.
8 Anyways, I can...I can go ahead and ask my question.
9 Yeah, that's...that's the one.

10 Your bottom row which I believe is the
11 one you used to...to...as your selection, you have flow
12 again, and are you...are you double counting for flow
13 in the...in the analysis, or am I...is it a different
14 flow?

15 MR. THURMAN: It's a different flow, and
16 the...and this is more, you know, trying to, you know,
17 economy of...of time. As described in the white paper,
18 the flow they talked about is they did, using national
19 elevation data and the national...NLCD to calculate
20 flow accumulation under row crop areas. So, that flow
21 under...the flow under crop is the same as this flow
22 here. It's just one of the parameters they were
23 considering was flow under row crop areas with the idea
24 being that it might be an indicator of...of...of
25 streams that were likely to receive more flow from row

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1 address?

2 MR. THURMAN: Honestly, I'm not sure
3 that it does really capture that, and I think that's
4 one of the things we need to take a look at. I mean, a
5 lot of these things that you're looking at is...your
6 done overland flow was something I had to wrap my mind
7 around whenever I was...whenever they were developing
8 the WARP model, and I...and I remember asking well,
9 why
10 is this a negative influ...factor in the WARP model
11 itself and what does that really mean?

12 And the nearest explanation I got that
13 makes sense to me is that it may be reflecting a lot of
14 runoff either over wetlands or a lot of times where
15 your soil's saturated so you really...your runoff,
16 you're not really getting much interaction with the
17 soil, so there's less contact with the chemical.

18 It's not the same thing as...as the...as
19 the conditions you're talking about, and that is one of
20 the things that, as we're looking at where and looking
21 at what may be available today that wasn't available
22 before, it's something to look at that we need...we
23 need to take a look at.

24 And it is something that we've had
25 conversations with some folks in USGS and some of the
26 additional monitoring studies they're doing that are

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1 crop, more potential for atrazine runoff.
2 I think one of the reasons why this did
3 not show up is because it was under row crop, and row
4 crop includes wheat, soybeans, a number of other crops
5 where atrazine isn't used. So...so, in effect, it did
6 not really capture use in that regard.

7 The done overland flow was more...it's a
8 hydrologic term. It's basically the runoff
9 you...percent of runoff you get that occurs over
10 saturated...where you're...you're over saturated soils,
11 and so, that's a different type of...of occurrence.

12 DR. EFFLAND: Okay, so then my last
13 question, so, do you think that...that type of...of
14 analysis has allowed you to capture variable source
15 area hydrology? That...that's one of the...in the
16 diagram that was shown yesterday by...by Dr. Orbell,
17 that's one of the kind of interesting things
18 that's...that's been rediscovered in the last decade or
19 so, is that when we have saturated flow at the base of
20 a slope, it starts to gen...you know, that starts to
21 congeal, basically, and we generate this large area of
22 flow related to storm events.

23 So, in...in...in this watershed
24 selection process, is...is that a process that...a
25 mechanism that you think you've been able to...to

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1 suggesting that this...some restrictive subsurface
2 layer does have an influ...influence on...on what
3 they're seeing in terms of chemical movement. So, it's
4 something that...I think there's a lot of valuable
5 information that we hope to be able to take advantage
6 of in this regard.

7 DR. HEERINGA: Dr. Lerch?

8 DR. LERCH: I've got a question. I'm
9 trying to understand this flow accumulation under crop
10 or urban and contrast what that might be telling me
11 relative to or compared to the criteria that would have
12 just said there was X amount of cropped area above this
13 point or X amount of urban above this point.

14 I understand the reason for the criteria
15 relative to urban or ag, but the flow accumulation is
16 hard for me to wrap my mind around, and is it giving me
17 anything that just saying certain area of crop or urban
18 wouldn't have?

19 MR. THURMAN: I tried to wrap...I was
20 trying to wrap...I was trying to wrap my mind on what
21 it told us, too, whenever...and this is one of
22 the...one of the metrics that Syngenta brought forward,
23 and my first reaction was it might be another surrogate
24 for percent row crop area. It may take
25 in...into...maybe a little more weighting in areas

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1 where you have more intensive, you know, flow patterns
2 and, basically, in a NAD.

3 What it tells us I wasn't sure, either,
4 and that's one of the reasons why, when we started
5 looking, we said have you looked at WARP and one...and
6 one of the reasons that...that pointed to there. Like
7 I said, I...I think it did a fairly decent job in terms
8 of, you know, looking at it, but it wasn't even close
9 to what we found in WARP, and I...I honestly think it's
10 because it's more a reflection of percent row crop
11 area, and that includes areas that aren't treated.

12 And, particularly, when we start looking
13 a little...you don't have to go too far west...of
14 the corn/sorghum areas where you start seeing a lot of
15 wheat and a lot of other row crop areas that...where
16 atrazine isn't used.

17 DR. HEERINGA: Dr. Grue and then Dr.
18 Randolph.

19 DR. GRUE: Well, will the subsequent
20 presentation talk about the population, trying to
21 extrapolate back to, based on the selection process
22 that you've gone through at this point?

23 MR. THURMAN: Yes, it will.

24 DR. RANDOLPH: J.C. Randolph. I'd like
25 to look briefly at figure 62 and then also figure 65,

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1 down to a county level.

2 I think Dr. Harvard pointed out that
3 there are some concerns they have, and at least in
4 their revised analysis, they've backed off more to the
5 crop reporting district which are multiple counties
6 rather than individual counties, because...I think a
7 lot because of their uncertainty in...in that result.

8 The planted...the harvested acres which
9 is the...which is what they used, they basically ended
10 up with X pounds of atrazine use per county in terms of
11 total pounds of atrazine use based on the survey
12 estimates and, you know, taking it down to a county
13 level. The harvested acres came from...from the
14 ACCENTIS.

15 Paul, can you correct me? Was that
16 ACCENTIS or National Agricultural Statistics Service,
17 or do we remember?

18 DR. HEERINGA: Dr. Hendley, why don't
19 you...sorry to do that to you, but...

20 DR. HENDLEY: Paul Henley. The data was
21 actually from the estimates of corn use as a fraction
22 of row crop when we extrapolated it down to the
23 watersheds, and that came from the NAS relative values
24 of corn to soybeans that...the crops that make up the
25 row crop designation used by USDA.

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1 and my question is, what are the...no, let's see. My
2 62 seems to be different. Go back one...couple more.
3 Yeah, that's it. Well, it's not. That's 65. 65 I
4 want to look at, and then, on my copy, it says 62,
5 watersheds. Yeah, okay.

6 I...I have two questions. One, what are
7 the sources of these data? Is it atrazine sales? How
8 do you get use? And how do you know where it's used?

9 The second part of the question is
10 what's the spatial resolution of the data...of that
11 calculation?

12 MR. THURMAN: Okay, and once again, I'm
13 interpreting the data that Syngenta calculated, but the
14 source of the data is there's a market survey called
15 Done's, and, basically, it is a survey of how much of
16 the chemical used by...they...they survey a number of
17 farmer and various crop reporting districts, and based
18 on that survey, they provide an estimate of...of use.

19 What Syngenta did is they compiled Done
20 usage for 19...the years 1998 to 2002. It
21 basically...the use over time for atrazine has been
22 relatively constant, so...so they were able to do this
23 without compromising too much. What it did, by
24 compiling over a number of years, increased the number
25 of samples so that they, at the time, could extrapolate

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1 Is that addressing the question, Nelson?

2 MR. THURMAN: Yeah, okay, so you can see
3 there are a number of different data sources, and, you
4 know, when Dr. Eckland starts talking about the various
5 uncertainties in scale, you'll still have uncertainties
6 in there that all these take into account.

7 You know, the one thing I'd point out,
8 so what you see here is what they then did...this is
9 the scale. They are based on these watersheds. So,
10 that...that was the scale that got them there, and they
11 basically looked at those watersheds that intersected
12 counties that...that had use greater than 0.25 lb/acre
13 in that regard.

14 You know, I don't worry too much about
15 the absolute number and what that means, because you
16 can calculate that any number of ways. When we were
17 taking a look at atrazine use, we basically looking at
18 various ways of depicting the use, overlaying the use
19 both in terms of total pounds on a county scale and
20 various things, and you roughly end up in the same area
21 of the country in doing that.

22 And as I pointed out, even if we
23 have...I think even if we hadn't...if we had just said
24 all right, let's look at the entire country and drawn a
25 WARP analysis on the entire country, my feeling is,

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1 based on what I know, we would still end up in the...in
2 the same...in the same area.

3 So, this map kind of shows you...the one
4 you saw earlier, the green in the 150 use, this is the
5 same area, and what you see is the
6 relatively...relative intensity of...of use in some of
7 those...those various watersheds.

8 DR. RANDOLPH: J.C. Randolph. Thank you
9 for that explanation. I want to come back but a bit
10 later when we talk about the individual watersheds and
11 ask some more questions about land use and land cover,
12 but I'll hold that.

13 DR. HEERINGA: Yes, Dr. Young?

14 DR. YOUNG: I just...I just want to
15 confirm that I understand what was done, because
16 counties and watersheds don't align perfectly. Okay?
17 So, you had to in some way solve that misalignment, and
18 how did you go about it?

19 MR. THURMAN: You basically have to...to
20 go from county to...to watershed, and basically,
21 there...there's a G...GIS...I call them GIS gymnastics.
22 The approach is where you...you basically have got to
23 take the counties. You've got to...to, in this regard,
24 they took the counties. They know there's X pounds of
25 atrazine use per county. You can take the...you know,

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1 because that's really more complex than if you just use
2 the area of the county. So, you actually used the
3 proportion of the row crops within the county to make
4 that assessment?

5 MR. THURMAN: Yeah, and prob...there
6 are...where that becomes more of an issue, it may
7 actually be more of an issue in the west than in the
8 east where you've got a larger county. I know, in
9 particular, in California, you...you have to do that,
10 because you've got counties that span the Sierras and
11 the...you know, and San Joaquin Valley and some of
12 those others so that you want to make sure that, you
13 know, all your use may be concentrated in one watershed
14 even though your county spans multiple watersheds. So
15 that's one of the reasons for doing that.

16 When I first started out working with
17 GIS before we started taking into that, we basically
18 made the assumption uniform across the...the county
19 area, but this...I think this is a little bit better
20 way of proportioning it.

21 DR. HEERINGA: Questions? Dr. La Point?

22 DR. LA POINT: This is Tom La Point.
23 Just a question is another way of ranking or is it a
24 way of ranking watersheds...I know not much about
25 this...to have those that flow into a...a standing

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1 when you overlay counties with...with watersheds, the
2 watersheds are likely to cut through the middle of the
3 county. There's very few of them where you're actually
4 going to honor the boundaries.

5 And...and so, you need to proportion,
6 you know, what...how much of that use belongs to the
7 county in watershed A and how much of the use goes into
8 watershed B. And one way of doing that is taking a
9 look at your row crop...at your land use or your row
10 crop data and say all right, 70 percent of the row crop
11 acreage in this county is in...is in watershed A, 30
12 percent is watershed B, so you proportion that. You
13 ration that...that usage proportional to...to that
14 percent in the watersheds, and then you...you do that
15 for each of the watersheds, and then you sum...sum use
16 on that.

17 It's...if you automate it, it's easier
18 to calculate than it is to...to describe, but like
19 I...as...it takes a little bit, and there is the basic
20 assumption of uniform distribution of use across
21 the...the row crop area, and it's part of the
22 uncertainties that we...that we run into, and it is
23 also one of the reasons why scale is something we need
24 to...to pay attention to.

25 DR. YOUNG: So, I just want to confirm,

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1 water body like a reservoir or a lake or something?
2 Because that, you know, given atrazine where it tends
3 to stay...its half-life of what, 30 to 45 days or
4 so...I mean, is that...does...can you pull that out of
5 this data set? You probably could, couldn't you?

6 Where it goes into a...

7 MR. THURMAN: Well, first of all, the
8 WARP is based on flowing water. So, that...it's based
9 on stream monitoring, so that influence is there.
10 And...and one of the things it incorporates like the
11 NHD plus, National Hydrography Database, is a way of
12 identifying locations of...of static water bodies as
13 opposed to flowing water bodies. So there are...there
14 are ways where we could say all right, where are the
15 static water bodies?

16 And there has been some evaluations of
17 WARP in terms of what does it represent in terms of
18 reservoirs. So, there are approaches we could take to
19 zoom that...in on that.

20 And as I said, we are looking at static
21 water bodies as a separate...in a separate effort, so
22 that is something that...that we need to take into
23 account.

24 DR. HEERINGA: I think that questions of
25 clarification have been answered at this point, and I

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1 guess we're ready to move on if you feel Mark is read.
 2 Oh, Tony.
 3 Just to remind everybody, Tony, Dr.
 4 Olsen, is with the Western Ecology Division of ORD
 5 within EPA.
 6 DR. OLSEN: Good afternoon. I'm Tony
 7 Olsen. There are some people who may believe that I
 8 don't actually work at Western Ecology Division. I
 9 never spend any time there.
 10 Just to give you an overview of what I'm
 11 going to talk about, I'm going to talk about three
 12 different topics, one, the monitoring design which
 13 includes the population definition and, actually, talk
 14 a little about what the results of the population
 15 estimation area and really to...and then, at the end,
 16 to come back and really sort of address a little bit of
 17 a question I think has come up in the...a little bit of
 18 a question that's already come up is the ability of
 19 WARP to identify the, you know, the most vulnerable
 20 watersheds.
 21 So to start out to begin with, this is
 22 definition of the target population. It's all the HUC
 23 10 watersheds that intersect counties with atrazine use
 24 greater than a quarter pound atrazine per...per acre
 25 with WARP scores greater than the 80th percentile, with

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1 on areas that are considered to be most likely to end
 2 up giving you atrazine concentrations that might end up
 3 being something over the level of concern.
 4 So...so the solution really was go
 5 through and look at a restricted set of watersheds
 6 based upon the HUCs and, particularly, the HUC 10s to
 7 identify the target population. First, one that's
 8 feasible to actually compute atrazine use for all of
 9 these HUD 10s. We can actually do that.
 10 It's actually feasible to compute the
 11 WARP scores for this subset of HUC 10s, and it's also
 12 feasible to actually implement field monitoring at a
 13 single targeted site within the HUC 10, and, you know,
 14 I purposely put in...purposely put in the word targeted
 15 site in there, because that has an important
 16 implication in the results.
 17 On this slide, using sort of Cervantes
 18 ion terminology, talking about strata, I've got two
 19 different columns here. I'll end up focusing on the
 20 column on the right which is the definitions in terms
 21 of the target population. The column in the middle is
 22 the same sort of thing. It's stated in terms of
 23 actually stream miles of kilometers where you don't
 24 impose the...the HUCs.
 25 What I really want to look at the

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1 HUC 10 weight WARP scores, and that identifies 1172
 2 specific HUCs in the United States out of these...out
 3 of some 9800 in the area of interest.
 4 I'm going to go back a little bit to
 5 look at the process used to arrive at that...at that
 6 definition. Again, the critical question to begin was,
 7 the way I understood the question was, was to what
 8 extent were waters in corn/sorghum areas exceeding
 9 effects-based thresholds, and, you know, to me, one of
 10 the first questions is, is, well, you know, what do you
 11 mean by waters? As one interpretation of that is how
 12 many kilometers of streams and rivers within the
 13 corn/sorghum areas exceed the established level
 14 of...level of concern.
 15 That's the way I would think about it
 16 from an Office of Water perspective and who...who might
 17 want to end up applying this. When you think about
 18 that, every point on the stream network actually does
 19 define a watershed.
 20 But at the same time, it's not feasible
 21 to implement field monitoring at this...for the type of
 22 monitoring at the end of every point, because you're
 23 going out and collecting every four days. And,
 24 moreover, you really want to end up focusing the
 25 limited resources that you have or dollars, in effect,

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1 other...at the last column. Basically, you have a
 2 strata A that's basically identified by all the HUC
 3 watersheds that do not intersect counties with atrazine
 4 use greater than a quarter of a pound of atrazine per
 5 acre, and that's a strata that actually...we're not
 6 going to actually end up doing the survey design on.
 7 It's not part of the target population for the
 8 population estimation. Doesn't mean it's not
 9 important. It's just that's not where we're focusing
 10 out effort.
 11 The second strata is basically all the
 12 other...all the other HUCs, all the HUCs that do
 13 intersect the counties with greater than a quarter
 14 pound of atrazine, and that's a...that's a population
 15 of 5860 HUCs.
 16 Within that stratum B, it's really split
 17 into two different parts, the stratum B, the WARP from
 18 zero to 80 percentile and then the stratum B for the
 19 WARPs greater than the 80th percentile. And the ones
 20 that are in the zero to 80th percentile actually
 21 consist of 4688 HUCs. And those, again, are a set of
 22 HUCs that we are not going to actually include in the
 23 target population for the survey design.
 24 The only...the ones that are going to be
 25 included in the survey...target population for the

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1 survey design is the ones that are greater than the
2 80th percentile, and those are, again, those that
3 have...I'm not going to go through the definition
4 again.
5 That last one actually gets split up
6 into two different parts in the survey design where we
7 actually ended up splitting it between two different
8 WARP scores, those between...that had a WARP score
9 between 2 and 4 and those that had a WARP score
10 between...greater than 4 or, essentially, between 4 and
11 14 which is, I think, somewhere around the highest..the
12 highest value.
13 And the reason for doing that, again, is
14 I don't...I'll call it maybe a partial or a weak belief
15 that WARP might still have some predictive capability
16 of distinguishing something that would be more
17 vulnerable at this scale than, you know, between 2 and
18 4 versus 4 and 14 and then also ends up, if you take a
19 look at the size of the two...look at the HUCs in each
20 of those, and you see that there's a lot more HUCs in
21 the 2 to 4 range versus in the 4 to 14 range.
22 Oh, thank you.
23 If you go to the next slide, there's
24 three different parts of the survey design I want to
25 end up talking about. The first one...it's on my

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1 computer. The projector went to sleep. I thought I
2 was talking much faster than that.
3 SPEAKER: We don't want to use the word
4 going to sleep. It...it malfunctioned. Sounds like a
5 deliberate act on the part of an inanimate object here.
6 DR. HEERINGA: Dr. Irene has made a good
7 suggestion. Since it's an appropriate time for a
8 break, I think, and Tony hasn't gotten too far in,
9 let's go ahead and take a 15-minute break and repair
10 the equipment, and we'll be back live, I guess, say
11 about 5 minutes after 3:00.
12 (WHEREUPON, a brief recess was taken.)
13 DR. HEERINGA: If everybody can find
14 their seats and...okay, welcome back. We are...we've
15 just begun Tony Olsen's presentation on the statistical
16 design and results for the...the monitoring study and
17 had a little equipment failure which I think we've
18 rectified, and so, please, Tony.
19 DR. OLSEN: Well, may that be the only
20 issue here.
21 I'd like to go back, and I was just...I
22 was just starting to talk about the survey design
23 itself, and there were about three different factors or
24 aspects of the survey design that I think are
25 important.

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1 The first one is about stratification,
2 and...and there's two parts to the stratification,
3 those that are the excluded HUCs and those that are
4 included HUCs. Excluded HUC 10 strata consists of the
5 two that I mentioned earlier, stratum A, these are the
6 HUCs that don't intersect counties with...they
7 basically are, you know, HUCs that have low atrazine,
8 you know, use in them. The second stratum is the
9 strat...of the stratum of HUCs that do have atrazine
10 use greater than a quarter of a pound of atrazine, but
11 they fall in the zero to 80th percentil of the WARP
12 prediction models, and those are actually HUCs that are
13 actually excluded from the survey design.
14 The included strata are the 1172 that
15 are left, and out of those, we're going to end up
16 actually sampling 40 of those. There's two strata
17 associated, one where WARP predicts scores or a value
18 of concentration...95th percentile concentration values
19 of between 2 and 4, but that...and that follows the
20 range between 80 and the 95th percentile of the
21 predictions of the 1172 HUCs. There are 874 of those
22 HUCs, and we're going to sample 20 of those.
23 The second stratum is the ones that are
24 greater than the 95th percentile, and we're going to
25 sample 20 of those, and there's only 298 HUCs in that

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1 particular strata.
2 Sort of the rationale on the
3 stratification here really is to try to focus more
4 sampling in HUC 10s that are likely to be more
5 vulnerable to exposures to atrazine and then,
6 presumably then, more likely to be above...if there is
7 anything above the LOC, to be above that.
8 The second thing was actually we end up
9 including an unequal probability selection process into
10 this...into the survey design. It was done within each
11 of the two stratum independently, and so, out of the 20
12 HUCs that were selected within the first strata here
13 from the WARP B from 2 to 4, we selected those
14 proportion...probability proportional to the atrazine
15 use.
16 And similarly for...and out of the...in
17 the second strata from 4 to 14, we ended up selecting
18 20 HUCs with probability proportional to atrazine use
19 among those 298. For example, if a HUC 10 that had two
20 times the atrazine use of another HUC 10, would be two
21 times more likely to be selected than the other...than
22 other HUC 10s.
23 And, again, here the rationale was to
24 focus sampling on HUC 10s that might be...you know,
25 that are likely to be more...most vulnerable to

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1 exposures to atrazine with, again, using the belief
 2 that atrazine use is a, you know, highly related to
 3 atrazine showing up in the streams.
 4 I guess at this point between both the
 5 stratification and unequal probability, I'd sort of
 6 like to sort of stop and say well, what we're doing
 7 here is saying we believe the...we believe the WARP
 8 model up to a point, but we don't believe it entirely.
 9 And so, we believe it reasonably well to say maybe you
 10 can identify what's maybe the 80th percentile, up in
 11 the top 80th percentile or even be able to do that sort
 12 of part of the process, but then, after that, we're not
 13 going to rely on it entirely. We're going to end up
 14 using...we're going to say look, we're going to end up
 15 using some information from WARP and some
 16 information
 17 from atrazine use levels to actually end up defining
 18 how we'll end up selecting the...selecting the HUCs to
 19 actually sample.
 20 The third aspect of this...of the...of
 21 the survey design is something we will call spatial
 22 balance, and spatial balance is basically a process
 23 that we've learned to use in dealing with environmental
 24 sampling but basically assures that every potential
 25 sample selection would have a similar spatial
 26 distribution as all HUCs within the strata so that if

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1 you think about...and...and the idea is that if
 2 you...if you have a set of...of 298 HUCs, there is the
 3 chance that you could actually draw a sample of 20 of
 4 those, and 20 of those out of those 298, and they may
 5 all end up in the eastern half of the study region.
 6 That is a legitimate probability sample, and if...if I
 7 happen to be the unlucky one to draw that sample and I
 8 showed that to you, you'd basically say I don't believe
 9 it's representative of what's going on.
 10 So, the spatially balanced idea is
 11 basically to try to get something that well, you get a
 12 sample that has a little bit more likelihood of always
 13 being a more representative sample and sort of guards
 14 against a lot of the other factors that you haven't
 15 really included in the design but may have some spatial
 16 aspect to them. So that's...and that's where the
 17 generalized random tessellation stratified or GRTS
 18 survey design process comes in.
 19 Now, you have to say...and the spatial
 20 balance is actually done independently within each
 21 strata, because a strata is actually an independent
 22 survey design in and of itself.
 23 And the second part is that that spatial
 24 balance also gets constrained somewhat by the fact that
 25 you're doing the unequal probability selection within

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1 the strata.
 2 So, the implementation of this, among
 3 the first...other people have earlier on brought up the
 4 idea that we actually ended up selecting not 20 HUCs
 5 but, actually, an extra 5 HUCs in each of the strata.
 6 One of the realities of...of doing field sampling on
 7 streams is that if you're doing survey designs anyway,
 8 not all sites are actually going to be...wind up being
 9 samplable, and with minimal sample sizes or little
 10 small sample sizes like this, you still like to come
 11 out of the field with the...the expected sample sizes
 12 you started out with. You really would like to sample
 13 40. So we've learned to end up selecting extra, extra
 14 HUCs in this particular case.
 15 The way that process works is you
 16 actually select a sample size 25 in each of the HUCs,
 17 but the way that they come out is they actually come
 18 out in a...in a specified order so that you use the
 19 first 20 HUCs. That's a legitimate probability sample.
 20 If you can't sample one of those, then you go to the
 21 next one on the list, and that's a...that's a
 22 legitimate probability sample and still guarantees the
 23 spatial balance.
 24 The last part of that slide just gives a
 25 reference and the fact...and the location of a

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1 survey...of a program that actually does the survey
 2 selection process.
 3 And this is a slide that Nelson showed
 4 earlier. These are the actual final 40 monitored
 5 sites. It doesn't include the 7 non-monitored sites at
 6 this particular point.
 7 So, that's...that's the sort of the
 8 survey design process.
 9 Statistical analysis for the population
 10 estimation, I'm going to...given that we've done
 11 stratification and given that we've done unequal
 12 probability selection, you're going to end up having to
 13 use a weighted analysis to do it. It's not...if you're
 14 going to take a mean, it's not legitimate to take just
 15 an average of values for each of the 40 HUCs to
 16 actually get the answer. You have to design weights.
 17 And the weights are...are based upon
 18 what happened with the stratification and what happened
 19 with the unequal probability selection, and they're
 20 determined separately for each of the stratum and are
 21 the inverse of the probability of selection. And for
 22 the WARP 2 to 4 stratum, the weights actually range
 23 from 20 to 4...20 to 93. If you would have done an
 24 equal probability selection, each one of the sites
 25 within that stratum would have had a...a weight of

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1 approximately 44.
 2 On the WARP stratum from 4 to 14 through
 3 and above the 95th percentile stratum, the weights
 4 range from 9 to 38, and I...and there I think the
 5 weights, if you would have done equal selection, would
 6 have been 15.
 7 And the weights are actually in terms of
 8 numbers of...or units are in terms of numbers of HUC
 9 10s.
 10 When you do the statistical analysis for
 11 where you would do the estimates, you're basically,
 12 from what we're doing, you're estimating proportions,
 13 and it's just a weighted average. The easiest thing
 14 here is to think of something above a HUC 10. If it's
 15 in a particular LOC category, it gets a value of 1. If
 16 it's not, it gets a value of zero.
 17 And so what you do is you just sum up
 18 the weights for the HUCs that are in that category and
 19 divide it by the sum of all the weights. Sum of all
 20 the weights is actually fairly simple. It's 1172.
 21 I want to go back...this is the same
 22 slide that Nelson had earlier...and talk about the
 23 selection of the monitoring site within the HUC 10.
 24 I'm not going to go over the details of this slide,
 25 because you've seen it before, but I think just to look

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1 try to identify, again, sort of the most vulnerable
 2 watershed. It wasn't sort of in terms of where the
 3 corn fields were and...and the size of the streams.
 4 The next slide...at that point, that's
 5 really sort of a discussion of, you know, sort of the
 6 survey design itself and how to go about doing the
 7 analysis and what the impact of the HUC 10 sub-
 8 watershed.
 9 In terms of the results, the level of
 10 concern is triggered when the CASM sign-out similarity
 11 index exceeds 4 percent, and you've heard extensive
 12 discussion of that. And then Nelson introduced these
 13 five categories that we're going to end up talking
 14 about.
 15 Next slide actually gives the population
 16 estimates using, you know, the weighted percentile that
 17 I ended up doing...showing before, and it includes a
 18 number of HUC 10s that are actually in each of the
 19 categories, estimates in terms of percents and then
 20 estimates in terms of the number of HUC 10s and also
 21 with 95 percent confidence intervals.
 22 The one category that's added to my
 23 table from the previous one is the explicit category of
 24 excluded HUC 10s that were not monitored. These are
 25 the seven where they couldn't locate a monitoring site

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1 at it, because it talks about the fact that you're
 2 going to...you focus on stream samples that are
 3 relevant to the study goals, and you're trying to find
 4 area...sub-watersheds that have a higher likelihood of
 5 atrazine use and, you know, have minimal other
 6 influences.
 7 The real question to me is just sort of
 8 well, what's the impact of having this targeted site
 9 within the HUC 10 on...on the answering the monitoring
 10 question, and the way I would end up stating the
 11 monitoring question that actually can be answered is as
 12 how many or what percent of the HUC 10s in the corn
 13 growing regions of the United States identified as most
 14 vulnerable...so that's the 1172...are estimated to have
 15 atrazine concentrations that exceed the LOC in at least
 16 one sub-watershed within that HUC 10.
 17 You're not saying everything within the
 18 HUC 10 exceeds. You're just saying that it's...it's in
 19 at least one of the...one of the sub-watersheds, and
 20 there's basically an infinite number of sub-watersheds
 21 within each HUC.
 22 The phrase in at least one watershed is
 23 necessary, because it was only one...one site in the
 24 HUC 10 was actually monitored, and I think it's
 25 important to note that it was targeted in some ways to

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1 within them. And when you do the estimate, that
 2 actually is...if you went out and did this, you'd
 3 estimate that approximately 22 percent of the HUC 10s
 4 out of the 1172, you would have that sort of difficulty
 5 in terms of locating a site to be able to be monitored,
 6 and that represents something like 255 HUC 10s, and the
 7 confidence intervals of...on the percentage is like
 8 from 10 to 33 percent.
 9 You estimate that 57 percent of the HUC
 10 10s actually are below the level of concern, and that
 11 estimate varies by plus or minus 10 percent.
 12 And then you...a category where the LOC
 13 exceeds in two or more years. You actually have two.
 14 These are the two Missouri sites. When you do the
 15 estimate, that represents 9 percent of the HUCs, but
 16 that estimate has a confidence interval from 0 to 19
 17 percent and represents something like 101 HUCs.
 18 And then the other categories are the
 19 ones that exceeds one year with more monitoring.
 20 That's the one Illinois...Indiana site. The low flow,
 21 the three sites, those are the three...those are
 22 represented by the three Nebraska sites, but when you
 23 put them into the population estimation, you know, they
 24 represent 3 percent...they would estimate that 3
 25 percent of the HUCs would have those sorts of low flow

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1 may exceed one year sort of questions.
 2 Another way of actually...of doing the
 3 analysis is to say well, I'm not going to actually
 4 categorize by the LOC. I'm...into above or below 4
 5 percent. I'm going to actually use the CASM SSI
 6 deviation percent score to actually estimate a
 7 cumulative distribution for the estimate which
 8 is...which is in this particular graph and then put 95
 9 percent confidence intervals around them.
 10 And...and this...there are a couple of
 11 things, you know, like if you've never seen one of
 12 these before, basically, if you look at a CASM score of
 13 about 2 or 2.5, depending on how you read your
 14 graph...vertically, if you go up vertically up to it,
 15 that represents about 80 percent of the watersheds have
 16 an SSI score less than 2.
 17 What I find sort of interesting about
 18 this particular graph is that there is a one very flat
 19 spot between 2...between 2...about approximately
 20 between 2 to 4, somewhere in there. To me, that's
 21 potentially indicative of the fact that maybe there is
 22 actually two different subpopulations going on here.
 23 You've got two different distributions.
 24 You know, it's a very small sample size,
 25 so you don't want to go too far out on the limb, but if

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1 you think about it's like not a single, you know,
 2 normal distribution but it's...maybe it has one
 3 distribution and then another distribution, another
 4 site onto it. That's at least a possibility.
 5 The other one is is that the first part
 6 between 0 and 2 is actually remarkably linear which
 7 suggests there's a lot more uniform...it's a lot more
 8 uniform than maybe a...a normal curve where you'd see
 9 more of an S shape.
 10 I want to go back to the question about
 11 the HUC 10s that could not be monitored. I guess the
 12 question here is, is well, what...what assumptions
 13 could be made about the seven HUCs that were initially
 14 selected that could not be monitored?
 15 One assumption is that they could be
 16 missing at random, or that the HUCs that could not be
 17 monitored have the same sort of atrazine chemograph
 18 characteristics and, consequently then, SSI deviation
 19 score as HUCs that could not be monitored.
 20 And alternative assumption is that they
 21 have atrazine characteristics that are similar to HUCs
 22 that result in LOCs below in both years. Or any other
 23 large number of assumptions that one can think of.
 24 The...and the reason that we ended up
 25 including...leaving them out as a separate category is

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1 that we weren't...didn't feel that we were in a
 2 position at this particular point to make any
 3 assumptions about what about those other HUCs. We like
 4 to leave them out in the other categories.
 5 So...but if you do make an assumption,
 6 the...the assumption should depend upon the reasons why
 7 the seven HUCs could not be monitored.
 8 If you...this is an example of...of
 9 making the estimates if you excluded the
 10 missing...excluded HUCs were missing at random, and
 11 what would happen is in the particular case, yes, the
 12 number that exceed in two or more years goes up by 11
 13 percent, but the number the LOC below two years
 14 actually goes from 57 up to 53 percent, but this
 15 is...you know, this is making the assumption that those
 16 HUCs are missing at random, and at this point, I'm not
 17 sure that we're ready to make that particular
 18 assumption.
 19 So, that's actually the summary results
 20 for the population, for the target pop...what I'd call
 21 the target population of 1172 HUCs.
 22 At this point, I wanted to go back a
 23 little bit and talk about the ability to identify the
 24 most vulnerable HUC 10s. The first part of that was
 25 actually to take a look at the WARP modeling scores,

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1 because the WARP scores were actually calculated for
 2 the HUC 10s when we actually ended up doing the
 3 identification of the top 20 percent or those above 80
 4 percent, but you have...when the monitoring is done,
 5 the monitoring is done on the sub-watershed, and so,
 6 actually, Syngenta actually calculated the WARP score
 7 for the sub-watershed as well as the entire HUC.
 8 So, here's a linear relation...the
 9 relationship between the WARP score at the entire HUC
 10 10 level versus the sub-watershed, and you have this
 11 for only for the 40 HUCs that were actually monitored,
 12 and it actually has...it's highly correlated. It's
 13 0.87.
 14 You look at...you know, that is very
 15 difficult. The eye is very good at picking up
 16 patterns, but if you look at this, there may possibly
 17 be an indication that the sub-watershed WARP score is
 18 slightly higher than the HUC 10 WARP score. And if you
 19 take a look at box plots for those, it...the sub-shed
 20 score is in the first box plot, and the HUC WARP 10
 21 score is in the second one, and there's...and then the
 22 last one is the difference between the two, and there
 23 is some indication that the sub-watershed WARP score is
 24 actually slightly higher.
 25 Gives you some indication that when

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1 you're selecting the sub-watershed that there was at
2 least some scale in actually selecting the sub-
3 watershed that actually was likely to have a atrazine
4 concentration, at least in terms of the WARP score.
5 Another question was...is, what evidence
6 does the monitoring data actually...from the 40
7 monitoring sites give to indicate that WARP was a
8 reasonable surrogate for an SSI deviation score and,
9 consequently, that the study focused on the appropriate
10 set of watersheds?

11 This is a...this is really, in some
12 sense, a fairly limited analysis, because the data is
13 only available for the 40 percent of monitored HUCs
14 that are in the top 20 percent of the WARP predictions.
15 So it's only in the top 1100...it's only out of...it's
16 only 40 out of these top 1172. So you're not seeing
17 the full range of WARP scores.

18 You know, you'd really like to see this
19 where you'd have the WARP scores and the CASM scores
20 run through a lot more for a little larger range, but,
21 you know, that's just not available.

22 A relationship may exist over the entire
23 range of WARP predictions, but at least from this
24 particular plot, there's little evidence that it
25 exists, particularly here. There's, again, since I

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1 model predictions that are listed on this particular
2 slide. The first three were actually calculated by
3 Syngenta and the last two were calculated by people
4 in...in the Office of Pesticides, and I think the next
5 table does a better job of actually sort of summarizing
6 them a little bit.

7 I think the first thing to note here is
8 that first two actually use exactly the same atrazine
9 use data, but the main difference is that one of them
10 actually included the Done, the overland flow component
11 into the model, whereas in the...in the WARP DUZ, it
12 was actually...it was actually set to zero in the...in
13 the equation.

14 The WARP New Year's was updated use data
15 that Syngenta had, and it...it's from the years 2001-
16 2003, and then the last two were done by...by EPA at
17 the Office of Pesticides using data from 2000-2003, and
18 there's actually another difference between those, and
19 I'm not the one to, you know, to give the details of
20 this, but there's actually slightly different data sets
21 used in that as well, because it's not only the Done's
22 data, but it's...it's some other data that are
23 available on that, and Nelson is the one that would
24 be...could be able to clarify that for that.

25 I guess that's the comment...the

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1 play statistical graphics in another life,
2 there...you...you know, you may think that there's some
3 sort of positive relationship in this bottom half, but,
4 you know, you also have to remember that you've got
5 these six WARP scores up here that sort of really cloud
6 it.

7 So, there may be a relationship there,
8 but it's...it's weak evidence, at...at best.

9 The other thing is is that, you know, in
10 some sense, you know, would you really expect WARP to
11 actually be able to have this relationship? WARP
12 only...is only having to deal with concentrations. It
13 has nothing to do with duration, whereas the SSI has
14 concentration and duration and other factors going into
15 it. So you may not expect a strong relationship, at
16 least at the upper end.

17 Next question is there was, when the
18 study was designed, there was a particular set of use
19 data that went into the WARP, use data and other data
20 that went into the WARP predictions, so the question
21 comes up, is what happens if you used alternative WARP
22 prediction models? If you add other data into the WARP
23 model, what would it do to you? Do they identify the
24 same set of vulnerable watersheds?

25 There were actually five different WARP

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1 footnote number 1 there, it's Done's and CEPR which I'm
2 not familiar with.

3 So, the first thing I did was actually
4 just take just a quick look at the correlations across
5 the 1172 HUCs that we actually have this data available
6 for, and if you look at this particular table, the
7 thing that you...the only...the notable thing is that
8 the correlation between alternative WARP predictions,
9 if you use the same use data, are much higher than
10 those when you don't. So, you'll see much...you'll see
11 higher predic...higher correlations between the WARP
12 and DMZ, and you'll see higher...higher correlations
13 down here, and the other ones are all lower, because
14 they end up using different use data. And that's not
15 unexpected.

16 This one is the same data but actually
17 produced as a scatter plot matrix so that you'd
18 actually see the relationships, and then visually, you
19 can end up seeing the...the two sets that actually
20 have...use the same data. Generally, they are
21 positively correlated, so it...it gives you some idea
22 that at least, you know, different use data and
23 slightly different application of the model have
24 some...some...they're giving you similar type results.

25 But that's only the top 1172. If you

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1 want to look at the 5...all 5860 which were great...had
 2 atrazine use greater than a quarter of a pound atrazine
 3 per acre, you can do the same correlation structure.
 4 In this particular one, I've actually
 5 still included this first column in the first row.
 6 Those actually are correlations that are still based
 7 only on the 1172. I just wanted to keep them on the
 8 same page for you, but the others are based on the
 9 5860, and you'll see that the correlations are higher,
 10 and you'd expect that, because you're looking over a
 11 larger range of WARP values. You're not just looking
 12 at the top 20 percent anymore.

13 But then the real question is, is
 14 suppose you still use the criteria of picking out the
 15 top 20 percent to use as your target population
 16 definition. How does...how do each of these different
 17 ones translate?

18 So on this particular table, basically,
 19 I'm doing a...the first table here is the one where
 20 this is the WARP score that was used for the design,
 21 and you'll...things that are in the 80 to 95th
 22 percentile and greater than 90th percentile, and you'll
 23 see that we've got the 874 there and the 298 there,
 24 and we also have diagonal elements are zero, as are the
 25 ones that are less than...less than 80th percentile.

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1 But, you know, in terms of percentages,
 2 it's not a lot, but there are some differences.
 3 Here's a couple of graphs that...that
 4 show the geographic distribution. The...the 40 HUCs
 5 are outlined...the 40 HUCs are these little blue ones,
 6 but the green area is the one that's common between two
 7 different WARP predictions, and these are just the WARP
 8 that were used in the original model plus the WARP used
 9 in the Done overland flow include...information
 10 included in it, and you'll see that the yellow are in
 11 the original 72, but on the other one...they're not
 12 showing up. They're not showing up very well there.
 13 There are some. There's a couple here and some there.
 14 The colors on the screens are not coming out the same.
 15 There's another yellow one there. So, they're very
 16 difficult to see on the screen here.

17 The blue are in the revised WARP set
 18 only which are in the ones with overland flow. These
 19 large blue ones down here, these are the consequence of
 20 using the HUC 8s in that particular part of the
 21 country, so they look...visually, they look
 22 intimidating, but, you know, that's just because of the
 23 change of scale between the HUC definitions.

24 So, again, sort of majority of them
 25 over...majority of the area overlaps, but there are

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1 This is the alternative one for the WARP
 2 same use data, but you include the Done overland flow.
 3 One of the things that you find here is that there are
 4 some off diagonal elements in this particular area, but
 5 here you've got about 87...87 HUCs that are actually
 6 above the 80th percentile if you will have used this
 7 WARP score. So, you would have had a slightly
 8 different set of 1172 HUCs identified if you used the
 9 alternative.

10 And, again, if you used one with the new
 11 use data, you would have identified, again, a slightly
 12 different set out of this new use data.

13 And if you go to the last two, again,
 14 you'll see a slightly different use here and a slightly
 15 different use here.

16 These last two have something else. We
 17 actually had these calculated not for just the 5880,
 18 but you have it for the all 9500 and some however HUCs.
 19 And what's so...this is...this is not as restrictive as
 20 the greater than just the...greater than the HUC
 21 quarter pound per acre, and you'll find there that what
 22 happens is you also end up seeing that you'll have some
 23 HUCs that you would have predicted to be in the top 20
 24 percent that were not included in the original cutoff
 25 of the...of 5860.

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1 some differences.

2 This is another one comparing the
 3 original WARP identifications with ones in the...using
 4 the 2001-2003 use data, and, again, the orange is in
 5 the o...is the overlap. You know, the red are in
 6 the...in the New Year's data only, and the yellow which
 7 turns out to look a lot more green here than anything
 8 else are these other areas. So there's a large degree
 9 of overlap, but there are differences between the
 10 different predictions.

11 So, in terms of use data in slightly
 12 different uses of the WARP...input data into the WARP
 13 model, you get slightly different sets, but there's an
 14 enor...there's quite a bit of overlap.

15 So, I want to go back sort of looking at
 16 the key points. I think, first off, I think we ought
 17 to remember that from the population estimation that
 18 basically we're estimating with making no assumptions
 19 about the non-monitored HUCs, that you estimate about 9
 20 percent of or 101 of the 1172 HUCs, include at least
 21 one sub-watershed that would exceed the LOC of 4
 22 percent in two or more years.

23 And the second thing, you'd estimate
 24 that 22 percent of the HUCs would not...could
 25 not...would not be or could not be assessed for the LOC

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1 and would...a decision has to be made about how these
2 would impact that above estimate, what...how you...what
3 assumptions are you going to make about that.

4 Third point is that the alternative WARP
5 predictions, they identify similar top 20 most
6 vulnerable HUC 10s, although differences do occur.

7 I think with that, that's the end of it.

8 DR. HEERINGA: Thank you very much, Dr.
9 Olsen, for that presentation.

10 Questions of clarification from the
11 panel with regard to the...the nature of the sample
12 selection or some of the exploratory results,
13 exploratory things that were done, analysis that Dr.
14 Olsen presented?

15 Yes, Dr. La Point, please.

16 DR. LA POINT: Tom La Point here. So
17 I'll probably show my vast ignorance on this topic, and
18 so it goes. I'm learning.

19 On...on slide 93 where we talked...where
20 you talked about the HUC strata and then the sample of
21 40 coming in from 1172 total HUCs...and I remember
22 reading this or about this in the...in the report, but
23 would you refresh my memory? Why was it important to
24 have an 80 to 95th percentile and a 95th to 100
25 percentile and then split out into those two strata?

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1 there's a higher...you know, there was a higher rate of
2 sampling in the great...95th percentile and above than
3 from the 80 to 95th. So you're taking 20 out of 298
4 versus 20 out of 874. So we're basically putting a
5 higher intensity of sampling in there with the belief
6 that, you know...you know, we're more...we...we want to
7 make sure that we end up sampling the high end of...of
8 the WARP predictions. Didn't want to leave that to
9 chance alone.

10 DR. HEERINGA: Dr. Novak and then Dr.
11 Portier.

12 DR. NOVAK: Jeff Novak. I'd like a
13 clarification on WARP model parameters that are shown
14 on slide 113 of the handout, and the clarification
15 concerns use of the watershed area, and it just states
16 watershed area. Did you use the watershed total area?
17 That...that's my point of clarification.

18 DR. OLSEN: I will end up deferring that
19 to Nelson or somebody else here. That's not my area
20 that...looking at the WARP models.

21 MR. THURMAN: Yeah, that's actually what
22 WARP...WARP includes. It's one of the additional
23 parameters that is included in there.

24 DR. NOVAK: And...and I think...well, I
25 think you see where I'm driving at. I mean,

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1 DR. OLSEN: This is Tony Olsen.
2 I...I...I think really here, the decision was that I
3 think that...I think we still had a belief that there
4 was some skill still left in WARP and
5 that...that...that you...you know, that...that if...if
6 WARP did have some skill up at this upper end that it
7 might be useful to actually target more of the
8 monitoring in the upper 95th percentile just because
9 you think that it might end up having a higher atrazine
10 concentration in the stream.

11 I mean, an alternative...an alternative
12 survey design could have been to say well no, we're not
13 going to end up doing any strata at this particular
14 level at all, and then what you would have done, you
15 would have picked 40 samples out of the 1172, and that
16 was an alternative design I think that, actually, we
17 did consider. I think there was some...there must have
18 been 20 or so different survey designs that we
19 considered in the process.

20 DR. LA POINT: Thank you, and if I may,
21 then, for that...but...but 40 samples were taken out of
22 the 1172. Right?

23 DR. OLSEN: Yeah.

24 DR. LA POINT: So they were combined.

25 DR. OLSEN: Well, they were combined but

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1 you're...you've got other areas in the watershed
2 including urban, streets, forests which could be
3 skewing your data. Now, why did you let that happen
4 when your presentation was presenting areas of atrazine
5 on an agricultural area basis? That's fine, but now
6 we're being asked to digest and accept WARP parameters
7 in A, and I'm having a problem now, because I know
8 watersheds aren't going to be 100 percent using of
9 atrazine. So you kind of...you have an opportunity to
10 rectify this model for...recalibrate it or something?

11 MR. THURMAN: It's true we basically
12 used a WARP model that...that USGS developed, and they
13 developed it based on total watershed area. So, if we
14 had...if we had used a different watershed area
15 calculation that would have not been the same as the
16 way WARP is. I mean, honestly, we just...we used the
17 model as it was. It was a regression-based model, and
18 that's what...that was the parameter that showed up
19 as...as, you know, the...as...as significant in terms
20 of explaining that.

21 So, I...this is...your point is well
22 taken, and I...I'd have to go back...have to go back to
23 the paper...it's been a while since I looked at it...to
24 see whether or not there was a focus on just ag crop
25 or, you know, crop land in that or...I don't think

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1 there was. Bob Gilliom is shaking his head, so I don't
 2 believe there was.
 3 I mean, and it's one of those things
 4 that there may have been a reason for that, and I think
 5 there could very well have been just some uncertainty
 6 in that regard.
 7 DR. NOVAK: This is Jeff Novak again. I
 8 guess this is one of the functions of the SAP, is to
 9 note these deficiencies without maybe pointing fingers,
 10 but for sitting here for two days, I'm looking at basic
 11 things that I don't think you can mix and match. For
 12 instance, your data set, again, to repeat myself,
 13 atrazine usage on an agri...agricultural area basis is
 14 fine, but now for the whole watershed, well, I don't
 15 know. I'll leave that to one of the other SAP members
 16 to explain.
 17 DR. HEERINGA: Bob Gilliom, USGS, steps
 18 forward here.
 19 MR. GILLIOM: Yeah, now I've got a sense
 20 of what everybody's gone through having their model
 21 talked about by somebody else. Right? I think I had
 22 it already, but I'm even more sympathetic right now.
 23 But...but seriously, on the watershed
 24 area thing, the watershed area variable is...is not a
 25 major factor in the model fit. It is a significant

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1 additional variable in the multiple regression model,
 2 but it's not a major predictor variable.
 3 The...the main...most of the variance is
 4 explained by the use per unit area of watershed. It's
 5 looking at not per...per crop. It's use per unit area
 6 of watershed, so it's a rate spread over all land in
 7 the watershed, and then that...that's the primary
 8 predictor for the stream concentration at the bottom.
 9 And...and the other variables are also additional
 10 explanatory variables that help improve the fit, and
 11 watershed area does fit in there but in a relatively
 12 minor way.
 13 DR. HEERINGA: Thank you very much for
 14 that clarification. Okay, Dr. Portier and then Dr. La
 15 Point.
 16 DR. PORTIER: And this is just a
 17 clarification. The 0.25 pounds atrazine, is
 18 that...that's per county area, so that first cutoff is
 19 per county area as on slide 89, or is it...yeah, slide
 20 89, not slide 93. One uses per county area, one uses
 21 per harvested area, and I just wanted to make sure
 22 which was which.
 23 MR. THURMAN: It's the same. It just
 24 didn't get carried in one place with...yeah, they're
 25 the same.

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1 DR. PORTIER: So it's county area and...
 2 MR. THURMAN: Well, no, it's the
 3 harvested...
 4 DR. PORTIER: Oh, it's harvested.
 5 MR. THURMAN: Yeah, yeah. I think it
 6 didn't get changed in all the slides, so it should be
 7 the harvested. It's the same...it's the same number.
 8 DR. PORTIER: And then one other
 9 followup then. And then when you talk about the...the
 10 within stratum B WARP stratification, you did
 11 probability proportional to atrazine use on your slide.
 12 Is that use in pounds AI per harvested acre or pounds
 13 AI per county acre, or is it just total pounds AI?
 14 What are we talking about in terms of...
 15 DR. OLSEN: It's Tony Olsen. It's still
 16 the same variable.
 17 DR. PORTIER: Still the same one. Okay.
 18 DR. HEERINGA: Dr. La Point?
 19 DR. LA POINT: And this, I guess, might
 20 go to you, too, but even with the...well, the estimate,
 21 this is comparing population estimates of how many of
 22 these units may exceed the LOC either for one year or
 23 for two or more years. The confidence limits, 0 to 19
 24 percent on a percent scale or the number, 0 to 218, is
 25 that fairly normal for these kinds of predictions? It

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1 seems large.
 2 DR. OLSEN: This is Tony Olsen.
 3 Actually, I think, you know, they are fairly common. I
 4 mean, these are actually fairly small sample sizes.
 5 The confidence limits here the way
 6 they're actually calculated is they...you get the
 7 estimates and then plus or minus, you know, the normal
 8 score, like basically two times, you know, the standard
 9 error and...and the standard deviation, and the way
 10 that is actually estimated, it's actually estimated
 11 using a...what's called a local neighborhood variance
 12 estimator that's actually been developed to go in
 13 conjunction with a spatially balanced design, and it
 14 makes use of, you know, sort of the spatial
 15 neighborhood relationships that these...these...these
 16 quantities have.
 17 When you do that variance estimations,
 18 all the weighting is taken into account as...as they
 19 appropriate...as they should be in a...in a weighted
 20 variance estimate like a Horowitz-Thompson, but it has
 21 some of the flavor of a...of a...sort of a...a creating
 22 your special statistics sort of a variance estimate
 23 where you do make estimates in local neighborhoods
 24 where you think that things are better.
 25 We've done some...a number of

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1 simulations and studies looking at that, and that's
2 actually...that variance estimator performs better than
3 the normal Horowitz-Thompson variance estimator.
4 Our experience when we actually end up
5 calculating this on streams from different studies
6 across the United States...and actually have other
7 things other than streams...it's not unusual for the
8 variance estimator from the local variance estimator to
9 be 20 to 40 percent lower than the...the standard sort
10 of a variance estimator, but it does give you the right
11 sort of coverage probabilities in general under
12 simulations.

13 DR. HEERINGA: Bob Gilliom.

14 MR. GILLIOM: One question I want
15 come back to that I'm still not sure I understand is
16 how the sub-water set was selected, because I've gotten
17 out of one part of the discussion kind of that it was a
18 random selection, constrained to a degree, and then the
19 other point of view is that it's one of the most...it's
20 the chosen to be like one of the most vulnerable within
21 the HUC.

22 So it's kind of critical to the whole
23 extrapolation of this weighted design out to the rest
24 of the world.

25 MR. THURMAN: Okay, this is Nelson

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1 MR. GILLIOM: Yeah, I...I actually
2 understood that correlation graph okay which made it
3 look like it's in the ball park with some variance to
4 correlate it, but it's...I guess let me ask it this
5 way. Would I be right in assuming that the...the
6 group of eligible sub-watersheds that the random
7 selection was made from was intended to be equal or
8 greater atrazine use intensity on a watershed basis
9 than the HUC? I mean, I need to relate it to the
10 intensity of use at the HUC level.

11 MR. THURMAN: I...Nelson Thurman. As
12 near as I understand and near as I can tell, yes, that
13 would be right in assuming that, because it did focus
14 on higher row crop intensities which would be where
15 your...your higher use would be.

16 DR. HEERINGA: Dr. Ellsworth first and
17 then Dr. Young.

18 DR. ELLSWORTH: I've got two questions,
19 brief. One, did you try to plot the 95th percentile
20 concentration versus the WARP predicted for these 40 or
21 86 site-years of data that you have to just kind of get
22 a sense in...I mean, you plotted SSI versus WARP
23 predicted, but did you actually look to see if the WARP
24 was doing a pretty good job at this sub-watershed
25 scale, what the relationship there was between the two?

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1 Thurman. Maybe I can...I can clarify that.
2 The final sub-watershed...I mean,
3 the...there was...that selection process identified a
4 number of target sampling sites, and each one of those
5 target, potential target sites had its own sub-
6 watershed associated with it. Now, those sites...the
7 criteria for selecting those sites was based on what we
8 thought would increase the likelihood of, you know,
9 trying to skew it toward more vulnerable, areas of more
10 vulnerable...likely more vulnerable for...for atrazine.

11 But so, you know, in most of the cases,
12 you end up with...with 4 to 6 stream segments that
13 could qualify, and any one of those would be
14 representative...would be representative, supposedly,
15 and that's what they used to select that.

16 Now, the sub-watershed that Tony
17 presented was okay, this was the monitoring site. What
18 was that sub-watershed that fed into that monitoring
19 site, and...and I...the analysis which was something
20 Syngenta said if we calculated WARP based just on the
21 properties within that sub-watershed, how does that
22 compare to the entire...entire HUC? And, you know, one
23 way of looking at it was do we see a big difference, or
24 is it fairly well represented by that...by that HUC
25 WARP score?

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1 And then one...one related question is,
2 if you would have plotted the median WARP predicted
3 regression, maybe that would have been related more to
4 this SSI, because that might be related more to a
5 duration kind of a index than the 95th percentile. Did
6 you look at any of that kind of stuff?

7 DR. OLSEN: I have not done many of
8 those particular plots. Has anybody else?

9 MR. THURMAN: We haven't done that yet,
10 but we've been talking about it, because that's one of
11 the things we'd like to take a look at, and, honestly,
12 it's one of the things that we'd like to be able to
13 provide as feedback to the model developers as...as
14 something they can take a look at, an additional data
15 set. You know, we have to work with Syngenta on that,
16 but an additional data set that might provide
17 some...along with the additional site characteristics
18 that are taken there, that might provide useful
19 feedback for...for...for the model developers on that.

20 So there's a lot of potential there. We
21 just haven't had a chance to look at that yet, but
22 those are things that...on our long list of things to
23 look at...to consider, including maybe crop area.

24 DR. HEERINGA: Good question. Dr.
25 Young?

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1 DR. YOUNG: I have a couple. First
2 starts with this. It seems kind of strange that you
3 have three HUCs and...and the corresponding percentage
4 is 3 percent whereas you have one at 4 percent. So,
5 was that...and I thought those HUCs were in areas of
6 high atrazine use. Is it because of down-weighting of
7 atrazine use?

8 DR. OLSEN: Yeah, I mean,
9 that's...that's...it's...it's going...it's associated
10 with the weights that are going on within, you know, if
11 you...if you put...if they happen to be on high
12 atrazine use weights and there's not a lot of them and
13 the high atrazine use weights, the weights are going to
14 go down, so it's going to represent a smaller
15 percentage. That's what's going on.

16 DR. YOUNG: Also, on...it shows 105. I
17 think it might just be the next slide. I'm just
18 wondering when you say targeted sub-watershed CASM
19 score, it's kind of hard to get in mind what
20 distribution function you're really trying to estimate
21 here, because it's kind of like the distribution
22 function of the upper limits within, you know, across
23 watersheds or something.

24 DR. OLSEN: Yes, Tony Olsen. Yeah, it
25 is very difficult to get around...your head around this

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1 randomize the order and go through and do a...and yes,
2 it is very difficult to get your heart...your
3 head...head around that. So, in some sense, it's more
4 of an index site of what's going on, in some sense, an
5 index of what's going on in the HUC.

6 DR. YOUNG: I think...I think maybe to
7 think about the wording of what...of what you're
8 calling that distribution function might be...be
9 helpful. It...and I don't know...I don't have the
10 solution, but...but I...the way it's worded, I think
11 it...you look for one thing, and it's actually
12 something different from that.

13 DR. OLSEN: I agree with the wording
14 issue.

15 DR. HEERINGA: Dr. Grue?

16 DR. GRUE: Dr. Olsen, can you...did you
17 indicate that out of the...that the total set for the
18 HUC 10s was 9800? Is that correct?

19 DR. OLSEN: I...it...the 98...

20 DR. GRUE: What's the total set of HUCs
21 for atrazine use?

22 DR. OLSEN: It's 9500 something or
23 another, I believe. I'm not...

24 DR. GRUE: I...I'm trying to put this
25 all into some type of a percentage basis, and I...I

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1 slide. You know, the...the closest sort of analogy
2 is...and one of the reasons the word targeted is in
3 there is one of the things that will happen a lot in
4 environmental sampling is that you'll get down to a
5 unit like a HUC 10 or something like that, and then
6 what they will end up doing is saying okay, then, what
7 I'm going to do is I'm going to select a site on some
8 judgmental basis as to where I'm going to go monitor.

9 Typically, one that would be done in a
10 HUC 10 pipe study like this would be the outflow point
11 of the HUC, and so, that would be the targeted site,
12 and that represents what's going on within the HUC. In
13 this particular...and that would be a little bit easier
14 to understand, because there was essentially...in most
15 cases, there's only one outflow point in a HUC 10. Not
16 always. So...but that would be a little easier to
17 understand.

18 In this particular case, you've got a
19 set of criteria that you're using to try to sort of
20 target based upon...where the criteria represent some
21 sort of judgment material that, you know, the
22 professional judgment going in to saying well, if we
23 knew this professional judgment, we ought to look
24 within these sets of stream segments, and then within
25 that, we don't know anymore, so we're going to

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1 need to kind of know what that...

2 MR. THURMAN: 9513.

3 DR. GRUE: Okay, it was 9513 was the
4 total of the HUCs. Okay, thank you.

5 DR. HEERINGA: Yes, Dr. Portier?

6 DR. PORTIER: Tony, I want to talk now
7 from target population to inference population. All
8 right? So your target population is well defined for
9 this study at 1172. One of the...when you use
10 the...what was it...the WARP new data or something, you
11 just shifted the...the data by one year or two years,
12 and you went from 1172, if I calculate right, to 933.
13 If you had done it on newer data, you'd have had 933
14 versus 1172.

15 So, to a certain extent, your target
16 population, by your definition, will change from year
17 to year primarily due to...to use information, because
18 of your corrosivity and all these other factors are not
19 going to change. It's just...your county acreage is
20 not going to change, so your...kind of your use
21 statistics. So, has the group been thinking about how
22 do we make sure when we begin to think about
23 application of this model to counties that are
24 vulnerable, how do you define that in the broader sense
25 over time, over years, as new data comes in rather than

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1 just the data set you analyzed?
 2 Because the...part of what you've been
 3 asking is kind of the inference of the utility of this
 4 model as a decision tool long term, and...and so that
 5 kind of WARP part, to me, I need to think about that.
 6 DR. OLSEN: Yes, Tony Olsen. I think
 7 you make a really good point. I think the first thing
 8 here is to make sure that we're very explicit about
 9 what was actually the target population for this
 10 particular study, and I think we've done a reasonably
 11 good job at that.
 12 I think the...trying to make the
 13 inference to sort of, you know, let's say all HUCs in
 14 the United States, you know, at some point, that's I
 15 think is...I think will come up also, I think, when we
 16 talk about the where question, because the where
 17 question, I think, shouldn't be constrained by this
 18 particular subset.
 19 DR. HEERINGA: Steve Heeringa here, if I
 20 could ask one question, Tony, and it's a follow-up
 21 on...on Dr. Young's question. Same issue I noted, too,
 22 that the...the two sites in Missouri constitute 2 out
 23 of 40 or one-twentieth of the sample locations, but the
 24 weighted estimate is about 11 percent of the
 25 population.

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1 So, clearly, the weights, which are
 2 reciprocals of the probability, are...are...are larger
 3 for those cases which meant that your model, your
 4 sample selection model, somehow understated the
 5 probabilities there. I mean, it's...I sort of live in
 6 the same world you do, so...and you know that, so I...I
 7 think I...I don't want to second guess the
 8 randomization here, but thinking about the process of
 9 choosing the...choosing the HUCs and then choosing
 10 suitable sites within the HUCs to sample in, could that
 11 be a case where the model predicted relatively...it's
 12 greater than 80th percentile, but we don't know to
 13 figure out where that...those Missouri sites fell.
 14 So the model itself said overall that
 15 that HUC really doesn't reach the 90th to 95th or the
 16 99th percentile but then when we got there, we had to
 17 make a choice of a sampling site, and then when we
 18 apply this agricultural land criteria, I don't know
 19 that area, but I...kind of looking over the fence, I
 20 thought I saw sage brush there, and coming from
 21 Marshall, Minnesota where the black dirt stands about
 22 three feet thick, you know, it didn't look like corn
 23 ground to me unless it was improved quite a bit.
 24 And I was wondering if that wasn't maybe
 25 a situation that inside that HUC that you were sort of

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1 searching for a piece of corn ground and had to choose
 2 that one location which, of course, would be quite
 3 vulnerable there. Is that...is that a possibility?
 4 DR. OLSEN: This is Tony Olsen. I think
 5 yes, I think you're right. The...the reason that, you
 6 know, the 9 percent or the 11 percent, depending upon
 7 which one of the analyses you look at, why that's more
 8 than sort of the standard is is that they did have
 9 lower...lower than normal or lower than the
 10 average...not normal...lower than average atrazine use
 11 within the HUC 10, because otherwise, they would have
 12 had different weights, you know, to do that. And so
 13 then the selection within it.
 14 And, again, that comes back to the sort
 15 of the basic question of trying to define exactly...
 16 DR. HEERINGA: Sure.
 17 DR. OLSEN: ...sort of what you mean by
 18 the response that you're getting here from this index
 19 site, if you want to use that term.
 20 DR. HEERINGA: But I fully...I mean,
 21 again, as sampling statisticians, you don't want to get
 22 into the process of second guessing, you know, outlier
 23 outcomes. On the other hand, they do...you know, if
 24 you sort of rethink the selection process as you're
 25 doing it, it may inform things for the future, too.

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1 Dr. Young?
 2 DR. YOUNG: I just want to follow up on
 3 Dr. Portier's question, and that is your target
 4 population is the upper...above 80th percentile in use,
 5 and yet, there's...or vulnerability, I should say,
 6 and...and there's certainly some misclassification on
 7 that. Have you thought about how that might impact any
 8 analysis?
 9 DR. OLSEN: No, I really haven't at this
 10 point, Linda.
 11 DR. HEERINGA: Okay, I think we're free
 12 to move on to...to Mark Corbin's presentation, and I'm
 13 giving away my slides here, but...what page number
 14 here? Oh, it's page 122 on summary page 26 in the
 15 handout for panel members.
 16 DR. CORBIN: Thank you, Mr. Chairman.
 17 I guess before I start, I'd like to
 18 point out that a lot of what you're going to hear from
 19 me today was kind of covered by Syngenta the other day
 20 in terms of uncertainty analysis, and...but I...I think
 21 it's still important for us to kind of go over it,
 22 because it...one refreshes the issues, and we have some
 23 slightly different interpretations of some of the...the
 24 issues that were discussed the other day by Syngenta.
 25 I guess previously you heard Dr.

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1 Erickson talk about the CASM model and the sensitivity
2 analysis he conducted, and that analysis really helped
3 us understand a little bit about the parameterization
4 of the model and what...what factors were important,
5 and as you saw in the uncertainty analysis, it
6 really...we ended up proposing an approach for applying
7 an uncertainty bound reflecting model uncertainty on
8 the risk conclusions.

9 But that analysis is limited to CASM
10 only. It doesn't really tell us about uncertainty in
11 the monitoring data and how it interpret...impact our
12 interpretation of the CASM results. So, we conducted
13 an uncertainty analysis of the monitoring data
14 separately from Dr. Erickson's analysis, and that's the
15 subject of my talk today.

16 You heard from Nelson Thurman some of
17 the basic analysis we did on the monitoring data and
18 our preliminary interpretations of the risk
19 conclusions. In addition, you've heard how we used the
20 CASM results to understand the CASM uncertainty and to
21 bin the 40 sites into these categories, including the
22 excluded sites, sites not exceeding LOC, multiple year
23 exceedences of LOC, one-year exceedences, and what we
24 call uncertain sites.

25 These uncertain sites include those that

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1 actual site during the years that they were monitored
2 relative to monthly historic normals. And
3 that's...that's the information that we used when we
4 made our...based our decommissioning decisions on.
5 But we also evolved from that where we
6 ended up looking more expansively...Nelson talked about
7 this a little bit...where we looked at the individual
8 chemographs and individual rainfall events and overlay
9 that with where the typical planting window was for
10 each of those sites. And...and that I'll cover a
11 little bit as we go on.

12 Then we shifted focus to the second
13 theme which the finding of these three sites in
14 Nebraska and what was going on there. You know, there
15 were a lot of...as Syngenta indicated, I think there
16 were close to 50 percent of the sites...50 percent of
17 the potential samples from each of those sites on a 4-
18 day grab cycle were missing, and it was a
19 little...little worse in 2006, actually, than in 2005.

20 So we reviewed a bunch of site specific
21 and regional characteristics of the landscape. We also
22 looked at hydrologic and climatological conditions for
23 those sites.

24 And...and what that did was as we worked
25 through that process, it kind of pointed us to this

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1 are defined by the uncertainty, this 2x factor that we
2 talk about, and also those that are defined by our lack
3 of what's going on in conditions on the ground, the
4 three Nebraska sites. So, the analysis I'll talk today
5 helped really inform our understanding of...or at least
6 helped to get us started down the road of understanding
7 about what the conditions were on those sites.

8 This one, this slide, just summarizes
9 for you the...kind of the main themes that I'm going to
10 cover for you today. I'm going to talk a little bit
11 about analysis we did looking at the precipitation
12 data, the analysis that we did looking at the low flow
13 condition in those three Nebraska sites, and then wrap
14 that up with a...a discussion of sample frequency and
15 some of the things that we've looked at to date.

16 Precipitation is the first theme, and I
17 guess we started that, actually, before we ever
18 received the final reports in response to requests from
19 Syngenta to decommission the sites, and it started with
20 a very simple analysis looking at total annual rainfall
21 at the site specific...from site specific information
22 relative to historic normals.

23 But we quickly realized that wasn't
24 enough, and so, we broke that down into sort of a
25 month-by-month analysis of what was being seen at the

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1 question of sample frequency and how that was...what
2 was really important out of this, and the conditions on
3 the ground that were driving the three sites was
4 important, but we also needed to think a little bit
5 about how the 4-day grab sample design was influencing
6 our understanding of the results and...and what we knew
7 about it.

8 So we...I'll walk you through some
9 examples. Syngenta kind of covered these a little bit.
10 I'll walk you through some of the examples that we've
11 looked at to date and some of the assumptions that we
12 included in those...in those analyses.

13 So, we beg...as I mentioned, we began
14 this precipitation evaluation in...in the context of
15 decommissioning. I won't go over that too much, but it
16 was...really, it was Syngenta's request to really take
17 the instrumentation away from the sites after two years
18 of monitoring, and as I said, we really...we focused on
19 the monthly totals.

20 We made our decommissioning decisions
21 based on whether a site was between the 25th and the 75
22 percentile in general on a monthly...month-to-month
23 basis. Sites that were below that were...or...or above
24 the 75th percentile we...we would recommend for
25 continued monitoring. We considered those sort of

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1 outside the norm of what was typical for the sites.
2 And as I mentioned, then we evolved this
3 analysis into a more site-by-site detailed look at the
4 individual rainfall events.

5 This slide is for Indiana 11 and shows
6 you 2005-2006 overlaying. It's more for...it's more to
7 be instructive than anything else and to show you
8 that...I'll use Nelson's technique in here...and in
9 2005, you can see here on a month-to-month basis that
10 the site was roughly a 25th percentile site in terms of
11 rainfall, whereas in 2006, the site was roughly a 75th
12 percentile, a little bit greater at the end of the
13 year.

14 What's interesting about this one is the
15 2005 was the year at Indiana 11 was really high, 200
16 ppb exposure, and so, it was interesting to us that was
17 actually a drier year than...than the subsequent year.

18 So that's where we started doing this
19 more detailed look at what was going on with the
20 individual sites. This slide shows you a side-by-side
21 analysis for 2005 which is on the left side of the
22 chart and 2006 on the right, comparing chemograph with
23 planting window and individual rainfall events. If you
24 look at 2005 here on the left, you'll see the green
25 box here represents the typical planting window as

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1 Indiana 11 continued, because they had exceeded, and so
2 they continued monitoring those sites.

3 But overall, it appeared that low...low
4 rainfall, possibly resulting in low flow conditions at
5 these sites, preceding a significant rainfall or runoff
6 event may be one of the possible explanations for some
7 of the high peak exposures that we're seeing in
8 individual sites.

9 Next we moved on to analysis of the
10 three Nebraska sites, and as you heard previously,
11 three of those sites experienced low or no flow
12 conditions as reported by Syngenta, resulting in
13 a...with a lot of missing samples. Syngenta's
14 contention was that the missing samples really limited
15 the suitability as a CASM input due to the less robust
16 nature of the data set and the fact that these...these
17 streams would be stressed by other factors than
18 atrazine, ostensibly being dry. But as you saw, Tony,
19 we...from Tony's talk and from Nelson's talk, we...we
20 weren't sure about this, so we didn't want to precluded
21 what was going on in the site, so we created them as a
22 separate category and done population estimates for
23 them separately, but we did want to do additional
24 analysis based on the data we had at the time to see
25 what we could come up with.

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1 defined by Syngenta. The chemograph here is in blue,
2 and the individual rainfall events are shown here in
3 these...well, they're dark red on the screen.

4 And what's really interesting about this
5 site is when you look at 2005 relative to 2006 is that
6 2005 is characterized by a much drier period overall,
7 and, in particular, in the period of time prior to and
8 during the planting window, and then you experience
9 these...these larger rainfall events within that
10 window, whereas when you look at 2006, it appears to be
11 quite a bit more rainfall prior to the planting window
12 and also during the window, and so you see much smaller
13 peaks in there.

14 And so, this is the kind of analysis, if
15 you go to the appendix in the document, this has been
16 done for every site year out of the 40...out of the 40
17 sets, and it was...it was fairly instructive for us.

18 We also note here that...well, I'll
19 cover that later.

20 So, the analysis indicated that for at
21 least six of the sites, we needed continued monitoring
22 beyond 2006 based on low rainfall. That was touched on
23 earlier by Nelson, I think.

24 There were a couple of additional sites
25 that were continued, Missouri sites, and I believe

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1 So we were concerned about periods of
2 missing samples that were sometimes bracketed by high
3 atrazine exposures when you look at both the grab and
4 the autosample results. So you would see these...these
5 windows of no sample, but on one or both sides of
6 the...of the...you saw this in the slides that Nelson
7 presented earlier where you would have these relatively
8 high peak exposures and not knowing what's going on in
9 the intervening time, we wanted to see what, at least
10 doing the stair-step approach, what that would tell us
11 about the SSI from these sites if we assumed those
12 concentrations continued.

13 We, like I said, we decided not to
14 exclude them from our analysis but...and create these
15 population estimates, but we really weren't certain how
16 to interpret them. So, you know, to better understand
17 them, we...what might be influencing the sites and see
18 if they're unique, we completed an evaluation of
19 several landscape, hydrologic, and climatic factors to
20 see if they're unique.

21 Just as a quick summary, from the three
22 sites, the three Nebraska sites averaged about 13
23 missing samples out of 37 possible in 2005. Two of the
24 sites, Nebraska 4 and 5, averaged 28 missing samples
25 out of 40 in 2000...40 possible samples in 2006. And

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1 Nebraska 7 had only 3 successful samples in 2006,
 2 although the autosampler was successful in collecting
 3 samples between April and mid-June.
 4 For all the other sites, the average of
 5 missing samples was about 3 from that 2005-2006
 window.
 6 There were a couple of sites, Missouri
 7 3, Nebraska 6, Indiana 11, Kentucky 2, that had a
 8 higher frequency of missed samples, somewhat consistent
 9 with the Nebraska sites. And, finally, the autosampler
 10 results, as I mentioned, in particular for Nebraska 4
 11 from 2006, showed multiple concentrations above 100
 ppb
 12 during periods of missing grab samples. So there was
 13 something going on there where the autosampler was
 14 successful in these windows when the grab samples
 15 weren't.
 16 So we...we considered a number of
 17 factors. We looked at spatial data and other pieces of
 18 information that we have, both regional and site
 19 specific, and these are the factors that we considered.
 20 We...we looked at precipitation, both historic and site
 21 specific. We looked at stream flow, both historic and
 22 site specific. We looked at several landscape
 23 indicators. We looked at ice flow recharge potential,
 24 stream water, geology soil type, the presence/absence

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1 if any of these factors might at least visually give us
 2 a sense of whether there was something unique about
 3 these...these three sites.
 4 This slide simply shows you the location
 5 of the three sites in southeastern Nebraska relative to
 6 the other four sites, three sites in here, four
 7 Nebraska...the other four Nebraska sites here, and
 8 there's an Iowa site here and a Missouri site here.
 9 This is just a simple map showing the
 10 three sites relative to historic precipitation from
 11 1961 to '90, and you see that, in general, southeastern
 12 Nebraska tends to be a...a wetter climate than the rest
 13 of the state.
 14 We looked at the data similar to what we
 15 did for the decommissioning, and here you'll see, for
 16 Nebraska 5, the monthly precipitation and, generally,
 17 in 2005, was a fif...about a 50th percentile year for
 18 Nebraska 5. 2006 was roughly a 25th percentile year.
 19 That's Nebraska 7, same map. 2005 was
 20 roughly a 75th percentile year; 2006 was a 25th
 21 percentile year.
 22 So, taken together, these...these slides
 23 suggest that at least for 2005, the...the three sites
 24 experienced relatively normal rainfall, particularly
 25 during the critical windows when sampling was

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1 occurring.
 2 We looked at USGS stream gauge data,
 3 both historic and site specific. This slide is a
 4 summary of stream gauge data for the region. We really
 5 just wanted to see if visually there was anything that
 6 jumped out that said whether there was something unique
 7 about southeastern Nebraska relative to the...the rest
 8 of the region.
 9 This just gives you sort of a general
 10 ranking. It's kind of arbitrary in terms of the
 11 categorization of it, but doesn't seem to be any
 12 apparent obvious pattern in southeastern Nebraska
 13 relative to the rest of the state based on historic
 14 USGS data.
 15 Just look quickly at the same data to
 16 see those sites that reported no flow conditions in the
 17 data base, and there doesn't appear to be any
 18 distinction. In fact, it seems to be a little bit
 19 inverse in that there are several sites in the
 20 southwestern part of the state that are reporting no
 21 flow conditions but nothing obvious in southeastern
 22 Nebraska.
 23 We looked at site specific flow
 24 information. This was information provided to us by
 25 Syngenta outside of the reports. They instrumented

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1 each site with a river station, and the following
 2 graphics show river flow on the left vertical axis
 3 along with the chemograph atrazine concentrations with
 4 the scale shown on the right axis.
 5 And for Nebraska 4, it does appear to me
 6 that there are significant periods in the early part of
 7 the year with extremely low flow and possibly no flow
 8 conditions for a couple weeks here. Later flows pick
 9 up and average roughly around 4 ft³/sec.
 10 I did the same analysis, not shown here,
 11 for 2006, and it's roughly the same pattern. A little
 12 bit of shift in when the dry periods were. Average
 13 flow was about 6 ft³/sec for that site.
 14 It's also interesting in this
 15 chemograph. It's limited in terms of the number of
 16 samples, but you see it appears to show the same
 17 phenomenon that I showed you previously with the
 18 Indiana 11 site where you have a period of...of low
 19 flow/no flow conditions here probably with a dry period
 20 of time followed by something causing a...a fairly good
 21 runoff event, and that's where you're seeing your
 22 spikes in atrazine concentration at this particular
 23 site. It's similar to the pattern we saw in Indiana
 24 11. There's not much data there to...to say whether
 25 that's the same phenomenon going on.

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1 This is Nebraska 5. Same information,
2 site specific flow from 2005. Here you see a different
3 pattern. Flow appears to be continuous across the
4 sample season with an average of about 25 ft³/sec. For
5 2006, I did the same analysis, and roughly the same
6 pattern with an average flow of about 22 ft³/sec.

7 Same analysis for Nebraska 7, 2005. In
8 general, the flow here is somewhere between the two
9 previous slides, 4 and 5, roughly flow of about 10
10 ft³/sec across the site. There's a few spikes in...in
11 low period here later in the season.

12 I would point out, too, here that it's
13 recently been indicated to us...we didn't realize at
14 the time that we did this analysis...that these weren't
15 absolute flow conditions, that these are actually
16 estimated flow values by measuring depth. And so,
17 there's been some suggestion and, obviously, it's
18 something we need to follow up on with Syngenta, that
19 there may be some issues with these individual streams
20 in terms of their morphology that may be influencing
21 the...the estimated flow values that I'm showing you in
22 these slides here. So, it's something that we still
23 need to work through with them, but taken on their
24 whole, it appears to be at least for Nebraska's 5 and
25 7, there appears to be flow in there from big chunks of

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1 with the possible exception of soil type which, as I
2 said, we'll talk about more tomorrow. Both
3 precipitation and flow appear to be normal relative to
4 the other sites and historical trends.

5 But the fact remains that these sites
6 had more missing samples than others, and given the
7 limited data and uncertainty associated with the sites,
8 we continue to believe these sites should remain a
9 separate category for population estimates. Based on
10 site and regional conditions, it's still unclear if
11 these sites are unique in a way that will help us
12 interpret the population estimates.

13 But it does...the analysis does raise
14 the question of suitability of using data from sites
15 that experience flow conditions and less frequent
16 sampling. So, for example, if a site experienced a low
17 flow or intermittent dry conditions, do these represent
18 conditions that can reasonably be expected to support
19 aquatic community such as those represented by the
20 microcosm/mesocosm studies? Also, given the less
21 robust monitoring data and uncertainty in in-filling
22 periods, large periods, of missing samples using a
23 stair-step approach, is it appropriate to draw
24 conclusions relative to the LOC using these data?

25 These are questions that we have. As a

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1 the year, most of the year.

2 Well, as I mentioned previously, we
3 looked at a number of other landscape variables,
4 including soils, geology, tile drain. I'm not going to
5 present them all here. None of them really showed much
6 of a distinction between southeastern Nebraska and the
7 surrounding landscape.

8 We did see a bit of a trend similar to
9 what Syngenta shows with more irrigation further to the
10 west, but seemed to me that might be balanced out by
11 the fact that there's more precipitation in the eastern
12 part of the state, but it's obviously something we need
13 to look a little closer at.

14 But what really did jump out at us was
15 this presence of CD soils in the southeastern part of
16 the state. There is a high percentage of CD soils in
17 southeastern Nebraska relative to the rest of the
18 state, and so, this is the only landscape factor that
19 really jumped out at us, and I think Nelson will
20 probably talk about this a little bit more in his talk
21 tomorrow, I guess.

22 So, overall though, the analysis
23 indicates there doesn't appear to be any clearly unique
24 landscape, climatic, or hydrologic condition that would
25 suggest these sites are distinct from the other sites

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1 result, we've completed further analysis, first talking
2 a little bit about the microcosm/mesocosm studies which
3 are the basis for interpreting that and then following
4 that up with some analysis of sample frequency.

5 As I noted previously, the question of
6 how representative these sites are compared to the
7 microcosm/mesocosm studies is still uncertain. Many of
8 the microcosm/mesocosm studies were based on static
9 systems, so if it's reasonable to assume the Nebraska
10 sites, low flow sites, can be considered like semi-
11 aquatic, semi-static systems within the stream bed, it
12 seems reasonable that the LOC derived from
13 microcosm/mesocosm data would be appropriate for
14 interpreting potential effects of atrazine exposures
15 from these sites.

16 However, if these sites have had
17 variable depth, volume, and surface areas during parts
18 of the growing season, then it raises the question of
19 what issues should be considered using the LOC from
20 microcosm/mesocosm studies based on...that are based on
21 essentially constant volume systems. Clearly, a stream
22 that dries down is not likely the same as conditions
23 that the microcosm/mesocosm studies were conducted
24 under.

25 So we must...we need to consider to what

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1 extent the aquatic community composition, dynamics and
2 susceptibility to stressors similar in constant volume
3 sys...are similar in constant volume systems versus
4 these variable volume, potentially dry-down systems.

5 So in conclusion for the low-flow sites,
6 it doesn't...as I said, there's no clear pattern
7 discernable among the variables evaluated to suggest a
8 uniqueness for these sites. Site-specific
9 precipitation data at all the sites during the sample
10 window are within the 25 to 75 percent window that we
11 defined as being normal. Based on that analysis, we
12 didn't require any additional monitoring for these
13 three sites.

14 Site-specific flow data suggest
15 continuous flow in two of the three sites, and the
16 third site had only sporadic dry periods, albeit during
17 the planting season. And as I mentioned, this is
18 something we need to look into further with this issue
19 of how these flow estimates were derived at.

20 Some of the microcosm/mesocosm data
21 represent static waters. It's uncertain if shallow
22 depth is represented by these studies and, clearly, not
23 dry sites. Overall at this point, we believe the sites
24 should continue to be treated as a separate category
25 for population estimates. We really haven't made a

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1 assumptions that we relied on were similar to those
2 that Syngenta used such as the 4-day stair-step
3 approach for interpolating between the grab samples
4 that were collected, but...but we had several
5 differences.

6 We assigned non-detections at the
7 detection limit. I believe used Syngenta half of the
8 detection limit.

9 As you heard previously, we...we in-
10 filled the concentrations from the first sample date to
11 the beginning of the year to get a 365-day chemograph
12 using that first sample result, and we back-filled, if
13 you will, from the last date to the end of the year,
14 and where we had a subsequent year, we would roll that
15 last sample result through to the beginning of the
16 first sample date of the following year.

17 I would point out that, with few
18 exceptions, it didn't change the chemograph profile by
19 much. Typically, we're dealing with concentrations
20 either at the detection limit or slightly above the
21 detection limit, and I don't believe there were any
22 that we used in our CASM runs that were much above 0.5
23 ppb. It's obviously something we need to look into,
24 but if you look at the...the analysis that was done for
25 Indiana 11 on this precipitation chemograph window

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1 determination yet of how to
2 interrelate...interpretate...interpret the population
3 estimates in the context of all 1172 watersheds.

4 And I would just add an aside that this
5 is really a subject area where we'd like some feedback
6 from you guys to help us get a...get a handle on this.

7 But the investigation did raise the
8 important issue of sample frequency and uncertainty
9 associated with the monitoring data. Because the sites
10 experienced a higher number of missing samples than
11 most of the remaining 37 sites, exposure data from
12 these sites can be considered an approximation of a
13 less frequent sample design.

14 So, given that we consider the SSI
15 predictions for these sites less certain, it raises the
16 question of sample frequency and the relevance of less
17 robust sample data as a suitable input into CASM. So,
18 the following investigation will...will cover some of
19 the uncertainty inherent in the 4-day grab sample
20 design and will explore whether there are approaches
21 available to help us characterize the use of less
22 robust data.

23 So, the first thing is to talk a little
24 bit about some of the assumptions that we used in our
25 interpretation of the chemographs. Some of the

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1 thing, you can see that for 2005, the...the first
2 sample was at about 0.2 or 0.3 ppb that we used in our
3 CASM run, and that's the value we extrapolated back to
4 the beginning of the year. I think that's on page 181
5 of the appendices in the...the white paper, so that's
6 that.

7 But regardless, when you look at the
8 assumptions that we made in our chemograph
9 interpolation/extrapolation where we filled in the 365
10 days, there really wasn't much difference between what
11 we had and...and the assumptions that Syngenta had of
12 zeroes during the ends of the year. It didn't really
13 change the chemograph profile much, and it didn't
14 change the SSI deviations, either. I mean, the risk
15 conclusions are essentially the same.

16 Looking at 4-day grab samples, the
17 analysis focused on simulate...simulating the impact of
18 less frequent sampling. The goal was really to see
19 how...how changing the sample frequency using the
20 atrazine monitoring program data would influence both
21 rolling average concentrations for this magnitude
22 duration of exposure and the SSIs.

23 It was a really simple analysis. The
24 slide shows you an overlay of Indiana 4 for...from 2004
25 as a representative example, and there's three

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1 chemographs shown, including the original 4-day
2 chemograph, an alternate version that we created by
3 making a synthetic 12-day sample chemograph by just
4 picking out every 12 days from the...from the actual
5 data but ensuring that the chemograph...the peak
6 concentration from the 4-day samples was missed, and
7 then we replicated that, ensuring that the 4-day
8 samples...the peak concentration from the 4-day samples
9 was captured.

10 And what you see is the slide here shows
11 that the original chemograph is in blue. The pink
12 shows the 12-day chemograph profile where the peak
13 concentration was missed, and the yellow shows the 12-
14 day profile where the peak concentration was captured.

15 It demonstrates a couple of key factors.
16 First, using the stair-step approach, less frequent
17 sampling can dramatically change the exposure profile.
18 Second, missing a peak concentration with less frequent
19 sampling can significantly reduce the profile and, as
20 you'll see in my next slide, change the risk
21 conclusions...well, not changing the risk conclusions
22 but changing the SSI significantly.

23 Alternatively, if less frequent sampling
24 happens to capture the peak exposure, the stair-step
25 approach may result in overestimation by the

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1 simple analysis suggest that the sample frequency is
2 really critical, and missing peak exposures can result
3 in underestimation of peak in rolling average
4 concentrations. And it really raises the question of
5 how frequent must sampling be to ensure an accurate
6 profile.

7 As you saw yesterday, there has
8 been...and has been discussed several times, there's
9 other data as part of this monitoring program, and
10 that's the autosample results. 25 percent of the
11 sample sites were outfitted with autosamplers, and the
12 autosamplers were programmed to collect on 8 or 6-hour
13 composite samples during increased flow and...and
14 ceased collection when the flow returned to a
15 predetermined level.

16 Where autosamplers...so what we did was
17 we created alternative versions of the chemographs,
18 incorporating the autosample results into those
19 chemographs, and we developed a decision tree. And it
20 was a little different than what Syngenta did. Where
21 an autosample result occurred on the same day as the 4-
22 day grab sample, we used the highest value from that
23 day. If we had multiple samples on that day, we used
24 the highest value.

25 Where an autosample result on a day

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1 extrapolation between data points.

2 This slide just shows you the results in
3 terms of both rolling average concentrations and the
4 SSI predicted for the three interpretations of the data
5 you saw in the previous slide, and in comparing the 12-
6 day chemograph without the peak dramatically reduces
7 the rolling average concentrations and SSI across the
8 board, while the 12-day sample frequency with the peak
9 captured significantly raises the...both the rolling
10 average concentrations and the SSI.

11 In this example, the second alternative
12 doesn't change the...the overall risk conclusion. It
13 still doesn't exceed the 4 percent SSI, but it gives
14 you a sense of how the...the change in sample frequency
15 just using this simple analysis can change the overall
16 exposure profile.

17 We would expect, I guess it's worth
18 noting here, that the chemographs with different shapes
19 will vary regarding this...this type of analysis. I
20 mean, if you have a chemograph with a much higher peak,
21 the...the effect will be more pronounced with less
22 robust data, and if the chemograph is less, if there's
23 less of a peak there, you would expect to see a
24 less...a lesser effect.

25 So, in conclusion, the results of this

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1 without a grab sample, we put that sample result into
2 the profile, and then we continued for days without
3 sample, either 4-day or autosample results. We just
4 continued the 4-day...the stair-step interpolation
5 between sample points.

6 The goal of this analysis was just to
7 get a sense of the impact of the flow-triggered
8 autosample results on overall exposure profile and risk
9 conclusion.

10 Same slide that Nelson showed you
11 before. This just shows you how we took Indiana 11
12 from 2005 and in-filled it. You'll see the early peak
13 that he described before, and this is just the change
14 in the overall profile when you assume that the
15 peak...the autosample result that we replaced the 4-day
16 grab 208 ppb auto...grab sample result with a 237 ppb,
17 I believe it was, autosample result which was the
18 maximum of those four samples collected on that one
19 day.

20 So we did this for 26 of the chemographs
21 out of 80, and the autosample results provide
22 additional information on single peak exposures and
23 suggest that peak concentrations can be missed, as you
24 saw in the previous example.

25 From the analysis, 6 of the chemographs

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1 did not change any of the rolling concentration or
2 average concentrations relative to the original 4-day
3 grab profiles, and 4 of the chemographs did not change
4 SSI.

5 5 of the chemographs with autosamples
6 yielded lower rolling averages with changes of roughly
7 3 to 40 percent and lower SSI with decreases between 1
8 and 26 percent.

9 12 of the chemographs yielded higher
10 rolling average concentrations, increasing from 5 to
11 400 percent, and 17 sites yielded higher SSIs,
12 increasing from 2 to 400, roughly 400, percent.

13 And for sites with increases, the
14 average change in rolling concentration was roughly
15 between 30 and 40 percent and, for SSI, was roughly 90
16 percent.

17 As was pointed out by Syngenta
18 yesterday, it does appear to be that the...that the
19 sites where you're seeing the greatest increase in SSI
20 percentage, particularly...excuse me...particularly
21 when it comes to the...the rolling averages, those are
22 the sites that had the lowest starting concentrations.
23 So if you had a profile with very low SSI or very low
24 chemograph profile, the autosampler results were the
25 ones that...those were the profiles that were being

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1 USGS. Syngenta talked about this a bit yesterday, and
2 in this work, Charlie Crawford used continuous
3 monitoring, I believe from the Heidelberg data, from
4 four sites in Ohio. And then, what he did was he
5 created sample...sample design frequencies, and he
6 randomly selected from this continuous data 1000 times
7 for each sample design in a Monte Carlo fashion for
8 each site and each year, I believe.

9 In so doing, he created these
10 alternative synthetic chemographs of the actual data
11 but using a less frequent sample design, and for each
12 of the 1000 runs, he then colig...calculated...excuse
13 me...90...mean 90th, 95th, and 99th percentile
14 concentrations and went back and compared these to the
15 original raw data to calculate error estimates for...to
16 see how well these synthetic sample designs were doing
17 in predicting the overall exposures from the actual
18 complete 365-day chemographs.

19 And by comparing the error estimates
20 from the different sample frequencies, he was able to
21 provide some statistical evidence of the impact of
22 sample frequency...increasing sample frequency on
23 exposure values in flowing streams similar to those
24 that we're talking about here from the atrazine
25 monitoring program.

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1 jacked up the highest.

2 And overall, none of these chemographs
3 that were added...with the autosample results added in,
4 none of them, similar to what Syngenta showed
5 yesterday, in our analysis, none of them exceeded the 4
6 percent SSI, and none of the ones that were above
7 dropped below, similar to what you saw yesterday.

8 And because this is a limited set, we're
9 not making any...at this point, not making any
10 extrapolation of the results of these 26 chemographs to
11 the full set of 80. We...we don't have autosamplers
12 for the other ones, so that's still uncertain in terms
13 of whether we would see the same general trends in the
14 full set of 80 chemographs as to the 26 that we've
15 anal...analyzed.

16 So the analysis so far indicates
17 uncertainty in the 4-day grab samples, and the
18 approaches evaluated suggest that overall exposure
19 could increase even for a robust data set such as what
20 we're looking at here, but it raises the question of
21 whether there are other questions to evaluate the
22 impact of sample frequency on overall exposure profile
23 and, ultimately, the risk conclusions.

24 One approach that we've done preliminary
25 analysis on was some work by Charlie Crawford from the

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1 This slide just presents the...the
2 different sample strategies evaluated by Crawford, and
3 none of them are an exact match for the AMP. I would
4 say that w46 listed here in the middle is probably the
5 closest approximation both in terms of number of
6 samples, had 46, relative to the 38 to 40 that was
7 typical for the atrazine monitoring program, and the
8 design was similar with a...a much more intense sample
9 frequency during the growing window between April and
10 September.

11 So we...we wanted to explore whether
12 this analysis could provide additional information on
13 the uncertainty by comparing error estimates first for
14 the w46 with the actual data and then explored whether
15 the analysis provide...might provide some quantifiable
16 evidence of how less robust monitoring designs might
17 add additional uncertainty to the exposure profile and
18 then, ultimately, the risk conclusions.

19 The analysis by Crawford indicated that,
20 for an example, at the 99th percent concentration, the
21 w46 would under predict exposures by up to 30 percent,
22 but there are more...but accuracy increased it at
23 the...the lower concentrations. And the error
24 estimates are lower than those seen in the...in the
25 examples that we did that I've showed you so far with

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1 the autosamplers.
 2 And, again, the comparison with the
 3 other sample frequencies indicates increasing error
 4 with less frequent sampling. For example,
 5 samp...monthly sampling would under predict exposure
 6 relative to the w46 by roughly 20 to 50 percent. So if
 7 you were looking at a sample design that was monthly
 8 sampling relative to...something in Crawford's analysis
 9 roughly comparable to the data we're talking about
 10 here, it might under predict by 20 to 50 percent.
 11 So, at this time, there's uncertainty
 12 with the use of this analysis as far as EPA is
 13 concerned and for several reasons. First, none of the
 14 sample strategies evaluated by Crawford is an exact
 15 match for the...the sample design that we're talking
 16 about, and, second, the estimated exposure
 17 concentrations, in other words, the mean or the 99th
 18 percentile, don't really match the rolling average
 19 concentrations that we're...that we're looking at as
 20 being important for...for these streams.
 21 But regardless, the preliminary
 22 investigation that we suggest that this type of
 23 analysis could prove useful for estimating uncertainty
 24 in different sample frequencies and may be useful for
 25 answering the question of how frequent sampling must be

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1 how edge-of-field concentrations are predicted using
 2 PRZM, and the central chart just shows you how these
 3 pieces are brought together. They use a decision tree
 4 that...that integrates the edge-of-field concentrations
 5 into the exposure profile.
 6 So we...we didn't do this analysis, but
 7 we did look at the results that were presented in...in
 8 Syngenta's report by Snyder, et.al. from 2007, and in
 9 that, 80 chemographs were filled in with PRZM-generated
 10 exposures, and the percent difference in rolling
 11 average concentrations and SSI were calculated. The
 12 SSI were really limited, at least in the Snyder report,
 13 because so many of the original SSI chemographs were at
 14 0 percent, so we really couldn't...there were only a
 15 few of the chemographs where we could compare the
 16 percent change in SSI from the original to the PRZM-
 17 modified chemograph, because we would be comparing 0
 18 percent to some percent SSI.
 19 So we...we relied on the rolling average
 20 concentration as more of a predictor or an indicator,
 21 if you will, of what the percent differences were
 22 between the original 4-day chemographs and Syngenta's
 23 PRZM-augmented chemographs.
 24 And using the 60-day rolling average as
 25 an example, 11 of the sites yielded lower rolling

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1 to be used in the model. The...the analysis that
 2 Syngenta presented yesterday is something that we'll
 3 obviously take a look at, and that's the kind of
 4 feedback I think we would like from the panel in terms
 5 of whether some approach like this would be useful for
 6 us to consider when looking at other sample frequencies
 7 relative to the CASM model.
 8 Okay, the last piece of information that
 9 I'll talk about is Syngenta's analysis of the PRZM
 10 modeling that they did where they...they used our...our
 11 standard surface water model for pesticide risk
 12 assessments, the pesticide region model, and where they
 13 calculated edge-of-field concentrations and then used
 14 these edge-of-field concentrations to in-fill a 365-day
 15 chemograph. And they...they did the modeling using the
 16 site-specific soil and agronomic planting information
 17 for all 80 site-years that were available at the time
 18 of the analysis.
 19 I won't dwell on this too much. This is
 20 pretty much the same slide that Paul showed yesterday,
 21 and it's just a conceptual model of how they integrated
 22 the...the site-specific information on the top where
 23 you see application information and rainfall
 24 information.
 25 The chart at the bottom just shows you

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1 average concentrations with the percent decreases
 2 ranging from 1 to 23 percent in overall exposure. 3 of
 3 the sites yielded no change, and 66 of the sites
 4 yielded higher concentrations with percent increases
 5 ranging from 1 to over 1300 percent, although, again,
 6 many of the sites that were...experienced the biggest
 7 changes in rolling average concentration were these
 8 sites with the lowest chemograph profile to begin with.
 9 So when you just look at the...the sites
 10 that increased, overall, the average increase in
 11 exposure profile was about 200 percent in...in the
 12 sites...only the sites experiencing an increase.
 13 So, overall conclusions from total
 14 analysis, the amount and timing of precipitation
 15 relative to atrazine application is critical. The
 16 relevance of low and no-flow conditions to CASM in the
 17 microcosm/mesocosm studies is still uncertain. The
 18 analysis suggests that less than continuous monitoring
 19 may underestimate the exposure profile.
 20 None of the evaluations change the risk
 21 conclusions from CASM, although, generally, exposure
 22 profiles can be characterized as increasing, and
 23 overall, it suggests the need for some approach to
 24 capture uncertainty in the monitoring data in a
 25 quantitative fashion, especially when you consider the

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1 sites with missing data such as the Nebraska site or
 2 less frequent sample designs.
 3 With that, that concludes my talk, and I
 4 will be happy to take any clarification questions.
 5 DR. HEERINGA: Questions of
 6 clarification from the panel? Yes, Dr. Grue?
 7 DR. GRUE: You mentioned that several
 8 sites other than the ones that were selected out were
 9 missing...were missing data. Is that...was that due to
 10 low-flow conditions? And what...what proportion would
 11 that be in the overall data set?
 12 MR. CORBIN: In terms of the second
 13 question, you mean how many of the sites, what
 14 proportion of the sites to the overall?
 15 DR. GRUE: Yeah, in terms of
 16 samp...potential sampling points and time or
 17 what...what are we...
 18 MR. CORBIN: For the individual sites
 19 that I mentioned that experienced...the...the non-three
 20 Nebraska sites, they experienced...they were random
 21 missing samples. I have not looked closely at the
 22 hydrographs for those sites yet, so I don't know
 23 whether they correlate with low-flow dry-down
 24 conditions.
 25 I suspect not. I suspect they're

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1 probably more a function of random missing samples for
 2 a variety of reasons. I don't know that yet. It's
 3 something to look into.
 4 And as far as representation of
 5 the...are you asking if we've calculated population
 6 estimates?
 7 DR. GRUE: No, what I was getting at,
 8 trying to get at was I thought maybe it was more than
 9 those three sites that...that were missing data out of
 10 the entire set, and if that...if that was the case, how
 11 many of those instances could be attributed to low-flow
 12 conditions. In other words, how common is low flow as
 13 a problem in the sampling scheme for these 40 sites
 14 over two years?
 15 MR. CORBIN: Yeah. When...if...I
 16 believe we summarized, actually, the annual average
 17 flow conditions in these sites from the...the data
 18 Syngenta provided in the white paper. In general, when
 19 you look at these...the three Nebraska sites, they're
 20 not the lowest flowing sites out of the bunch. They
 21 tend to be more in the middle of the pack.
 22 Obviously, this issue of how the flow
 23 estimates were derived at is something we need to talk
 24 about, because there may be something unique about the
 25 stream morphology in Nebraska that's influencing them,

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1 but my guess is...and I'm just guessing here...is that
 2 the other sites, those are probably more random
 3 sampling error issues.
 4 DR. HEERINGA: Steve Heeringa. On the
 5 low-flow sites, there was a verification that there was
 6 no sluice or stop dam upstream at which people were
 7 simply shutting off the flow to accumulate water?
 8 MR. THURMAN: Yeah, I think this
 9 issue...this is Nelson Thurman. I think this issue is
 10 something that we...we've got on our list of things
 11 that we need to follow up with and...and try to get a
 12 handle on and, you know, that's a question that needs
 13 to be asked, and I suspect sometime after the holidays,
 14 we'll be sitting down with Syngenta and say here are
 15 some questions we have or provide...you know, try and
 16 get some clarification on some of these.
 17 And this is just one of these we...we
 18 don't know at this point.
 19 DR. FAIRCHILD: I think...
 20 DR. HEERINGA: Dr. Lerch?
 21 DR. FAIRCHILD: I think that's a good
 22 question. Jim Fairchild. That given the rainfall
 23 patterns of that site and the fact that...that
 24 precipitation and flow or flow actually increased later
 25 in the year is really counter intuitive, and I know you

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1 said it's in a transitional area for irrigation, but do
 2 you know if it...is that associated with a Bureau of
 3 Reclamation irrigation district?
 4 MR. CORBIN: Do you mean do I know
 5 specifically about the three Nebraska sites?
 6 DR. FAIRCHILD: Right, are they
 7 associated with a Bureau of Reclamation irrigation
 8 district?
 9 MR. CORBIN: I don't know.
 10 DR. FAIRCHILD: Well, I think it would
 11 be well worth your time to talk with Bureau of
 12 Reclamation, because that...that's such an unusual
 13 pattern in...in those streams, in my mind, and I...I
 14 think there is some agronomic operational thing going
 15 on there if not simply a dam, water use of some type.
 16 DR. HEERINGA: Same observation. Seemed
 17 like someone was collecting water during the start of
 18 the growing season and then, once things were
 19 established, letting it through, and then that
 20 would...just a rough interpretation of that.
 21 Yes, Dr. Gay?
 22 DR. GAY: Faith Gay, University of
 23 Georgia.
 24 Could...could you talk about how your
 25 autosamplers were set up to take samples? Were they

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1 flow initiated so when you had a rain event, that
 2 generated flow in these no-flow sites that they were
 3 all captured?
 4 MR. CORBIN: Yeah, they're not my
 5 autosamplers but...but yeah, I think you're...I think
 6 you're right. They were...they were program...I mean,
 7 they were programmed to trigger at a predefined level
 8 when flow increased above their base flow value,
 9 and...and then, similarly, they would stop sampling
 10 when the flow decreased.
 11 What those specific triggers were, I
 12 don't...I don't know specifically how...how much
 13 increase had to occur in flow for them to begin
 14 sipping. I'm not...I'm not...I'm not sure. I don't
 15 remember if it's in the Syngenta documents or not. I
 16 believe so, but I'm not sure.
 17 MR. THURMAN: I think if you...remember
 18 yesterday, Dr. Harvard was talking about, you know,
 19 part of the challenge they had was calibrating, you
 20 know, when do you trigger that, and I think there was a
 21 learning process for each of those...those sites,
 22 because if I'm not mistaken, there was actually some
 23 type of increase in depth that triggered the
 24 autosampler and then...but I think they had to...they
 25 learned a lot in the first year and had to do some

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1 recalibrating, you know, in the second year of...of
 2 flow in...on that.
 3 And I think we saw a difference in
 4 frequency in autosamplers between the first year and
 5 the second year as they...they learned how those work.
 6 But that is captured in their documents
 7 and something that we're...we're looking at. A lot of
 8 what we're presenting is here are things we've started
 9 to look at, and we know there's a lot of more...a lot
 10 more detail we need to get into on those, and that's
 11 one of the areas that has a lot more detail we need to
 12 get into.
 13 MR. CORBIN: And I would just...I would
 14 just that that is a good point, that, actually, they,
 15 because the flow is estimated, they actually were
 16 triggered by increase in depth and not...not by flow.
 17 DR. HEERINGA: Dr. Lerch and then Dr.
 18 Grue.
 19 DR. LERCH: I wondered if you did for
 20 this Nebraska site...so you had the example of the
 21 Indiana 11 where you did a comparison with a typical
 22 planting window. Is that also in some of our
 23 supporting documents so we can look at that?
 24 MR. CORBIN: Yes, that's in the...that's
 25 in that appendix in the back all...for all those sites.

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1 We have that in there.
 2 DR. LERCH: Okay. And...and I guess I'm
 3 also wondering, I mean, one of the sites, obviously,
 4 did have frequently low flow, and I can't, even with my
 5 glasses, read which one that is. Nebraska 04 I think
 6 it is. But the other two really are pretty typical
 7 flow.
 8 If samples were missing because they
 9 were missing for some random reason, in other words,
 10 there was no lack of water to sample, I guess I'm
 11 having a hard time with the conclusion that's at least
 12 on my slide, 142, that it's still considered...those
 13 are considered unique. It seems to me that...that at
 14 least two of the three are not.
 15 MR. CORBIN: Right. I guess
 16 when...well, I guess what we're...we're saying is that
 17 yet we can't...it's uncertain to us if they are unique
 18 or not. I think they're obviously unique, because they
 19 have a higher frequency of missing samples. Whether
 20 there are conditions on the ground that are making them
 21 unique, we're not sure.
 22 MR. THURMAN: Yeah, in our list of
 23 questions that...that we're...that we're developing
 24 that we need to...to ask Syngenta to follow up on, it's
 25 the flow was not directly measured. It was calculated

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1 based on a number of things. So, there are some
 2 assumptions that in the flow that you see, it may not
 3 actually be that amount. So, we've got to take a
 4 closer look.
 5 And the stream morphology may be
 6 different there, and you...you saw the type of sample
 7 tubes that needed to go in, and...and, you know,
 8 there's just times whenever you may have flow, but it's
 9 shallow, and you just can't get that sample tube
 10 to...to get a sample.
 11 So, those are the type of issues that we
 12 start asking questions and generating a list of
 13 questions that we need to follow up on, and...and
 14 that's some of the things that we need to follow up on,
 15 and if there are any other questions from the panel or
 16 any things to suggest looking at, we'd be glad to...to
 17 take that into account when we follow up.
 18 DR. HEERINGA: There was a question
 19 from...Dr. Grue?
 20 DR. GRUE: Chris Grue. I just wanted
 21 some clarification on the overall statistical design.
 22 Is...is EPA operating on the assumption, then, that
 23 any...any sub-basin not identified in the greater than
 24 the criteria that identified vulnerable does not pose a
 25 significant risk to aquatics? Because your design is

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1 essentially making that assumption unless you're now
 2 going to go back and sample sites that did not meet
 3 those criteria, at which point I would ask why
 4 something like a stratified random sample wasn't
 5 employed such that you could confirm that the
 6 hypothesis that sites that did not meet those, your
 7 vulnerable criteria, actually are not producing
 8 concentrations that would exceed a LOC.
 9 DR. OLSEN: Yes, Tony Olsen. At...at
 10 this point, I guess I'm not making the assumption about
 11 what's going on with that strata A and the strata less
 12 than, you know, less than 80 percentile. I think
 13 that's an open question as to what's going on.
 14 There's...you know, there's certainly a
 15 feeling that, you know, that it's less likely that
 16 you'll have a, you know, an SSI in that area, but
 17 there's some...that's one of the reasons why we ended
 18 up taking a look at the alternative WARP predictions,
 19 was to say hey, wait a minute, did we really identify,
 20 you know, you know, the highest, you know, the highest
 21 set, and I think there's some...there's some suggestion
 22 that we didn't, you know, that there was...you get
 23 slightly different sets, depending upon what sort of
 24 input data you put in the WARP. So, I think, you know,
 25 we haven't made that assumption.

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1 In terms of actually doing a design,
 2 let's say, where you actually stratified and say well,
 3 I...well, we actually did stratify. We've got
 4 two...we've got actually essentially four strata.
 5 We've got a strata A that we didn't do anything, we've
 6 got a strata B less than 80 percent. We didn't do
 7 anything. We've got two other strata that we did do
 8 something in.
 9 The question is, is did you want to
 10 allocate any resources to actually sampling these first
 11 two strata. And, you know, that's a question in some
 12 sense, you know, you always hate to bring up dollars,
 13 but it's a question of okay, if you have, you know, if
 14 you have a limited amount of study to do the amount of
 15 work it's going to require at one of these sites, how
 16 much effort do you want to put over in these other
 17 sites. Do you want to end up putting in another, let's
 18 site, 20 sites in each of those strata just for a
 19 number out of the air and monitor those?
 20 And you could do that, and that's a
 21 legitimate...a legitimate thing to deal with. The
 22 expectation is, is, though, that you're going to end up
 23 getting chemographs that are very flat and very low.
 24 Is that worth...is that worth the effort? Is that
 25 where you want to spend the money? If you had to spend

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1 your money, where should you end up putting the
 2 allocation?
 3 DR. GRUE: Well, the reason...the reason
 4 I...Chris Grue. The reason I bring that up is that
 5 unless that...but that would assume to...one would
 6 assume, based on that, then, that EPA would not go back
 7 to the registrant and say well, now we need to monitor
 8 what we consider to be the...the assumed negative sites
 9 to identify false negatives, and that's why I'm just
 10 wondering if taking care of that initially or you have
 11 that...you still have a lingering question and then
 12 you're going to have to address that at a later time.
 13 And the reason I bring that up is that
 14 if you look at the total number of HUC data sets
 15 and...I think that's...that's approximately 10,000,
 16 something like that...and you express the figures that
 17 you've shown in terms of vulnerable sites, then you're
 18 essentially dividing those percentages by 10, and that
 19 has implications as long as you're comfortable in
 20 making the assumption about the set that you did not
 21 sample.
 22 So, anyway, it's just something in terms
 23 of thinking about those figures and, ultimately, where
 24 the Agency and the registrant are going next. That
 25 would have some implications.

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1 DR. HEERINGA: Dr. La Point and then Dr.
 2 Effland.
 3 DR. LA POINT: My question builds on
 4 what...what Chris just talked about. The...will, at
 5 some point, some of these...well, you'd mentioned the
 6 standing water study is ongoing, and will that be
 7 linked to this one, the results from that stuff?
 8 Because that may be some of the same...same areas, and
 9 you get some cost efficiency out of understanding the
 10 fate and some of the consequences in some of these
 11 areas. Just a question.
 12 Because it...and it influences the
 13 design of each if they go their separate ways.
 14 MR. THURMAN: I, you know, we're still
 15 expl...I mean, right now, we're focused on this...on
 16 this flowing water. The...the whole sugar cane is a
 17 complete...is a separate pilot study, and it's looking
 18 at a separate area, because where sugar cane is.
 19 The stand, you know, static water
 20 bodies, we're going to start by looking at...at
 21 monitoring that's been conducted in reservoirs
 22 that...that feed drinking water intakes, because
 23 there's a...a wealth of sampling that's out there on
 24 that that's been collected for several years now, and
 25 we're going to look at that in terms of all right, it's

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1 being collected for...for drinking water purposes, but
2 we're going to look at the...at the chemographs from
3 there to see what that tells us, and...and, you know,
4 those haven't...those weren't...weren't selected in a
5 statistical design, so you can't really make the same
6 type of inferences from that, but we're going to look
7 at it in terms of what does that tell us, what do we
8 do...need to do next from that.

9 So, I don't think you can really link
10 that, fold that in with this, because it...those sites
11 were selected for different...based on different
12 criteria.

13 DR. HEERINGA: Dr. Effland, then Dr.
14 Ellsworth.

15 DR. EFFLAND: Bill Effland. One
16 question I have, and maybe it's been answered and I
17 just missed it. The autosamplers, just to...just to
18 back up a couple people, how...how did you decide where
19 to install the autosamplers? And I think it was...the
20 number was 10 in each year. Is that correct? But
21 how...how did you decide which sites received the
22 autosamplers?

23 MR. CORBIN: We didn't; Syngenta did.
24 Was it 25 percent of the sites? I don't remember in
25 the original discussions. I believe that was their

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1 DR. CHU: We can...we can look at the
2 chemographs actually for many sites where it seems that
3 we had several peaks in April and May or in June, but
4 in August, it seems pretty stable. So I'm just curious
5 why we selected the 4-day time interval for samples.

6 Also, I'm wondering if there's any
7 reason to keep the same time interval. Actually, you
8 know, if we know application in...April and May are
9 application months, why...actually, we can...we can
10 increase...we can increase the sample times during
11 these months and decrease...reduce the times for
12 Ap...for August. I don't know if there's any reason.

13 DR. HEERINGA: Mark?

14 MR. CORBIN: Given...given...given our
15 experience with monitoring data, we were very happy to
16 see 4-day grab samples over such a long period of time.
17 We don't usually get that good a quality of data.

18 I mean, I wasn't part of the discussions
19 when the 4-day interval was selected, but I'm sure
20 logistics played into it. I mean, otherwise, you'd
21 have to have somebody out there nonstop constantly, and
22 there are logistical reasons why, you know, 4-day...4-
23 day is pretty...is a pretty good frequency of...of
24 sampling.

25 And as far as modifying the sample

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1 decision, and I believe that most of the autosampler
2 locations...and Paul can shake his head yes or no...are
3 roughly co-located with the grab sample sites in most
4 cases.

5 DR. HENDLEY: They were also...Paul
6 Henley. They were also...Paul Hendley. They were
7 also...

8 DR. HEERINGA: Sorry, Paul, please use
9 the...it's for the transcript, yes.

10 DR. HENDLEY: Okay, for the record, Paul
11 Hendley. The autosampler sites were at the same
12 bridges and the same points as the grab samples were
13 taken, and, also, they...they were located, and we did
14 make a recommendation to EPA, and the approximate
15 reason for selecting sites was smaller and what at the
16 time we perceived may well be flashier watersheds where
17 the thought was the chance of missing sharper peaks was
18 greater, and that was the thinking.

19 Now, obviously, that was in advance of
20 knowing anything about the hydrology. Does that cover
21 your question, Mark?

22 MR. CORBIN: Well, yeah, I think so,
23 but...

24 DR. HEERINGA: Dr. Ellsworth? Okay, Dr.
25 Chu.

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1 design, I...I don't think that's something we're
2 contemplating at this point.

3 MR. THURMAN: Yeah, I think one of the
4 things you've got to keep in mind, 4-day interval was a
5 lot more frequent than the general monitoring program
6 you get. I mean, a lot of...you know, a lot of the
7 more detailed monitoring might have weekly or every
8 other week intervals. So this was a quantum leap ahead
9 in terms of frequency of sampling.

10 In terms of why we stretched it out into
11 August, we weren't sure what was going to happen. I
12 mean, you're looking in retrospect, and when we were at
13 the other end of this...this study, it sounded...it
14 makes sense to cover this period to make sure we don't
15 miss any...any...any late season piece.

16 As it turned out, at least these
17 monitoring studies, except for maybe a couple of sites,
18 they all happened early in...early in...relatively
19 early in the growing season, and you didn't see much
20 later on. So, that's something we've learned which is
21 something that might inform, you know, future
22 monitoring studies, what do you do, how frequently do
23 you sample, when do you target, where do you target.

24 These are the type of things that we're
25 just...we have questions that in terms of evaluating

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1 what you learn from here for future studies, and these
2 are lessons learned that...that may help inform future
3 studies, not just for atrazine but for maybe
4 other...other chemicals as well.

5 DR. HEERINGA: The systematic nature of
6 what was done in this case certainly informs any
7 consideration for the future, but at the time, I think
8 it probably represents the best coverage in terms of
9 hypotheses.

10 Robert Gilliom?

11 MR. GILLIOM: Could you say a little bit
12 more about the reasoning behind going to the smaller
13 sub-watershed instead of just going to the HUC in that
14 scale? And it's coming to mind because of two things.

15 One...one is it...it would probably get
16 around a lot of the issues with low flow and all that,
17 because you'd have a bigger system. It smooths things
18 out so you would...and from what I'm understanding, it
19 might even be some of the more sensitive time periods
20 for the Steinhart deviation just because the more
21 sustained, elevated moving averages.

22 I really don't have a sense of that, but
23 I'm...so, bringing what you've learned from this kind
24 of combined with the initial reasoning, are you
25 thinking the scale of future monitoring should

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1 information on. I think, as Paul Hendley mentioned in
2 his...his talk, there's a whole lot of information in a
3 lot of these other watersheds, generally larger
4 water...water bodies than what we monitored, so that we
5 can take a look at that, take advantage of monitoring
6 that's already out there.

7 That was the general thought at the time
8 in terms of that. You know, some of these flow issues
9 obviously coming back. Some of these other questions
10 are coming up now as we look into it. So, you know, we
11 may have made a different decision based on what we
12 know now, but now we know something.

13 DR. HEERINGA: Dr. Olsen?

14 DR. OLSEN: Yeah, the...another aspect
15 which I'm sure you know in terms of the HUC...HUC
16 structures and, certainly, HUC 10s are this case, just
17 generally, about half the HUCs are inter-basin HUCs.
18 They have flow in as well as out, and so, you know, for
19 those that, you know, are true...are true watershed,
20 you say fine, measuring at the outflow might make some
21 sense.

22 The other inter-basin HUCs, you know,
23 you've got flow in as well as out, and so, when you're
24 trying...when you've tried to estimate sort of what the
25 WARP score is, it's done for that particular HUC, but

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1 change...is...is a way to put it.

2 DR. HEERINGA: Nelson, do you want to
3 take it?

4 MR. THURMAN: I...I'm going to make a
5 quick comment from the perspective of where we were,
6 and I think Tony has some comments he wants to make,
7 so
8 I'll...I'll let him share that.

9 You know, we went in...we know a lot
10 more now than we did then. I mean, we...we had some
11 understanding before. A lot of the monitoring of
12 atrazine was in the larger water bodies than what we
13 were looking at, so one of the...you know, we were
14 looking at one of the questions you had early on is
15 well, why do another monitoring study? We've got so
16 much monitoring out there, why do you need another
17 monitoring study?

18 You know, some of the answer in the
19 question of given the...that we're looking at magnitude
20 and duration combination, we need to take a closer look
21 at how frequently do you need to sample to characterize
22 that. One of the thoughts was let's look at some of
23 the flashier water bodies and see how frequently you
24 need to sample.

25 The second and third order streams where
we ended up were something we didn't have a lot of

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1 you have...you've got other stuff coming in. That also
2 means you've got a lot larger streams in the...possibly
3 in the inter-basin HUCs.

4 So, that's...that's one of the things
5 that would come to mind. And I wasn't involved in the
6 first part of this process at all, but that's one of
7 the things that would come to mind in that particular
8 area.

9 Sort of a comment, I guess, about would
10 you use a different...change the scale or not, and I
11 think we have to go back to the use of well, if you're
12 going to try to prioritize which, if we use smaller
13 HUCs, for example, if you're going to try to prioritize
14 those at a smaller scale, can you really do that based
15 upon the level of the spatial data that you had to do
16 the prioritization with where, you know, these would be
17 much...maybe much smaller than some of the scales that
18 are used for either the soils data or the...or the use
19 data and that sort of stuff. And so, there might be a
20 limitation going down that way as well.

21 DR. HEERINGA: Dr. Ellsworth?

22 DR. ELLSWORTH: Yeah, just a...a
23 question and comment I have is, you know, looking at
24 it, a time series like that, my first take on it is I
25 would want to look at...and maybe you have...auto-

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1 correlation. And I know these things are spaced, you
2 know, four days apart.

3 You probably lost any auto-correlation,
4 but if...if you have lost it, then what's the
5 justification for using a stair-step? You know,
6 shouldn't you use some kind of moving window of a local
7 mean instead of the true measured value four days
8 earlier?

9 And the other question I would have is,
10 is there a cross correlation with the flow depth that
11 was measured? And if there was, is there a way to
12 piggy-back on that to improve your prediction? You
13 know, you've got some kind of a REMA of a certain
14 order. You can start looking at the uncertainty in
15 these time series and quantify that and come up with a
16 much better than kind of a heuristic estimate on it.

17 MR. CORBIN: We...we have not done any
18 of that. We have had conversations with NOPP about
19 auto-correlation and some things that we might look at
20 beyond what we've done, but those are great
21 suggestions.

22 MR. THURMAN: Yeah, I'd like to...just
23 let me add a couple other clarifications. We
24 do...we've had some people in OPP who've looked at...at
25 that kind of a auto-correla...time series auto-

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1 seem to work? Is there a...was it done for all sites?
2 I didn't...I didn't really get a...I wasn't able to
3 read the...I think the report was submitted to us, but
4 it was something I haven't had a chance to go through
5 yet.

6 But it's...it actually brings up a much
7 bigger question about as your field modeling and then
8 in...in-stream effects or exposure, and so, can you
9 comment on that?

10 MR. CORBIN: Not too much. I mean, we
11 haven't looked at depth into that, either. There is
12 a...I'll describe it as a decision tree that they used
13 to integrate these edge-of-field predictions from PRZM
14 into the chemograph. I think Paul described it
15 probably better than I could yesterday in terms of how
16 those edge-of-field concentrations that were predicted
17 were...were adjusted based on percentage of crop
18 applied and some other factors. I...I forget what the
19 exact parameters were, but there was an adjustment
20 there.

21 But you're right. There's...there's an
22 assumption there. I think you raised the question
23 yesterday about, you know, how do you take a field
24 scale model and integrate that to the watershed scale,
25 and there's...there's many things with that approach

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1 correlations and other efforts that...that we have. We
2 actually thought about putting a slide in in here to
3 mention that, but we just didn't...didn't. We kind of
4 ran out of that time.

5 Your question about cross correlation
6 with flow depth, I want...early on, Syngenta had done
7 some analyses with the Heidelberg College data to see
8 whether you could do that, and I was one of the ones
9 who...it looked like in a couple...in some cases, it
10 looked good. In other cases, it didn't like any...it
11 didn't look good at all, and I think part of it is
12 because what...you still have to get the timing of
13 application in relation to ran...you have to get all
14 that in there.

15 It's something I...I suspect Syngenta
16 has still been investigating, because there
17 was...it...it makes sense. There might be something
18 that you can do for...that may help with that, and so,
19 it is something that maybe, as a result of this...of
20 this work, could be re, you know, revisited.

21 DR. HEERINGA: Bill Effland and then
22 Linda Young.

23 DR. EFFLAND: Bill Effland. One of my
24 questions is about the in-filling with the PRZM data or
25 the PRZM modeling outputs. How...how well did that

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1 that we would need to look at before we could get
2 comfortable with thinking about how we might use that,
3 and we haven't done a lot of that work yet.

4 DR. EFFLAND: I guess I...my comment
5 would be, then, that I think that that's something that
6 should at least be investigated further, because
7 there's a lot of edge-of-field results, and the real
8 trick is what does that mean to the stream system, and
9 we're...there's a lot of big question marks about that.

10 MR. CORBIN: I think that's a great
11 suggestion.

12 DR. HEERINGA: Dr. Young, and then I
13 think maybe one other question and we'll bring it to a
14 close for the day. Dr. Young?

15 DR. YOUNG: As I understand it, when the
16 study was originally developed, we were trying...the
17 goal was to estimate the percentage of...of...of
18 watersheds exceeding the LOC within a particular group.
19 And then, as...as...when the results came in and there
20 were some that exceeded the watershed, the LOC, then
21 the question be...begins to change in what
22 characteristics are associated with that increased LOC.

23 Now, that's a very different question
24 and one for which the study wasn't designed. So, have
25 you thought about what additional sampling might be

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1 needed or how...whether...whether, even, this study can
 2 address that type of question?
 3 MR. CORBIN: I guess the answer is stay
 4 tuned for tomorrow. Right? Because Nelson is going to
 5 talk about that a little bit in terms of how we...
 6 DR. HEERINGA: Sort of questions 10, 11.
 7 MR. CORBIN: And...and what you'll see
 8 is proposed approach. We haven't done that yet.
 9 We...we have the population estimates, but we're not
 10 sure how to interpret them or extrapolate them out to
 11 identify watersheds that they represent.
 12 MR. THURMAN: I'd just add we knew that
 13 was going to be a challenge and...and our...and I am
 14 looking forward...you know, one of the things we do
 15 hope is...is to pro...is to get some feedback
 16 from...from this panel on...on some of the things we've
 17 thought about and maybe some things we haven't even
 18 considered yet that...that may help us.
 19 DR. HEERINGA: Okay. I think for this
 20 evening that I'd like to...to draw the proceedings to a
 21 close. We've been...had a very good discussion here.
 22 I think we've had coverage of this second component in
 23 terms of its elements, and there's a sequence, I
 24 believe, of five charge questions related to that.
 25 It's my proposal that we would pick that up.

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1 I'll turn to Designated Federal Official, Jim Downing,
 2 for any final comments, administrative comments.
 3 DR. DOWNING: I actually don't believe I
 4 have any, and so, we'll stand adjourned until 8:30
 5 tomorrow morning.
 6 DR. HEERINGA: 8:30 tomorrow morning.
 7 We'll see everybody here. Thanks so much.
 8 Panel members, I wonder if we could just
 9 meet for just two or three minutes in the break-out
 10 room to discuss sort of plans for tomorrow and
 11 preparation for discussion.
 12 (WHEREUPON, the Meeting was recessed at 5:17 p.m. to
 13 reconvene at 8:30 a.m. on December 6, 2007.)
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1 Dr. Irene and I talked. I think that,
 2 although I don't want to force timing, that we will aim
 3 to complete the proceedings tomorrow.
 4 And to just sort of give you a sense of
 5 how that might go, I would hope to certainly complete
 6 the discussion of the five charge questions on this
 7 issue in the morning and reserve the afternoon, maybe a
 8 little longer session, for the final topic and
 9 questions 10 and 11, again, if that's reasonable.
 10 Clearly, if there are other issues that
 11 come up and we need the time, we'll take it, but that
 12 just...for everybody in the audience and for everybody
 13 on the panel, I think we're...we're not really cutting
 14 things short, but we would have about a half a day to
 15 finish this up and a half a day for the other topic.
 16 You know, there's only two questions,
 17 but I...I think, in some ways, intellec...I'll tell
 18 you, intellectually, they may be the more interesting
 19 and more stimulating thing for everybody on the panel,
 20 not that the other material isn't, but I think that, in
 21 general, I think it is where...where it ultimately
 22 goes.
 23 And so, I want to thank everybody again
 24 for their participation today. The audience has been
 25 very good. I haven't seen people leaving early, and

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1 CAPTION
 2
 3
 4 The foregoing matter was taken on the date,
 5 and at the time and place set out on the Title
 6 page hereof.
 7 It was requested that the matter be taken by
 8 the reporter and that the same be reduced to
 9 typewritten form.
 10 Further, as relates to depositions, it was
 11 agreed by and between counsel and the parties that
 12 the reading and signing of the transcript, be and
 13 the same is hereby waived.
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1 CERTIFICATE OF REPORTER
2 COMMONWEALTH OF VIRGINIA
3 AT LARGE:
4 I do hereby certify that the witness in the
5 foregoing transcript was taken on the date, and at
6 the time and place set out on the Title page
7 hereof by me after first being duly sworn to
8 testify the truth, the whole truth, and nothing
9 but the truth; and that the said matter was
10 recorded stenographically and mechanically by me
11 and then reduced to typewritten form under my
12 direction, and constitutes a true record of the
13 transcript as taken, all to the best of my skill
14 and ability.
15 I further certify that the inspection,
16 reading and signing of said deposition were waived
17 by counsel for the respective parties and by the
18 witness.
19 I certify that I am not a relative or
20 employee of either counsel, and that I am in no
21 way interested financially, directly or
22 indirectly, in this action.
23
24 MARK REIF, COURT REPORTER / NOTARY
25 SUBMITTED ON December 5, 2007

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