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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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UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY

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 9 DECEMBER 6, 2007
 10 MR. DOWNING: I'd like to call the
 11 meeting to order. And note that we've gotten a couple
 12 of handouts. One comes from Bill Effland, and it's a
 13 reference for you to consider. And, then, also, the
 14 other handout we just gave that has some photographs on
 15 it is an additional, supplemental information for you
 16 to consider from Syngenta. So, with that, I think we
 17 are about ready to begin. I'll turn it over to our
 18 chair, Dr. Heeringa.
 19 DR. HEERINGA: Thank you ver much, Jim,
 20 and welcome back everyone to the third day of our
 21 meeting of the FIFRA Science Advisory Panel on the
 22 topic of the interpretation of the ecological
 23 significance of Atrazine stream water concentrations
 24 using a statistically designed monitoring program.
 25 I think we have a very full schedule
 today. As I indicated at the end of yesterday's

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1 portion of this meeting today. And the panel, itself,
 2 may be involved in a writing session to write up their
 3 review comments tomorrow morning.
 4 But, we'll try to aim to finish the
 5 public meeting today, and just to, sort of, give
 6 everybody a sense of where I'd like to head, we'd like
 7 to use, at least, this morning to finish up the charge
 8 questions, in response to the presentations and the
 9 material that we've had provided to us on the study
 10 design for the monitoring study. And, then, to reserve
 11 the afternoon for the discussion of the final topic,
 12 including presentations and the two charge questions
 13 related to where do we go from here with all of this.
 14 In the interest of time, I think
 15 everyone's had a chance to introduce themselves twice,
 16 so I'll pass up on that. Again, I don't think we need
 17 to do that, and I'll turn, right away, to Dr. Doyle or
 18 Dr. Irene to, sort of, open things up for the EPA.
 19 DR. BRADY: This is Don Brady, and I
 20 thought it'd be appropriate in the interest of
 21 completing the one discussion where there was an open
 22 question to ask Dr. Erickson to define the question
 23 that he was going to provide an answer for later, and
 24 then, to do so, hopefully, quickly, so we don't disturb
 25 your agenda.

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1 DR. HEERINGA: Yeah, and pardon me for
 2 getting your last name wrong.
 3 DR. BRADY: That's okay.
 4 DR. HEERINGA: I switched from Doyle to
 5 Brady. I don't know why I did that. Must be some old
 6 friend.
 7 DR. BRADY: It's all the same to us.
 8 DR. ERICKSON: Okay, thank you. This is
 9 Russell Erickson. There was a question yesterday about
 10 positioning of the LOC to equalize false positives and
 11 false negatives, and why that was done. And that I
 12 wasn't prepared to answer yesterday. But, a question
 13 noted that LOC's are, typically, based on more
 14 sensitive species, when based directly on species
 15 sensitivity, and not the median sensitivity of the
 16 species, and why was the, basically, the median
 17 approach used with mesocosm microcosms. Should first
 18 note that, even with species, it's not, necessarily,
 19 the most sensitive. And, also, for any one particular
 20 species, it's not the most sensitive test, uh, it's not
 21 the most sensitive test for that species, but rather,
 22 the median value for that species is, generally, used.
 23 So, it's not, strictly, going to the
 24 sensitive end of it. And, so, the question is to
 25 whether to treat mesocosm microcosms like a sensitivity

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1 distribution for species, or as a more analogous to the
 2 spread of results within a species. And, especially,
 3 given the fact that mesocosm microcosms already contain
 4 a spread of species sensitivities. Another factor in
 5 this is that, another way to state this is, the overlap
 6 that I showed on the mesocosm microcosms scores, how
 7 much does that reflect a difference in sensitivity of
 8 different systems, that we think is relevant to the
 9 field; and how much might represent variation or even
 10 test error, that we don't necessarily want to
 11 completely go to the low end for this, uh, low end of
 12 sensitivity.
 13 And related to this, although, I would
 14 take some exceptions to Syngenta's analysis regarding
 15 the false positives and negatives, there, admittedly,
 16 should be some rate at which tests do produce false
 17 negatives statistically in any large collection of
 18 tests. And there should be some care in just, simply,
 19 identifying the most sensitive mesocosm. Another
 20 aspect of this is that the false positives and false
 21 negatives, also, include any modeling error.
 22 And it was noted yesterday that the
 23 model results do not sort out exactly with the mesocosm
 24 microcosm test, even within a category. For example,
 25 the most sensitive category rated three with the model



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1 is not corresponding to the lowest rated three
 2 concentration of the mesocosm microcosm. And for
 3 these reasons, there was a decision, not made by me,
 4 but a decision made earlier to take the approach of
 5 equalizing the false positives and false negatives,
 6 though that was the rationale behind it. Although, I
 7 would just, then, finally, add that, you know, this is
 8 a decision that, you know, could be revisited, and
 9 subject to, you know, feedback from the panel.
 10 DR. HEERINGA: Thank you very much, Dr.
 11 Erickson. Yes, Bob Gilliom.
 12 DR. GILLIOM: I know you're trying to
 13 move on, but I asked that question, and I just want to
 14 make an observation, maybe, for the moment, and then
 15 leave it for the time being, is that, one of the
 16 things, in sifting through all of this, which effects
 17 almost everything we've talked about, is the
 18 sensitivity of the whole final decision making process
 19 you do to the decisions starting with the Brock scores,
 20 and then proceeding to the LOC, which you just
 21 described.
 22 And then, how to relate the LOC, in
 23 terms of the Steinhardt deviation back to
 24 concentrations and all that. And part of the whole
 25 discussion's been about model error, model error or

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1 strike the median, even in that, based on the empirical
 2 data. And so, the, for, I mean, just to clarify that.
 3 This wasn't, strictly, the model trumping the results.
 4 It was a decision about the results themselves. Again,
 5 that could be argued, as far as the appropriateness.
 6 DR. HEERINGA: Okay, at this point, thank
 7 you very much for that additional clarification and the
 8 discussion. I think that's helpful. Dr. Effland.
 9 DR. EFFLAND: I wonder, will there be an
 10 opportunity to ask one or two clarifying questions
 11 before we go to the charge questions, or should we do
 12 that - -
 13 DR. HEERINGA: I'm about to go to the
 14 charge questions, so if you have a clarifying question,
 15 please ask it.
 16 DR. EFFLAND: Okay, I'd like to, I guess
 17 the question is addressed to Dr. Olsen. You showed a
 18 correlation plot between the HUC warp score and the
 19 sub-watershed warp score. And I'm curious how, it
 20 looks like a very strong positive correlation, but I'm
 21 curious how the calculation of the sub-watershed warp
 22 scores was conducted, I guess, is my first question?
 23 DR. OLSEN: The sub warp scores,
 24 actually, were calculated by Syngenta. They, actually,
 25 did delineate the sub-watershed, and went through the

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1 uncertainty or reliability in filling in the time
 2 domains, which was the main reason it was used to
 3 supplement the mesocosm results as a correlate.
 4 So, the one thing I would say that seems
 5 relevant to that whole decision thing is, whether it's
 6 revisited or not, at some point, where that LOC should
 7 be with the mesocosm scores and the Brock scores, is it
 8 seems like, the mesocosm results that are, actually,
 9 at the time domain, that you have of interest, in terms
 10 of moving averages, should, in effect, trump model
 11 results. You know, in other words, you have empirical
 12 data at exactly the time domain that you want, and you
 13 have a collection of studies, why would you, then,
 14 instead of using the empirical data from the lab
 15 studies, you know, go to the model and fill in. So,
 16 it's a big issue, maybe, but I want to raise it,
 17 because it's something that's come up in discussions
 18 from time to time.
 19 DR. HEERINGA: Sure.
 20 DR. ERICKSON: Just to clarify that, I
 21 would say that the arguments I presented, really,
 22 weren't, necessarily, just pertaining to the model. It
 23 was arguments pertaining, if, even if we went directly
 24 to the mesocosm microcosm in that overlap region, and
 25 so, the, this was a, sort of, a pre-model decision to

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1 same process, presumably, the same process they used
 2 with the HUC 10 to get the use rates down to the sub-
 3 watershed, and then apply the work model, the same way
 4 they did for the HUC 10. But, you know, if it, you
 5 know, they may, whether they'll need to clarify any
 6 more than that. It was done exactly the same process,
 7 though.
 8 DR. THURMAN: This is Nelson Thurman.
 9 Is, from what we looked at, in doing a preliminary look
 10 at it, it looks like, basically, you end up with the
 11 same use data because you can't get that, you know,
 12 because of scale refinement. But, what you saw
 13 variation differences in some of the other site factors
 14 that result in those differences.
 15 DR. EFFLAND: That helps, because the
 16 warp score is driven so much by the use component. I
 17 mean, those other, those other variables are a, fairly,
 18 small contribution to the overall prediction. And that
 19 helps that, basically, that was the, that's why that
 20 correlation is so strong. And I wonder, when you start
 21 zooming in to those scales, I think you're use data may
 22 be somewhat different from what it would be at HUC
 23 level.
 24 DR. THURMAN: Stay tuned this afternoon.
 25 I think this is the type of discussion that will come

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1 up again this afternoon.

2 DR. HEERINGA: And I think that, thank
3 you, Dr. Effland. Additional questions?

4 DR. EFFLAND: Just one more, and then
5 we'll move on. The, if I understand right, when you
6 calculate the use data, it was pounds of AI, or pounds
7 of Atrazine. I don't know if it was AI, or whatever,
8 but per area, and the area was the harvested acres.
9 Why wasn't it the, because, Atrazine is, typically,
10 applied at the beginning of the season, so I think it
11 would be the planted acres, rather than the, I guess, I
12 don't understand why harvested acres was the - -

13 DR. THURMAN: The explanation that Dr.
14 Harbourt gave to me is that, when you take a look at
15 the acreage, and started planted acres, because if you
16 have frost damage or something, you can end up
17 replanting the acres, so those would still, you know,
18 so you could end up with some acres being double
19 counted. But the harvested acres are, if, you know,
20 just the field. I mean, and to be honest with you, I
21 think, you may have, it may have had some subtle
22 changes, but I'm not sure how much of a difference you
23 would really see in most cases there.

24 DR. EFFLAND: Okay, 'cause that leads me
25 to question, again, that use number, because of the,

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1 question.

2 DR. HEERINGA: The reason he's sitting
3 there is he's from Ohio, you know.

4 DR. BRADY: I knew that would start a - -

5 DR. HEERINGA: Grind us out till you
6 smell it.

7 DR. BRADY: Charge question six, this is
8 Don Brady. The monitoring program used a tool, warp,
9 designed to assess the vulnerability of watersheds in
10 stream segments to, one, identify watersheds within the
11 corn sorghum growing region that are likely to be most
12 vulnerable to Atrazine exposure; and two, select
13 sampling sites within the watersheds that are likely to
14 be more susceptible to Atrazine runoff.

15 Please comment on the use of warp
16 predictions for hydrologic units, HUC's ten and
17 eleven, to restrict the survey design to those HUC's in
18 the upper 20th percentile. And then, one, to stratify
19 by warp predictions between 80th and the 95th
20 percentiles, and above the 95th percentile; and two, to
21 select HUC's with probability proportional to higher
22 Atrazine use rates. Comment on the use of survey
23 design population estimation approach for estimating
24 the number and percent of HUC's that may have LOC
25 exceedances.

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1 just because you're planting corn doesn't, necessarily,
2 mean you're going to apply Atrazine. You know, it
3 depends on conditions. Four dollar a bushel corn, you
4 know, you're going to use as many inputs as you need,
5 but if the price is low, maybe you'll, you know, I know
6 a few producers that don't, necessarily, put nitrogen
7 on every year, even though they know that nitrogen
8 boosts their yields, just to try to save money. So, I
9 just want to make that clarification.

10 DR. HEERINGA: Is that all, now, okay.
11 Let's, as a group, then, if there are other items that
12 require clarification as we go along, I think we've
13 covered a number of them, but certainly, they can be
14 brought out. But, let's proceed with charge question
15 number six, and I'll ask Dr. Brady to read that into
16 the record.

17 DR. BRADY: Thank you.

18 DR. HEERINGA: I should remember that. I
19 mean, we've got a distinguished graduate of the
20 University of Michigan who plays football with the same
21 last name.

22 DR. HEERINGA: I don't think we ever had
23 a quarterback named Doyle, and so, I don't know why.
24 That's fine - - Plus I'm sort of what?

25 DR. BRADY: Let's go to the charge

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1 DR. HEERINGA: Thank you very much. Our
2 lead discussant is Dr. LaPoint, and will supplement his
3 discussion, the associate discussant, with
4 contributions from some of the statisticians, too.
5 But, Dr. LaPoint, if you would be willing to take the
6 lead here.

7 DR. LAPOINT: Thank you very much. This
8 is Tom LaPoint. Yeah, I'll look for input from my
9 colleagues on this, because, in answering the question,
10 and doing a lot of work reading the background, and
11 listening to the discussions tomorrow, from the white
12 paper, several criteria were used to make the final
13 sub-watershed monitoring location decisions, and the
14 justification for the use of the criteria appear sound
15 to me.

16 These are all listed in the white paper,
17 but basically, the consideration of drainage areas to
18 be no more than half the HUC unit size, unless that was
19 50 square miles, and so forth, and so on. I won't
20 spend time here going through the criteria, because
21 everyone's read them, and they were in there. But, the
22 emphasis, almost independently of the size, the
23 emphasis on the more susceptible HUC's is appropriate
24 to me, and focusing on the ones that were in the 20th,
25 upper 20th percentile. And the reason for that is

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1 that, in a survey, no matter what size or, ultimately,
 2 the discussions about the nature of the size of the
 3 watersheds and the use thereof, but if the focus is on
 4 the ones that are expected to be a problem, and little
 5 or no problem shows up here, then the rest of the sites
 6 will, very likely be of a smaller magnitude of problem,
 7 and very likely be okay.
 8 As to the further stratification above
 9 the 95th percentile, what I can say to this that,
 10 hopefully, has some value, stratification's always
 11 good, especially in a first survey. Because, what it
 12 does is, it provides information on the upper bounds of
 13 Atrazine concentrations, the expected hot spots and
 14 consistent problem areas, perhaps. For future
 15 monitoring plans, however, the plan to link warp to the
 16 newer GIS-based stream segments may lessen the need to
 17 stratify the uppermost.
 18 That is to say, the above 95 percent of
 19 situations where high Atrazine concentrations exist.
 20 The reason I say that is, it would be better, and my
 21 presumption here, and we talked a little about this
 22 yesterday in the discussions, is, depending upon the
 23 resources available, and the, also, how far and how
 24 long the monitoring program goes on, the selection of
 25 further sites, if, and as, needed, could be taken off

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1 the upper portions of the cumulative distribution of
 2 sites ranked by the CASM scores in the slide we saw
 3 yesterday presented by Dr. Olsen, because I don't
 4 think, at this point, given the information that's
 5 already existing, about the distributions of Atrazine
 6 in some of these, and the nature of those more at-risk
 7 or mor vulnerable watersheds due to Atrazine exposure,
 8 I don't think the focus has to be on the, necessarily,
 9 the upper 5 percent of that, or the 95th percent and
 10 beyond.
 11 So, that would be my response to the
 12 first part of that. And, in terms of representation,
 13 how representative these was, I was very impressed by
 14 the similarities presented in the Sielken and Valdez-
 15 Flores report, which is part of the readings that we
 16 have, or we've had to go through in matching the
 17 distribution of the twenty sample warp scores from the
 18 80th to the 95th percentile of the 5800 sites closely
 19 matching the population distribution of the warp scores
 20 from the 80, 95th of the, in the 95th percentile.
 21 They, pretty much, closely match that population
 22 distribution of warp scores, and that, to me, on that
 23 reading, again, given my lack of absolute background in
 24 this, seemed appropriate, seemed good, it seemed
 25 logical. Now, if another, in terms of the

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1 characterizing the, kind of the distribution of these
 2 sites, and to the sense of how vulnerable they are, and
 3 how often one might expect to see the Atrazine
 4 concentrations in here, perhaps, because they have a
 5 good set of additional data, the 34 characteristics
 6 that were mentioned in the Sielken Valdez report,
 7 seemed like a canonical correlation, or some
 8 independent assessment of the geochemical variables,
 9 and how they respond, how they influence each other
 10 that, say, how they correlate with each other is really
 11 the correct thing here, to correlate with the Atrazine
 12 concentrations, might be an independent way of
 13 analyzing some of these to see how those
 14 characteristics influence Atrazine runoff, not runoff,
 15 but concentrations.
 16 On part two, the survey design
 17 population estimates were estimating a number
 18 percentage of HUC's that have LOC exceedances. That
 19 seems to be a discussion in progress. And my best
 20 answer is that, what we've talked about yesterday, and
 21 what you had mentioned, Dr. Thurman, is that, you know,
 22 it seems here that to best describe how it, to better
 23 determine that, I like the exceedance distribution that
 24 Dr. Olsen presented yesterday. And to go any farther
 25 with that, to be able to do that, it seems like it's

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1 going to have to be an updated Atrazine with a GIS-
 2 based approach to be able to better identify stream
 3 catchment characteristics and land use. And that
 4 means, whether we like it or not, is more data.
 5 Otherwise, we're, the answer I came up
 6 with is the data now represent the best available, and
 7 would have to be used. But it does seem, from the
 8 discussions yesterday, that there's a lot more
 9 information coming down the line on this, in terms of
 10 better, not better use, but GIS mapping that can help
 11 explain some of that. So, it's kind of a weak answer.
 12 Like I said, I'm hoping that with some expertise from
 13 the others on the panel, we can fill this in, be more
 14 help to EPA, so that's my comments.
 15 DR. HEERINGA: Thank you, Dr. LaPoint.
 16 Our second in associate discussant is Bill Effland.
 17 DR. EFFLAND: Bill Effland here, and I
 18 would agree with what Dr. LaPoint has just discussed.
 19 And I would also say that, statistically, I'm probably
 20 more dangerous than, actually, helpful, but I do
 21 believe in talking with statisticians very early in the
 22 design of something, so I think you're, I think that's
 23 a good point. But I will make a couple of comments.
 24 One, I think that the availability, the
 25 current availability of what, I believe, is more

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1 accurate and precise GIS data is something that, and
2 Tom mentioned that, something that should be
3 considered, as far as looking at that data, in light of
4 what you had a few years ago. Because, you do want to
5 use the best available data.

6 And, again, there's still going to be
7 some questions about the compatibility of that. And I
8 just want to bring that up, because, I just want to
9 point out. I just handed out one page, this is an
10 article by Gotway and Young, in 2002, talking about
11 combining incompatible spatial data. And it's really
12 just a overview of various issues and problems related
13 to doing that. And, so, I bring this up as a point of
14 reference, that, I think, and working with Tony and
15 other folks, I think it's a valuable thing to consider,
16 as far as how to put some of those pieces of data
17 together. And this paper discusses some very explicit
18 examples of that. So, I think that's something to look
19 at.

20 The other point that I'd make is that,
21 the work model, in my opinion, in looking at the
22 equation, the regression equation is primarily driven
23 by that use data. And we've already had a little bit
24 of discussion about that, but I think that that use
25 data is, if you're going to use the work scores, the

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1 identification of some of the highly vulnerable areas
2 Atrazine exposures, including the Minnesota Erodibility
3 Index data from NRCS soil ratings, some flow up
4 accumulation models from the NLCD, and actual surface
5 water datasets for Atrazine. And all of these showed
6 that, seemed to support the predictions of warp that,
7 indeed, they were selecting the most vulnerable
8 watersheds. So, there is a high level of redundancy in
9 potential approaches.

10 The decision to stratify between the 80
11 and 95th and greater than 95th percentile warp scores
12 appears to me to be based on the best professional
13 judgement. But this is made in order to ensure that an
14 adequate number of highly, vulnerable sites were
15 selected for the model, given the amount of resources
16 that are being put into this study.

17 In regards to the survey design, again,
18 I'm not a statistician, but the documents presented
19 indicate that a survey design method across the two
20 vulnerability strata used appropriate weighting
21 procedures to ensure that the design was spatially
22 balanced and not unduly biased. The statistical
23 methods that have been used, have been peer reviewed,
24 and subject of a three peer review publication, and
25 has been in use by EPA and other entities for over five

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1 use data, having the most accurate use data that you
2 can is critical to being able to apply that model. And
3 so, I would, you know, caution that if, if you have
4 uncertainties, if there's a lot of uncertainty about
5 your use data, then your work scores, and, certainly,
6 related to your work scores is going to go up quite a
7 bit.

8 And then, I really can't comment on the
9 population estimation component of this question that
10 Dr. Olsen went over yesterday. I'd hope that some of
11 the statisticians on the panel could help with that,
12 'cause I, although, I work with the National Resources
13 Inventory, understanding how the statistics and all of
14 that works is still, I still have trouble grappling
15 with some of those things. So, I'll defer to my
16 colleagues for that.

17 DR. HEERINGA: Our next associate
18 discussant is Jim Fairchild.

19 DR. FAIRCHILD: Yes, this is Fairchild.
20 And, from the data provided, it looks like that the
21 warp model effectively reduced the, approximately,
22 6,000 HUC's down to the pool of, approximately, 1100
23 units, exhibiting the 80th percentile of warp scores.
24 And the document indicated to me that there were
25 parallel comparisons to other approaches for

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1 years, but not being a statistician, I really can't
2 comment further on the appropriateness of the survey
3 design method.

4 DR. HEERINGA: Thank you very much, and
5 our last associate discussant is Dr. Novak.

6 DR. NOVAK: This is Jeff Novak. Over the
7 past two days, you've probably heard from some of my
8 questions that I'm not a modeler. I ask basic
9 questions. I challenge people with their assumptions,
10 but, yeah, I, also, try to acquire knowledge, but I'm
11 also trying to understand their frame of reference, and
12 where they're coming from. Unfortunately, like my
13 other three colleagues here, I am not a statistician.
14 I do not have the knowledge base nor the wisdom to
15 impart Mr. Olsen with any earth-shattering or lightning
16 new components for his research. However, one of the
17 questions is very dear to my heart, because I have done
18 pesticide monitoring work. And I have made assumptions
19 about the studies before I start. And the one question
20 asks for, to select HUC's with probability proportional
21 to higher Atrazine use rates. Well, what I'd like to
22 do is, I'd like to impart some wisdom to the group here
23 by reading my opinion on the answer to that. It'll
24 take a few minutes, here, but Mr. Olsen, or Dr. Olsen,
25 I'm sorry, I can't give you any more wisdom for your

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1 design, but I hope to leave you with a little bit of a
 2 warning here.
 3 Selection of HUC's with probability
 4 proportional to higher Atrazine use rates is a simple
 5 first step to label HUC's that may have surface water
 6 Atrazine issues. This approach sounds appropriate on a
 7 large, national scale. This will allow the utility of
 8 other web-based data pools to be merged or overlaid
 9 onto watershed vulnerability maps. This is where I was
 10 saying that, I understand from your perspectives, that
 11 if you're working at your desk and working on a large,
 12 multi-state basis, you need information that would be
 13 available on the GIS data. Ground-truthing is very
 14 hard in this situation. However, on a watershed scale,
 15 selections simply based on Atrazine use per watershed
 16 area, agricultural land use area, or as we're learning
 17 today, it might even be on the harvestable acreage.
 18 And I, again, I still don't believe the USGS
 19 explanation for that, that was provided last night.
 20 But I think it would lead to spurious conclusions
 21 selecting watersheds based, simply, on Atrazine use.
 22 Now, let me tell you why I can make that
 23 conclusion. I was involved in a pesticide monitoring
 24 study on a coastal plain watershed that had an
 25 extensive history of agricultural production,

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1 analysis revealed that a minimal amount, four percent,
 2 had the parent pesticide. That's important. We did
 3 measure the degradates, but we knew they weren't
 4 important. It was the parent that we were concerned
 5 with. We, also, by comparing to the literature, found
 6 less than one percent of those parent detects had
 7 anything over the how. So, basically, the water was in
 8 pretty good shape.
 9 We concluded from this study that the
 10 surface waters did not contain massive amounts of
 11 pesticides. Farmer applicators were successfully using
 12 BMP to minimize offsite movement. So, ultimately, we
 13 were wrong in our assumption of expecting massive
 14 amount of pesticides, based upon making prior
 15 assumptions. So, again, not to belabor this point, but
 16 a person needs to be careful when they're selecting or
 17 pre-selection going into a study. The question that I
 18 would like to leave the EPA panel here to slug though
 19 is, can your initial assumptions about higher pesticide
 20 usage also, then, lead you to spurious conclusions.
 21 Thank you.
 22 DR. HEERINGA: Thank you very much, Dr.
 23 Novak. At this point, I'd like to open it up to other
 24 members of the panel, and I'd like to go to Dr. Young
 25 first and then Dr. Ellsworth.

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1 everything from making Mount Olive cucumbers to
 2 tomatoes to corn and soybeans. The area receives
 3 approximately 45 inches of rainfall per year. It's
 4 loaded with massive sandy soils that have low soil
 5 carbon contents and low herbicide Kd values. You may
 6 consider that these conditions are extremely conducive
 7 to offsite pesticide movement. So, you're going into
 8 the study with some pre-conceived notion that, boom,
 9 there's a lot of pesticide use, not only a lot of
 10 pesticide use, but a multi-varied pesticide use. And
 11 the soil conditions slope K value, I guess, as you work
 12 with, are telling you red flags, there may be runoff
 13 here.
 14 Okay, it was our objective to determine
 15 if pesticides were occurring in water sources, but also
 16 determine if the farmers were applying best management
 17 practices to minimize the movement into the streams.
 18 When the study commenced, we made a few assumptions,
 19 based upon this information. We ended up gathering
 20 thirteen grab sa-, or excuse me, fourteen stream
 21 locations. We monitored them for two years on a weekly
 22 basis. We ran over 2200 water samples, first screening
 23 with immuno-assay and extracted approximately 220
 24 positive detects.
 25 After two years of monitoring, GC

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1 DR. YOUNG: First of all, I'd like to
 2 congratulate EPA. I've been on several review and
 3 advisory panels for EPA, and, honestly, a few years
 4 ago, you'd never see a probabilistic sampling in water.
 5 So, the fact you tried to target toward the most
 6 vulnerable, and have probabilistic sampling, and all
 7 that gives you is terrific. Congratulations, guys.
 8 So, I think this is really a move forward, because
 9 there's some problems with that, or some, not problems,
 10 some challenges with it, but it's a move in the right
 11 direction. Now, I didn't really have this in my
 12 prepared remarks, but on this last deal, the weighting
 13 toward higher Atrazine use in the context of
 14 probabilistic sampling, if that's not the right thing
 15 to do, you still can get unbiased estimates of these
 16 proportions. It may not be as efficient as what you'd
 17 like, but you, it does it no harm no foul, as long as
 18 you're doing probabilistic sampling. That's one of the
 19 great, the great benefits. Now, Steve, if I'm wrong on
 20 that, you correct me. That's right, right? Okay.
 21 Okay, I'm just, I, you know, so, I mean - -
 22 DR. HEERINGA: I dare not.
 23 DR. YOUNG: That's one of the things, ha.
 24 Well, I mean, that's, yeah, I mean, and that, that's
 25 what you get when you use statistics properly. So, way

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1 to go guys, way to go in thinking about the design.
 2 So, that's, I, too, wonder whether you really should
 3 weight additionally, do the weighting by Atrazine use.
 4 Especially, after you've already done the strata, and
 5 whether you really are getting anything more, given all
 6 of the uncertainties associated with that. But, you
 7 know, given that you're doing the probabilistic
 8 sampling, you're kind of saving yourself, even if
 9 you've messed up in that regard, okay.
 10 So, that part, I feel pretty good about.
 11 The problem I see is, kind of, reflected in that second
 12 comment, or the challenge. It's not a problem as much
 13 as a challenge for estimating the number and percent of
 14 HUC's that may have LOC exceedances. That's not really
 15 what you're trying to estimate here. It's not what you
 16 did estimate. You're estimating the percent of HUC's
 17 in those strata that have at least one-, you know, that
 18 have some kind of LOC exceedance.
 19 So, it's not of all the HUC's, not of
 20 all the 9500, but of only this sub group. And so, to
 21 be able, when you're targeting your sampling, to be
 22 able to generalize to the proper population, and keep
 23 everybody clear on exactly what you're generalizing to,
 24 is really important. And it, and I mentioned that
 25 yesterday when we looked at that distribution function.

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1 In fact, I'm not sure that that distribution function,
 2 if you put out for common consumption, is going to be
 3 interpreted correctly.
 4 And, so, I think, some creative
 5 approaches to developing the statistics that will
 6 accurately display the picture that you've developed,
 7 because the percent say 9 percent, but it's 9 percent
 8 of the 11,000; not of the-, 1100, not of the whole
 9 group. And so, it's a lot better picture than the 9
 10 percent would show. And so, how to do that in the
 11 correct way is really important. So, I just, I,
 12 overall, I'm very happy. It is a complex sampling
 13 design. Fortunately, I, it's not my first time I've
 14 seen it, so I've had some time to kind of catch up, and
 15 you know, I know, kind of, how it works. It's
 16 innovative, and yet, it still brings us, it allows for
 17 that geographical spread, and at the same time, gives
 18 us a probabilistic base upon which we can generalize to
 19 the population. And so, I feel really good about it.
 20 And I commend you for using it. Thank you.
 21 DR. HEERINGA: Thank you, Dr. Young. Dr.
 22 Ellsworth.
 23 DR. ELLSWORTH: Yeah, just, Dr.
 24 Ellsworth, Tim Ellsworth, Doctor, whatever. The point
 25 is, not used to saying that. I have a couple comments

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1 on this that I wanted to make, too. First of all, it
 2 seems like there's an issue that keeps coming up from
 3 Bill and others here, the idea of scale. And the total
 4 area, it seems like, that you would classify as
 5 potentially, or stream length that you would classify
 6 as exceeding an LOC.
 7 That total area would increase as you
 8 got finer spatial resolution. Now, if you called whole
 9 United S-, or the Mississippi Basin one watershed, one,
 10 and looked at a HUC that scale, you'd say everything's
 11 fine. As you get finer and finer resolution, you're
 12 going to classify more and more area as, perhaps,
 13 exceeding an LOC. And the other thing, so, for step
 14 one, I would, the first part of the question up here, I
 15 would agree with you.
 16 I like what you did. I think you did
 17 the best you could. You had warp. You used that to
 18 help identify the most vulnerable, everyone else has
 19 said that. The second part, I think, is very
 20 problematic to me. And I think that was pointed out by
 21 Tony yesterday. There's not a good correlation between
 22 SSI and the warp value. You're restricted to this very
 23 small set range of factors. So, if you wanted to try
 24 to develop a regression relationship between physical
 25 factors and SSI, because of the study design, you're

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1 really limited in doing that. And, uh, so, you know,
 2 the best way now, with the new data, would be to try to
 3 use the smallest spatial scale where we have good
 4 resolution, and develop regression between your index
 5 to go on, anyway, that's all I have. That's all.
 6 DR. HEERINGA: Dr. Randolph.
 7 DR. RANDOLPH: Yes. I'd like to follow
 8 up on that. I continue to be very concerned about the
 9 land cover land use data. As I understand it, the data
 10 that were used were from the 1992 LULC database.
 11 Those, that database was developed from imagery from
 12 the mid- to late 1980's, which means the information is
 13 now twenty to twenty-five years old. I realize that
 14 in, say, central Illinois, in high productivity
 15 agricultural areas, that once a cornfield, it's,
 16 probably, always a cornfield, or at least, in tillage.
 17 However, other parts, other watersheds in the Midwest,
 18 and I'm from Indiana, so I'm familiar with southern
 19 Indiana, southern Illinois, parts of southern Ohio. In
 20 those less productive areas, land use change is very
 21 common.
 22 We get agricultural abandonment. We get
 23 shifts between tillage and non-tillage or low tillage.
 24 We get shifts between tillage and pasture. And, of
 25 course, in all agricultural areas, we know that

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1 there's, generally, a trend in land use change from
 2 agriculture to residential suburban and other kinds of,
 3 including some commercial uses.
 4 So, my question is, given the level of
 5 detail and the attention that's been given to other
 6 parts of this study, why use twenty-five year old land
 7 use data. I mean, it just doesn't make any sense. The
 8 follow up question is, given that you've got forty
 9 watersheds, it strikes me as entirely feasible to
 10 secure the land site TM or ATM data from 19-, uh, 2004,
 11 2005 actually do supervised classifications for each of
 12 the watersheds, develop your own accurate up-to-date
 13 land cover maps, and use that information in warp, in
 14 the analysis, in looking at the actual sample sites
 15 within the watershed. There's a lot better way to do
 16 this.
 17 DR. HEERINGA: Dr. Randolph, in that
 18 latter, for the forty sites, you're suggesting,
 19 possibly, updating that information, repeating the warp
 20 analysis, and looking at how that would correspond to
 21 the original sites?
 22 DR. RANDOLPH: I'm a little reluctant to
 23 suggest that - -
 24 DR. HEERINGA: Okay.
 25 DR. RANDOLPH: Because that's a huge

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1 area is sampling. And, you can make some
 2 misclassifications. You can do, and you do lose some
 3 efficiency, but you still can get out those estimates
 4 of those proportions. Now, but then, the question
 5 comes up, the naturally, is, well, there are some
 6 exceedances, so what are the characteristics, and how
 7 do those relate. And then you begin the modeling
 8 phase. And, and this wasn't, really, designed for a
 9 modeling phase, which is, what I brought up at the end
 10 of the day yesterday.
 11 The question's now changing. And when
 12 the question changes, this question of changes support
 13 or scale become important. The how to do regressions
 14 properly becomes important. Whether we have the right
 15 land use cover becomes important. But that's, kind of,
 16 to, in my view, the next step. And, so, it's a, it's,
 17 kind of, trying to answer the next question, as opposed
 18 to the purp-, does that seem, and that's all I'm try-
 19 I would encourage our panel to, kind of, keep straight
 20 is, is whether we're just doing a samp-, uh, a design
 21 phased estimate of proportion of wha-, something, that
 22 something needs to be clearly defined. Or, are we
 23 trying to model relationships for which these data are,
 24 really, not set up to do, and they're, are all of these
 25 issues do have to be answered before we can go to that

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1 amount of work. And, I'm just saying, maybe a way to
 2 do it would be, pick a water-, Indiana eleven comes to
 3 mind. Pick a watershed where there's some question.
 4 Perhaps, go back and do a supervised classification.
 5 Compare that current land use information with the '92
 6 database. I think there's a way to, perhaps, examine
 7 the validity of the data, or in some cases, if it's
 8 really me-, if it's really off, at least to know that.
 9 And that would give you, I think, an indication of just
 10 how serious, or, perhaps, not serious as a site. Parts
 11 of the Midwest, I don't think land use changes all that
 12 rapidly. But I know, for a fact, that in parts it
 13 does.
 14 DR. HEERINGA: Dr. Young and then Dr.
 15 Portier.
 16 DR. YOUNG: I think that there are two
 17 different things going on here. And I think it's
 18 important to keep them separate. One is, the sampling
 19 design that allows you to estimate the proportion of
 20 watersheds that have, at, some occurrence of an LOC
 21 exceedance. And that's what this was done. And then,
 22 the natural ques-, follow up, and you can do
 23 everything like this.
 24 And I visited with Steve at lunch the
 25 other day, just to kind of go over this, because his

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1 next step.
 2 DR. HEERINGA: Thank you, Dr. Young. Dr.
 3 Portier, then Dr. Randolph.
 4 DR. PORTIER: Actually, Dr. Young just
 5 said everything I was going to say. So, I'll just
 6 leave my notes here, and - -
 7 DR. HEERINGA: Dr. Randolph, please.
 8 DR. RANDOLPH: Let me just respond, I
 9 completely agree. I think there's, sort of, the na-
 10 as you say, there's the natural progression, and
 11 perhaps, in discussing question six, I think several of
 12 us have then moved, at least in our minds, to question
 13 seven. So, I, also, agree with the comment that maybe
 14 it's a step ahead.
 15 DR. HEERINGA: As we approach the end of
 16 this, you know, there will be some convergence of some
 17 questions here. And I think some of these issues are
 18 coming forward. That's fine, because we can have that
 19 as background as we move on to ten and eleven. Just a,
 20 Steve Heeringa, here. I'll ask just a few questions.
 21 Dr. Young is absolutely right in her
 22 assessment. One of the things that, as I read through
 23 all of this material, in trying to, this statistic, the
 24 proportion of watersheds, however we define them,
 25 stream segments, sub HUC's, HUC's that exceed the
 LOC.

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1 That's really, sort of, a one-time statistic. And then
 2 we move on to, sort of, looking at, you know, how do we
 3 identify. So, it sort of sets a threshold. So, in the
 4 end, that's really not the primary target of this
 5 program. Ultimately, you know, it's an intermediate
 6 statistic. We'd look at it. I mean, clearly, if it
 7 were 50 percent, it would raise a different concern
 8 than, you know, an issue of 11 percent or 9 percent.
 9 Again, as Dr. Young, 11 percent of, maybe, 20 percent.
 10 So, I think it's probably well within the realm that
 11 all of us would anticipate. And so, I think that it's
 12 valuable to focus on it, and Dr. Young's right. I
 13 mean, the design is good to provide, at least, an
 14 unbiased, or a nearly unbiased estimate of that. And
 15 Dr. Olsen has worked out with his methodology variance
 16 estimates, and we saw fairly large confidence
 17 intervals. The, I think the critical thing here, too,
 18 is to think about what is your population of inference.
 19 And, you know, just in the strictest terms. We really
 20 are sampling stream segments. So, the inference is to
 21 stream segments that would have been eligible here.
 22 And, again, we have to extrapolate, does a stream
 23 segment, is that sufficiently representative of the sub
 24 HUC or the HUC itself. I think those are issues we can
 25 deal with. But, we just have to be cognizant of that.

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1 Because, you know, we, sort of, talked about this as an
 2 estimate for HUC's, but it's really an estimate for
 3 bridges within stream segments. And, so, technically,
 4 and that's fine, and we have to realize that, and, but
 5 I think, as we think about it, we have to realize, is
 6 there anything about bridges within stream segments
 7 that wouldn't, necessarily, and we all, I think,
 8 particular the ecologists here, would rec-, you know,
 9 immediately, go, there are many factors, but this is
 10 the way we have to do it.
 11 So, with regard to additional comments
 12 on question number six, the, I think the stratification
 13 based on the warp, we had an initial problem, and you
 14 set out a fairly systematic and informative design. I
 15 mean, the design was scientifically informative, and
 16 that is, we didn't so over-skew this design that it
 17 would only answer one question or one set of
 18 assumptions. It provided a broad base of data,
 19 somewhat restricted. We only looked at the upper 20
 20 percentile of the warp scores. But, nevertheless, I
 21 think it's representative and systematically so. And,
 22 in a way that can inform the next step. And I think
 23 that's what's important here. I'm not sure, you know,
 24 in hindsight, whether I would have added the additional
 25 probability proportionate to size within the strata. I

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1 think Dr. Olsen, looking at this data, might have
 2 revisited that decision, too. But, initially, you
 3 know, you're thinking about a model in which the warp
 4 score is proportional to the impact. If you think that
 5 variance of the LOC is proportional to the SSI, then
 6 this would be an optimal design. It doesn't appear to
 7 quite hold that way, but it, as Dr. Young points out,
 8 it's not optimal, but it's appropriate, and leads to
 9 correct inferences when we incorporate standard error.
 10 So, I guess, that's comments that I have on that
 11 particular question. Do, any other comments? Can I
 12 turn to Dr. Olsen, Thurman, Corbin?
 13 DR. OLSEN: This is Tony Olsen. I, first
 14 off, I appreciate everybody's comments. In terms of
 15 the statistical part of it, I agree with what's been
 16 said. As always, you know, once you get done with the
 17 study, if you go back and you look at it, you might
 18 actually do it slightly differently. But you know
 19 more, so it's not a fair comparison. But, I really
 20 appreciate that. I think it was Linda that made the
 21 comment about the inferences, well, then, actually,
 22 Steve did it, too, making inference to the right po-,
 23 the correct population. And our inferences that we,
 24 explicitly, did were only to the 1172. And it is very
 25 clear, 'cause we've had this happen in other cases,

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1 that somebody will end up taking that, and they take it
 2 out of the context. And they're going to interpret
 3 that with respect to the United States. And so, you,
 4 that's something that's very clear, and it's extremely
 5 difficult to, actually, label the figure or an answer,
 6 and not have them do that. So, that's something that
 7 we do have to pay attention to.
 8 On, in terms of the statistics, I guess,
 9 I'd, sort of, I'll leave it there. The other, 'cause I
 10 think a lot of the other comments have to do with, sort
 11 of, the prediction problem, and we're going to come up
 12 with that later.
 13 One comment, I guess, about the National
 14 Land Cover Dataset, of, that this is, the National, the
 15 NLCD for 1992, since I was involved in that, or that
 16 data in, coming involved because of a program I've been
 17 involved with. The imagery, I think, is from '90, '92.
 18 It's not, it is from that time period. They didn't get
 19 the, they didn't get the entire classification done
 20 until late 1900's, or late, you know, like 1999. It
 21 took them a long time to do it. So, it is, it is that
 22 1992, but it still is ten to fifteen years out of date.
 23 So, but at the time, it was the only national one that
 24 was available.
 25 I guess one comment, when you talk, and



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1 this sort of goes down the other path. When we're
 2 talking about doing, sort of, a classification for
 3 individual sub-watersheds, is there any particular
 4 reason why one wouldn't want to look at aerial photos
 5 and, as an option?
 6 DR. HEERINGA: Dr. Randolph, if you could
 7 use your mike.
 8 DR. RANDOLPH: J. C. Randolph, sorry.
 9 Sure, you could. I just think TM imagery would be
 10 easier, and you have the advantage that you could
 11 develop three or four or more classes in a supervised
 12 classification, and then apply it. It's a more
 13 effective approach, I think.
 14 DR. OLSEN: Thank you.
 15 DR. HEERINGA: All set? Thanks.
 16 DR. PORTIER: What kind of imagery were
 17 you asking, he was talking about land set TM imagery,
 18 and you were talking about, I'm sorry, you were talking
 19 about what kind of imagery? I'm just getting my notes
 20 down, so.
 21 DR. OLSEN: Oh, just, as opposed to using
 22 imagery, using aerial photos.
 23 DR. HEERINGA: Thank you very much.
 24 Yeah, Bob Gilliom.
 25 DR. GILLIOM: Bob Gilliom. One, just one

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1 final comment. I agree totally on the background
 2 discussion that happened on statistics from Dr. Young
 3 and so forth. And just want to note that in refining
 4 the statement of what's being the outcome of the
 5 survey, that the scales are really a critical issue to
 6 keep people square on. We talk about HUC's, and I,
 7 every time we slip into the discussion, I, you know, I
 8 hear the HUC's, when it's really these small sub-
 9 watersheds that were sampled. And everything's got to
 10 be referenced back to what that tells us at that scale.
 11 'Cause every part of this, including the concentration
 12 duration curves are scale dependent.
 13 DR. HEERINGA: Dr. Grue.
 14 DR. GRUE: Just a quick comment on
 15 interpretation. The statement, and I realize why
 16 you're using it, but at least, the exceedance in at
 17 least one sub-watershed, that's just problematic. And
 18 I don't know the, what, how to address that, but if
 19 that were to be viewed by folks outside of this
 20 discussion, you could interpret it a couple of ways.
 21 And one interpretation would be that, in some
 22 situations, there were exceedances in more than one
 23 sub-watershed. And, I don't have the answer to that,
 24 but I think it's something that the Agency needs to
 25 think about.

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1 DR. HEERINGA: I think those are
 2 important points, in terms of public presentation and
 3 consumption of this data. Because I think the people
 4 sitting around this table, after two and a half days,
 5 have a little better understanding of what this is,
 6 but, you know, the two or three word, two or three
 7 sentence paragraph, that presents this in any other
 8 format, so be carefully considered to make sure the,
 9 survey population and the statements about inference
 10 are coincident.
 11 Okay, if there are no other comments on
 12 this, again, I think we'll have a chance to revisit
 13 some of these issues. But, Dr. Brady or maybe Mark or
 14 Nelson, if you would want to read this into the record,
 15 question number seven?
 16 DR. BRADY: This is Don Brady. I can
 17 read it in. Question number seven, once the vulnerable
 18 HUC 10 and 11 watersheds were selected for monitoring,
 19 specific monitoring sites were selected within each
 20 watershed, using criteria that were designed to
 21 maximize the potential for selecting the streams most
 22 vulnerable to Atrazine exposure. However, with only a
 23 single point monitored per watershed, estimates of
 24 within HUC variability for detections of Atrazine could
 25 not be calculated. The resulting population estimates

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1 reflect variability across watersheds, but not within
 2 the monitored watersheds. Please comment on this
 3 approach, and identify and discuss any alternative
 4 approaches to extend the results of the monitoring
 5 sites.
 6 DR. HEERINGA: Our lead discussant on
 7 this question is Jim Fairchild.
 8 DR. FAIRCHILD: Yes, Jim Fairchild.
 9 Well, the study team arrived at the decision to select
 10 a single sampling site within each HUC, based,
 11 primarily, on logistical and cost reasons. But a
 12 standard protocol was used to locate the actual sample
 13 site at the lowest end of the selected stream segment,
 14 even though, in some case, it was adjusted, based on
 15 the decision tree. In this case, this minimizes bias
 16 across sampling units, and assures that the location
 17 will include the resulting Atrazine inputs from all
 18 possible locations from tributaries located upstream
 19 from the sampling point. This is prudent, since it
 20 samples the largest drainage area possible, and
 21 minimizes the uncertainty associated with sudden
 22 changes in cropping patterns or crop rotations. This
 23 ensures that the main objective, which was to identify
 24 the watersheds that are most vulnerable, is
 25 accomplished. But it is a given, as stated in the



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1 question, that you have data from only one location.
 2 However, the data that you do have can be implied in
 3 many ways. Because, you already have data regarding
 4 the exposure duration pattern, in addition to discharge
 5 data and other factors within the warp model.
 6 And to follow up on some of the previous
 7 discussion, the first thing that could be done as to
 8 further ground truth actually cropping patterns from
 9 aerial photography or satellite imaging that might be
 10 available. This would allow you to fine tune that
 11 dataset, in terms of actual exposure potential. And
 12 the quality of the digital elevation sets and remote
 13 sensing data is constantly improving. Therefore, post
 14 HUC modeling can be used by examining Atrazine
 15 concentrations from the watershed in a hydro-geomorphic
 16 context, in consideration of the slope, or the soil
 17 type, slope, timing, intensity of the rainfall could
 18 be used to model concentrations in the root zone, as
 19 well as the edge of field, has already been done in
 20 some of the presentations showing the combination of
 21 the basic warp stream concentration combined with some
 22 PRZM exercises. In examining the relationships between
 23 peak flow events and Atrazine concentrations, in
 24 relation to these other post HUC data, may allow
 25 exploratory data mining to place each HUC into a

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1 from the observations you have at individual sub-
 2 watersheds. And use these observations to form
 3 hypotheses, leading to future collaborative studies on
 4 Atrazine, in addition to other substances of concern,
 5 such as nitrate. And I think that the high quality of
 6 the data that you have, and the level of interest, is
 7 going to create these collaborative opportunities to
 8 work with other entities, and try to cluster these
 9 specific watersheds into similar sites, and use those
 10 to make inferences based on other outstanding data.
 11 DR. HEERINGA: Thank you very much, Jim.
 12 Our first associate discussant is Tim Ellsworth, Dr.
 13 Olsen.
 14 DR. ELLSWORTH: Tim Ellsworth. Okay,
 15 the, I agree along the same lines with what Jim's
 16 saying here, the idea of getting better data, the corn
 17 acreage. I know from the satellite, you can identify
 18 that. And it seems to me like, perhaps, within local
 19 regions, crop protection regions, you might, actually,
 20 come up with a better estimate of what's the average
 21 Atrazine application on that land. Anyway, that seems
 22 doable to me. The 86 site years that you have, and
 23 then there's 10 more coming, I guess, it looks like
 24 this year, so you've got about 96 site years site years
 25 of data and all the associated environmental factors,

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1 classification that can be examined using cluster
 2 analysis or principal components analysis techniques
 3 previously discussed. And, to some degree, this is a
 4 similar approach taking to place the Missouri sites
 5 into their own separate class. Once similar land
 6 classes are clustered or differentiated, then they
 7 could be compared to long-term study sites, such as the
 8 Heidelberg datasets, or any of the numerous loca-
 9 datasets located at, for example, as USDA ARS stations
 10 located across the Midwest. For example, one of the
 11 sites in this study, the Young's Creek lies within the
 12 good water creek ARS watershed, where Dr. Lerch is
 13 doing some of his research. Many of the sites will lie
 14 near NAWQA sites, for example, the Wolf Creek, Iowa
 15 site lies within the East Iowa NAWQA basin. And I do
 16 know that they have study-specific studies specifically
 17 targeted in these different watersheds and data
 18 available. USGS gauging stations may also present
 19 opportunities, giving access to long-term data
 20 regarding rainfall stage and discharge relationships.
 21 So, in each of these instances, there is a wealth of
 22 data that have been collected that you could examine
 23 and compare to the site's specific data, where you only
 24 have one point in a specific sub-watershed. But,
 25 ultimately, you can use this to generate hypothesis

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1 like use rates, flow accumulation on corn acres, the
 2 Sirsco dataset that you're using now, with the
 3 increased estimate of, you know, restricted layers,
 4 conductivity, you've got a wealth of information that,
 5 kind of, at this, to come in now, with this SSI index
 6 that you're using to develop a regression for that.
 7 And I'm trying to take it to where you would go next.
 8 That could be used to develop this relationship between
 9 these variables in an SSI index similar to what was
 10 done with warp, and perhaps, let you move on to another
 11 level. But I think it's real important what Bob was
 12 just saying earlier, is that, it's really, at this
 13 scale, now, because of the design. It's no longer the
 14 HUC 10, 11. You're really constricted, now, to be
 15 working more at this spatial scale because of the
 16 design.
 17 DR. HEERINGA: Our next discussant is Dr.
 18 Gay, Paige?
 19 DR. GAY: Paige Gay, University of
 20 Georgia. I think, pretty much, all of my comments have
 21 been discussed during question six and seven. The use
 22 of the improved NHC plus data seems very appropriate to
 23 me, and along with that, perhaps, tweaking the criteria
 24 used to get the smaller selection definitely needs to
 25 be done. I, also, agree about PRZM estimates,

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1 estimating field of edge loadings could be quite
 2 beneficial in conjunction with this, if they could be
 3 tied together in some method. And that's about all I
 4 have different.
 5 DR. HEERINGA: Thank you very much, Dr.
 6 Gay. And finally, associate discussant is Dr. LaPoint.
 7 DR. HEERINGA: All right, thank you.
 8 Very simply, I concur with everything. It's a matter
 9 of scaled assessment. For regional, or among watershed
 10 risk assessment, it would be best to have some inter-
 11 watershed estimates, no question. But, given the
 12 reality of limited resources and the way this study was
 13 designed, I think the approach described more
 14 watersheds as valid and quite appropriate. It may be,
 15 as we've already said here, or heard here, I should
 16 say, that more within HUC variance could be accounted
 17 for by continued GIS models, linking them to either
 18 Atrazine or some of the stream characteristics.
 19 Thanks.
 20 DR. HEERINGA: Additional comments, Dr.
 21 Young.
 22 DR. YOUNG: Again, I think it all goes to
 23 the goal of sampling. If your goal is to estimate the
 24 proportion of watershed that has some, some occurrence
 25 of exceedance somewhere in that watershed, however, you

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1 want, however that needs to be said, then you have, you
 2 get your smallest standard airs, you get your most
 3 precision by looking at as many watersheds, and not
 4 sampling within, doing replicate samples within a
 5 watershed. Now, so, again, I think it's a matter of
 6 the question beginning to change a little bit, for the
 7 original purpose of estimating the proportion of
 8 watersheds, then, this was the correct approach to use.
 9 And you would not want to do it now. As the question
 10 changes, that may lead to a different design.
 11 DR. HEERINGA: Dr. Lerch.
 12 DR. LERCH: Bob Lerch. I just want to
 13 reiterate what Jim Fairchild was saying about, you
 14 know, ARS does have, at least in some of these
 15 watersheds, some data we would be happy to share. I
 16 don't want to preempt, but I will give a little bit of
 17 a preview of what that looks like in my response in
 18 question ten. But something that's related to this,
 19 for me, at least, is the ability to draw statistical
 20 inferences from sub-watershed to the bigger HUC 10.
 21 And it would seem to me that, given the statistical
 22 design that exists, you should be able to draw that
 23 inference. And I will, also, address that in my
 24 example, and show that I do believe you can use the
 25 segments that exceeded the LOC to infer something about

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1 the whole HUC 10.
 2 DR. HEERINGA: Thank you, Dr. Lerch.
 3 Steve he-, oh. Dr. Randolph.
 4 DR. RANDOLPH: This, I think your
 5 comments about the within watershed analysis are
 6 appropriate. I have a question, and I've just been
 7 thinking about this, and would, simply, like to ask a
 8 question, and hear from others. If there's an Atrazine
 9 application and a given rate, let's say two kilometers
 10 away from the sampling point, and you contrast that
 11 with the same Atrazine application a hundred meters
 12 away from the sampling point, same weather conditions,
 13 same cropping practices, same soils, all I'm saying is,
 14 let's extend the distance. How much influence does
 15 that have on the chemograph?
 16 DR. HEERINGA: It's a problem, I think
 17 that's a question a lot of us would like to have the
 18 answer to.
 19 DR. FAIRCHILD: Jim Fairchild. I think
 20 in that particular example, it's going to be dependent
 21 upon the hydrologic factors associated with that
 22 particular sub-watershed. And that, you know, if one
 23 has good flow discharge data, and, you know, reasonable
 24 estimates of the topography of that area, that you
 25 probably could, pretty, effectively, model the effect

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1 of distance and, as I said previously, I think that ARS
 2 probably has some of that data across their ARS
 3 laboratories, which are, basically, located probably in
 4 every state that's been sampled as part of this larger
 5 eleven state effort.
 6 DR. HEERINGA: Dr. Grue.
 7 DR. GRUE: Just to make a comment that,
 8 that, actually, was the basis, this discussion is,
 9 actually, the basis for my questions related to the
 10 position of sampling site within the system. And to
 11 what extent was EPA and Syngenta using position as an
 12 integrator for what might be occurring throughout the
 13 watershed that was being sampled. And it gets at the
 14 questions that were just based. If, in fact, the
 15 sampling sites were at the low end, and that's why I
 16 was asking, you know, maybe a plot of the distribution
 17 of position relative to selected stream length or
 18 length of the system within the HUC, that might provide
 19 us some basis as to, at least, making the assumption
 20 that, if it's, in fact, low in the system, then maybe
 21 that's an integration. It doesn't, necessarily,
 22 address the issue of what those peaks might be at
 23 individual sites along the system, but at least, using
 24 the low end of the system and integrator.
 25 DR. HEERINGA: Steve Heeringa. I'd like



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1 to reinforce Dr. Young's comments, and those of others,
 2 too. I think, in this situation. You have resources to
 3 choose forty sampling sites, and your objective was to
 4 obtain the chemograph for an extended sampling period.
 5 Clearly, if we could expand sample sizes infinitely,
 6 you know, interesting questions like within HUC
 7 variability could be addressed. But, the purpose there
 8 would be to, simply, measure components of variance,
 9 sort of, between HUC or between segment within HUC.
 10 And those are interesting scientific questions, but for
 11 your objective at hand, at this point, that's
 12 secondary. And I think, we, also, have to be careful,
 13 too. People often recommend replication, but we need
 14 power to really, components of variance are very
 15 tricky, and require large, large sample sizes to
 16 measure accurately. So, simply, going through the
 17 mechanics of a design that tries to do that, and spends
 18 enormous resources on that replication, simply to get
 19 at that inter-HUC variability, it might be better, as
 20 many of the scientists have suggested is to, to use
 21 these direct measures in a very efficient forty sample
 22 size. I'm thinking about location, and that decision
 23 was right, to come back at the intra-HUC variability
 24 using modeling approaches that are, essentially,
 25 established through relationships that have, can now be

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1 fitted with these data, so. Turn to, Tony, Nelson, or
 2 Mark, is this clear, with regard to this particular,
 3 it's a pretty direct question, and I think that's some
 4 good and extended response on the one, give to them.
 5 Okay, Dr. Brady, if you would be willing to read
 6 question eight into the record, please.
 7 DR. BRADY: Certainly, Don Brady,
 8 question eight. Three monitoring sites in Nebraska
 9 experienced low or no flow conditions that precluded
 10 sampling. While Hampton, et al, suggest that these
 11 sites with intermittent or low flow are already
 12 stressed by other factors, Meyer, et al, indicate that
 13 such aquatic communities are rich in diversity. The
 14 Agency has generated statistics for these three sites
 15 as a separate stratum. However, the meaning of these
 16 separate population estimates is uncertain. Please
 17 comment on whether the Agency should consider the low
 18 flow sites, and or intermittent streams, as part of the
 19 population estimates, or treat them separately. Please
 20 comment on whether the aquatic systems and exposure
 21 conditions of the existing microcosm and mesocosm
 22 studies adequately represent these low flow and or
 23 intermittent stream communities. If not, how would EPA
 24 determine an LOC for low flow conditions?
 25 DR. HEERINGA: Our first discussant, lead

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1 discussant is Dr. Gay, Paige.
 2 DR. GAY: Thank you, Paige Gay,
 3 University of Georgia. I would, first, like to
 4 acknowledge the effort it took to undergo this rigorous
 5 monitoring schedule, and commend EPA, Syngenta, and
 6 the
 7 contractors. The effort and cooperation needed to do
 8 this, and just the diligence of everyone to do this on
 9 a four-day regime is just, really, incredible. In my
 10 view, from being a field technician and laboratory
 11 analyst for a long time, it's just a really big
 12 undertaking, and they really did a very good job. In
 13 terms of the low flow and intermittent streams, in my
 14 world, in South Georgia, this is a common occurrence.
 15 I, certainly, think that the data represents an
 16 important part of this study. The interpolation of
 17 concentrations across the gaps for samples were not
 18 available, certainly, can produce grossly exaggerated
 19 values, particularly, when you have these very high
 20 peaks of concentration occurring, preceding a gap in
 21 the data. In addition, I would suspect, and based on
 22 studies of the intermittent streams that we've done,
 23 even in a four-day sampling regime, I'm not sure that
 24 you wouldn't miss some intermittent flow events that
 25 might curve due to rain driven effects. And that was a
 26 concern of mine as well. The flow measurements, I

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1 know, we got an additional piece of information
 2 regarding this this morning were a concern of mine.
 3 Because the auto sampler data, everything is so
 4 dependent on that, and it would have seemed to me that
 5 taking a flow measurement when the sites were visited,
 6 perhaps, using some kind of probe to give an initial
 7 idea of what the flow is anyway if you weren't able to
 8 capture that using your estimated regime here. And why
 9 these sites were not ranked among the lowest flow, and
 10 yet, had these gaps in data, is really not clear to me
 11 if it's the erroneous estimates of the flow, or if it's
 12 due to the Lamott sampler not being able to, actually,
 13 acquire a sample. And my thought was that, if you say,
 14 I believe, it was the Nebraska 5 site, if you had an
 15 ISCO sampler out there anyway, and typically, ours are
 16 in the streambeds, and you know, the nominal distance
 17 from the actual streambed itself, that if you have some
 18 flow, you should be able to capture some kind of
 19 composite sample. However, it seems that the automated
 20 samplers here were strictly used to collect rain-driven
 21 events, and could've been used on a more scheduled
 22 sampling regime in these low flow areas to try to
 23 capture some of this flow that, evidently, was lost,
 24 but seems to be there. We often do weekly composite
 25 samples and refrigerated ISCO's, and often capture some

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1 of that flow. The aquatic systems and exposure
 2 conditions of the existing microcosm and mesocosm
 3 studies would, seem to me, not to, adequately,
 4 represent these stream flow conditions. As we've
 5 discussed many times, and Syngenta has stressed, that
 6 these ecosystems are likely stressed already at the
 7 time of exposure. So, the reaction to recovery from
 8 exposure to the Atrazine concentration certainly would
 9 be altered, if the organisms were stressed or the fauna
 10 flora. And in the microcosm mesocosm studies in the
 11 handout, I'm not sure that I was able to discern
 12 anything that really addressed stressed systems. And
 13 to me, it would seem that the LOC wouldn't really apply
 14 here, because it would be probable, in my mind, that
 15 lower level of concern should be applied because they
 16 are already stressed. So, lower concentrations in
 17 durations would cause similar effects to the LOC of
 18 four. The flow measurements, again, I haven't had time
 19 to look at this. If you guys want to comment on that
 20 and the accuracy, I would appreciate anything that you
 21 might add to that. I found that that was a huge
 22 gap in looking at these in trying to suggest a method
 23 for determining LOC when you have to have a 365 day
 24 interpolated dataset. I just don't see that that's
 25 feasible, based on, especially, the huge gaps in, I

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1 came to mind yesterday evening, and one was, to look at
 2 aerial photography and see what the kinds of practices
 3 are, or the kinds of production and crop management
 4 practices in that area, and see if there's water
 5 storage. I think Dr. Heeringa mentioned yesterday,
 6 maybe there's some water storage going on, or possibly,
 7 maybe irrigation. I don't know what the, it just seems
 8 counter-intuitive that you've got, you have flow in the
 9 hydrograph, but then it dries up. And so, I think, one
 10 other comment I'll make that, actually, I asked Dr.
 11 Harbourt about earlier is, I think it's really hard for
 12 you all to be able to interpret some of this
 13 information without ever visiting some of these sites.
 14 I'm not saying that you visit all forty of the sites,
 15 but, especially, the ones where you have questions
 16 about, my experience is, if you don't go to the field,
 17 and take a look at what's going on, and maybe do some,
 18 you know, on the ground truthing, some truly on the
 19 ground truthing, sometimes you miss some simple things
 20 that you wouldn't have. So, I guess, that would be one
 21 of my recommendations, is to consider it. In some of
 22 these areas where you have some questions, and it could
 23 even be something as modern, technologically as a
 24 virtual tour. There are ways to, you know, there are
 25 ways to do that if you want. But, at least, something

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1 believe that was any five that really had the big gaps.
 2 You might be able to find a better method for
 3 interpolation for the other ones that had smaller gaps,
 4 but to me, I would like to see further sampling,
 5 perhaps, finding a way to better capture low flow,
 6 using the auto sampler, which can get closer to the
 7 streambed or some other method. In trying to look at
 8 the data before trying to address the LOC question, I
 9 just don't think they had, the true concentration
 10 duration profiles have been identified here.
 11 DR. HEERINGA: Thank you, Dr. Gay. Our
 12 second associate discussant is Bill Effland.
 13 DR. EFFLAND: Bill Effland here, and I
 14 guess I'm, it's surprising to me in looking at the flow
 15 data that was provided in the slides that some of these
 16 sites that dried up, actually, have continuous, some
 17 pretty high flow rates. And I think, Bob Lerch
 18 mentioned that yesterday, that it's, it seems
 19 counterintuitive that there seems to be quite a lot of
 20 flow yet, they still dried up, or the one that did dry
 21 up in, and I have a hard time reading it. The one in
 22 Nebraska, I think it was either, I think it's 04, that
 23 dried up early in the season. I guess, one of my
 24 initial reactions was, what else is going on in this
 25 area, in this sub-watershed. And, a couple of thoughts

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1 so you get a better idea of what's going on in that
 2 particular sub-watershed. Because, looking at these
 3 things through reports, and even looking at photographs
 4 and things of the sites, you don't always get the, you
 5 don't have the same interpretation. So, I just make
 6 that one comment. And I always like to encourage my
 7 soil science colleagues to get out into the field
 8 again, 'cause it helps to bring them back to our roots.
 9 So, I make those comments.
 10 DR. EFFLAND: I make those comments, and
 11 then, as far as the question about whether the existing
 12 microcosm mesocosm studies adequately represent a low
 13 flow, I just wrote, no. I don't think they do. And,
 14 this was last night while I was sitting at the dinner
 15 table at 9:30, so, you have to take it partly, is
 16 because of that time of the day. And, I guess, I also,
 17 in looking at, I'm also a fisherman, and by hobby, and
 18 looking at conditions where there is low flow or no
 19 flow, those systems are stressed.
 20 I mean, they're under some stresses related,
 21 you know, the organisms under stress is related to
 22 things besides maybe inputs of contaminants. So, I
 23 guess, I'm somewhat questioning the reality of why you
 24 would treat a low-flow, a no-flow site exactly like you
 25 would ones that have, at least, some minimal flow. And



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1 so, I just, it seems, if you would try to explain that,
 2 it just, it seems hard for me to grasp it, so, just,
 3 those are my comments.
 4 DR. HEERINGA: Dr. Ellsworth, I wonder, I
 5 want to get through the associate discussants, and
 6 then - -
 7 (WHEREUPON, the speaker was speaking without a
 8 microphone.)
 9 DR. HEERINGA: Oh, okay, if you could
 10 hold it, we'll come back to that, that would be great.
 11 Our next associate discussant is Dr. Lerch, Bob Lerch.
 12 DR. LERCH: Bob Lerch. I'll just answer
 13 each of these in order, although, I do have a slightly
 14 different take on the relevance of the microcosm
 15 mesocosm studies. I think the answer to the first one
 16 is, they should be included in the larger population
 17 set if the typical planning window was included, in
 18 terms of flow regime and in some samples collected.
 19 And, I think, in some of the examples yesterday, for,
 20 at least, two of three, I think that was the case. And
 21 then, also, your own criteria of 25th to 75th
 22 percentile flows, if those are met, I don't see any
 23 good reason to throw them out. I think the only one
 24 that's problematic is Nebraska 4 and, yeah, something's
 25 going on there, because you don't get an event followed

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1 by an immediate return to base flow without some
 2 alteration going on in that system.
 3 The, my tact on this, or my viewpoint on
 4 the relevance of micro and mesocosm studies here would
 5 be that, I think, at least, the statics tests are,
 6 actually, probably, pretty relevant. What we're
 7 talking about, between flow regimes are series of
 8 disconnected pools that are a whole lot like a static
 9 system. So, I think, that, actually, it's some of, not
 10 all of the studies that are, I think, there were 77 or
 11 whatever included, but those that were static, I think,
 12 are relevant. I'm not sure if I have any other comment
 13 about that.
 14 And so, therefore, I think you could
 15 use, in most instances, the normal approach to
 16 determining a LOC, one issue that was brought up is,
 17 what if the last concent-, or the last sample collected
 18 is high concentration. Well, let's assume that during
 19 these low flow periods you're going to get a series of
 20 disconnected pools that, probably, have a similar
 21 concentration to that last sample. Because, if, by
 22 definition, there's no base flow coming in to dilute
 23 it, the only thing that's going on is evaporation,
 24 which would, actually, increase the concentration
 25 between flow. So, I think you can use your last sample

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1 to extrapolate forward. And, therefore, I think that,
 2 well, and then, I guess at the other extreme there, if
 3 your sample was below the limited detection, then you
 4 could extrapolate or interpolate with zero. So, I
 5 think that these could, and should, be included in the
 6 larger set, other than maybe the Nebraska 04 where
 7 there may be some human alteration going there that
 8 would justify throwing that side out.
 9 DR. HEERINGA: Thank you, Dr. Lerch, and
 10 Dr. Novak, Jeff.
 11 DR. NOVAK: Yes, this is Dr. Novak,
 12 again. I have answers to three questions here. I
 13 acquired some knowledge and wisdom earlier in my
 14 career
 15 by serving as a post doc at the Savannah River Ecology
 16 Lab. And in that time period, I had opportunities to
 17 speak to many stream water ecologists who talked to me
 18 about nutrient spiraling in streams, and how important
 19 that was for organisms. Basing some of my answers on
 20 that past experience and wisdom from those folks, I've
 21 come up with three answers to the questions that have
 22 been posed to the Scientific Advisory Panel. The first
 23 answer is that, yes, the EPA should treat Atrazine
 24 detection in low flow intermittent streams as a
 25 separate case, and not mix this data with their entire
 data pool, which is argumentative now. The ecosystem

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1 created under low flow conditions is not comparable to
 2 conditions in other stream ecosystems with flowing
 3 water. Low flow will cause nutrients to concentrate
 4 along with temperature increases. Flowing water
 5 disperses or shifts many of the chemical and physical
 6 life-sustaining variables needed by water critters.
 7 Additionally, the spiraling concept of nutrient flows
 8 in streams predicts that flowing water delivers
 9 processed food sources, and notice I emphasize process
 10 here, to critter available to them. If those processed
 11 food sources decline, stress will occur to those
 12 critters. The stressful conditions will propel shifts
 13 in the consumer producer populations, which was brought
 14 up over the last few days in some of the models,
 15 resulting in upheavals of this bio-mass carbon
 16 production, which, I believe, is one of the core
 17 measurements for the statisticians. These changes in
 18 environmental population characteristics will
 19 undoubtedly change bioenergetic parameters, which is
 20 one of the buzzwords I heard yesterday, thereby, making
 21 comparisons with previous macrocosm studies conducted
 22 under higher flow conditions as unrealistic. Retooling
 23 of bioenergy equations may be needed to reprocess them,
 24 retest them, and post-validate them.
 25 The second question concerned about the



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1 Nebraska sites, it's good that the EPA has generated
2 statistics for the sites in Nebraska, and treats the
3 system in different strata. Perhaps, this should be a
4 trend in your overall research design that intermittent
5 flow streams will be examined. Heavens, we have plenty
6 of dry streams and almost dry rivers in South Carolina
7 right now. Florence, in particular, as of December,
8 '07, is about 12 inches of rain short, when we normally
9 have 45 inches of rain annually. In the big picture,
10 it remains to be determined how will standing water
11 systems be correctly studied using the CASM model,
12 which is referenced to flowing water.

13 My last answer, here, I believe, the EPA
14 has the data in hand, which was handed out to us
15 yesterday. Not to belittle the fact, but I think those
16 LOC values are obtainable from reviewing the data, but
17 let me go back to one of the questions that I proposed
18 about two days ago for the EPA panelists. Wouldn't
19 this be a great opportunity to verify results from the
20 CASM Atrazine model? Now, again, seeing Stephanie's
21 face the other day, depending upon funds, I know that
22 funds are hard to come by. The team could create a
23 macrocosm with low flow to static flow, inoculate with
24 critters, gather information on changes in their
25 bioenergetic parameters, carry through the experiment

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1 willing to come to the public mike here over Dr.
2 Frankenberry and. Maybe, just for the record, restate
3 the question that led to the conversation.

4 DR. ELLSWORTH: I just asked him why did
5 it not have grab samples available, although it looked
6 like there was flow in what was going on there.

7 DR. HEERINGA: Simple enough, thanks.

8 DR. HARBOURT: Sure, Chris Harbourt,
9 here. The Nebraska, the three Nebraska sites, first of
10 all, had a flow condition there that made it very
11 difficult to measure flow, first of all. And, we
12 provided EPA the fifteen minute stage and flow data
13 that we calculated sometime in the summer to help them
14 with their White Paper. We really provided that
15 without the necessary clarification and background
16 information to use it, perhaps, in the best fashion.
17 Especially, at the three Nebraska sites, we saw flow
18 hydrographs yesterday, oh, thank you, in that slide
19 packet that was sent around this morning. I guess, I
20 can just go through some of these with you, if you want
21 to pull them out. It's probably the best way to go
22 through this.

23 I'm on the first page, I'm just showing,
24 again, some slides, the type of equipment we used,
25 either pressure transducers or ultrasonic sensors. The

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1 at different exposure durations, which I heard for the
2 last two days, was one of the entrenched tools that the
3 modelers were using, and then examine changes in the
4 population. So, I'm learning some of the words from
5 them and trying to make suggestions to get validation.
6 Again, this provides the opportunity to create some
7 ground truthing data that should convince skeptical SAP
8 panel members, that the model will provide trustable
9 results. Thank you.

10 DR. HEERINGA: Thank you, Dr. Novak. Dr.
11 Ellsworth, Tim Ellsworth.

12 DR. ELLSWORTH: Tim Ellsworth, I didn't
13 mean to interrupt there. I was just thinking there was
14 something that have saved some conversation. I had a
15 discussion with Dr. Harbourt after this came up, and
16 asked him, kind of, what was going on there, and there
17 was, you know, maybe it'd be better just to, I don't
18 know if that's appropriate to have him say something,
19 but it's like what Bill was saying. Talk to the person
20 that was out there, and he's kind of got some info on
21 it.

22 DR. HEERINGA: Dr. Brady, is that okay
23 with you?

24 DR. BRADY: Yes, I think that's fine.

25 DR. HEERINGA: Dr. Harbourt, would you be

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1 bottom slide, two, is a description of how we
2 calculated flow from the river depth. Dr. Heeringa,
3 they want to put it up on the screen, so it'll just be
4 a second here.

5 DR. HEERINGA: That would be fine. I'm
6 still trying to, I have it, and I've lost it, so. I
7 don't think I've got it here. These slides here, Dr.
8 Harbourt, are illustrative in general, not of the
9 Nebraska sites, isn't that what you're saying?

10 DR. HARBOURT: Correct, yes, and it
11 talked a little bit about the Nebraska sites.

12 DR. HEERINGA: While we're waiting, I
13 mean, if, Nebraska, if you know Platte River Basin,
14 and, often, very wide channels with very, very shallow
15 flows. I mean, literally, in a matter of an inch of
16 water, across Grand Island, it's 100 meters wide and an
17 inch of water flowing, now, is that, are you thinking
18 that might be part of it.

19 DR. HARBOURT: Very much, it's a, it's
20 different from the vast majority of the rest of the
21 Midwest, especially, in this study. Just to carry
22 through these slides, slide two, this is Bill's slide.
23 If you just click one button at a time, we'll see it.
24 That's an indicator of the ultrasonic sensor, how we'd
25 locate it on the bridge. What it does is, it, there's

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1 a cross-section. The blue line represents the water
 2 surface, and the green line's the channel bottom.
 3 Shoot an ultrasonic pulse down, and it measures that
 4 change in river stage. And a pressure transducer,
 5 also, coming in from the bank, measures the depth up.
 6 We, then, measure the channel gradient for slope to
 7 determine the energy grading of the flow. We integrate
 8 that with Manning's equation to come up with the flow.
 9 Yeah, go ahead to the next one. So, just, in summary,
 10 we're measuring a river depth. We're surveying a
 11 channel cross-section. We're surveying the channel's
 12 slope. We're applying a Manning's equation. And we're
 13 using that to come up with an estimate of flow. Now,
 14 within that flow estimate, there's uncertainty. And,
 15 you know, I'm sure as USGS can talk to this, we've, we
 16 are overestimating low flow, and I can go into that in
 17 some detail. And that's, particularly, evident at
 18 these streams that go dry or are very, very low in
 19 depth. We're not verifying the flow with a flow meter
 20 or anything like that. We're, also, not checking for
 21 back water. And that's a condition where the small
 22 streams that we're monitoring, and these are all very,
 23 very small headwater type streams. As they enter
 24 larger conveyances, sometimes those are deeper,
 25 perhaps, and they cause backflow and the velocity

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1 And largely, that's due, and the sensor has a physical
 2 dimension. It's, literally, an inch off the bottom.
 3 As soon as the water drops below the level of the
 4 sensor, even though it's dry, it still thinks there's
 5 an inch of water, because it's a calculated flow, there
 6 appears to be flow moving by. So, estimates like this,
 7 especially at these dry down sites, it's very important
 8 that we tie that back to the observations that the
 9 field folks made every four days. And they made
 10 observations of river depth and, also, condition,
 11 whether or not they could collect the sample. Next
 12 slide.
 13 This is Nebraska 5. We had an issue
 14 here, and, really, at all these Nebraska sites.
 15 They're very active channels. They're moving, and I
 16 use the word aggrading here, which means, they're
 17 actually filling in with sediment. There's sand that's
 18 coming to the channel. The channel bed is changing.
 19 So, in one of the figures yesterday, it appeared that
 20 stage increased halfway through the year, and we had
 21 this flow where you had nice hydrographs early on. And
 22 then, all of a sudden, it's this elevated level, and
 23 there was conjecture that, perhaps, it was an upstream
 24 release. It's more likely the streambed moved enough,
 25 and the channel shifted, and we're not correcting for

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1 profile changes. So, we're not accounting for that.
 2 And that could lead to overestimates of flow,
 3 particularly, during the storm vents. And we're not
 4 coming up with a rating curve, and USGS can talk to
 5 this. I mean, they've spent years and years developing
 6 these rating curves, where they measure flows at
 7 different stages to develop that relationship between
 8 depth and flow. And, so, really, what we're saying
 9 here is that, although, we're providing flow, it's
 10 really there as a contextual measure to take a look
 11 when we're viewing things, in terms of a residue in
 12 time chemograph, what was occurring in the field? Was
 13 there rain? Did that drive some type of runoff? Is
 14 that sample tied to runoff, or is it just something
 15 that occurred at random throughout the year? Next
 16 slide.
 17 And here's an example of the Nebraska 7
 18 site, and we saw this earlier in one of the other
 19 presentations. Highlighted in the orange circle, the
 20 pressure transducer is sitting on the bottom of a dry
 21 creek bed. We went back to the data record, and this
 22 is the same data that was provided to the EPA in the,
 23 over the summer in August. And for that day, we had a
 24 range where the sensor was predicting a flow of
 25 somewhere between .7 and 4.2 cubic feet per second.

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1 that in our flow calculations. Nebraska 5 and the
 2 others all have that. And then, just, Dr. Gay spoke,
 3 touched on this earlier on talking about the depth.
 4 The Lamott samplers, according to our protocol, they're
 5 a four inch device, and I showed one of those on
 6 Tuesday. We require that they be at least an inch off
 7 of the bottom to not stir up the sediments and things
 8 laying right there. So, really, we had five inch
 9 minimum depth in order to collect the sample. And it's
 10 true that an auto sampler, it's just, I mean, the
 11 intake's the dimension of your finger, so it can lay
 12 right on the bottom and could collect a sample at a
 13 lower stage. And that's why, in some cases, we weren't
 14 able to collect a grab sample, but the auto sampler was
 15 successful on the same day. And that explains that a
 16 little bit. Next slide.
 17 We also, these low flow samples, we
 18 documented them. They're in the reports, both in
 19 summary, on a site by site basis in text form, and
 20 then, there's a summary table, detailing each of the
 21 ones that we were not able to collect at each site. If
 22 we just go to the next, here's an example of the table.
 23 And then highlighted in the red block, and this is
 24 showing our success, our number of grab samples that we
 25 were, actually, able to obtain. Just to highlight, we

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1 were on the site every time. We never missed a trip to
 2 the field. So, every four days, we were there, without
 3 fail across the years and across all sites. This table
 4 indicates the number of samples we were, actually, able
 5 to collect. In the red box, if you look into 2005 and
 6 2006 for these three sites in question, and we're
 7 talking about 10, 15, you know, in the case of Nebraska
 8 7, only three samples that we were able to pull with
 9 our equipment across 37 to 40 attempts there, where we
 10 were physically there attempting to take a sample. I
 11 mean, it's our job to bring back a bottle of water.
 12 Now, if we can't, we're kind of upset. So, it's
 13 unfortunate this happened, but it really highlights to
 14 us that something's different with these three site,
 15 absolutely, as a group.
 16 DR. HEERINGA: Thank you very much, Dr.
 17 Harbourt. Any questions, Dr. Gay, do you have a
 18 question?
 19 DR. GAY: I think I just have a comment
 20 here, that, now that I'm really looking at the
 21 streambeds and thinking about the inch of water, I'm
 22 wondering if you could somehow incorporate, like, an H
 23 flume or something in one of these streams to
 24 concentrate the flows that you do have, in order to get
 25 a handle of the concentrations, particularly, since

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1 there are such high concentrations when you do have
 2 some intermittent flow that would capture it in
 3 conjunction with using an ISCO on a regular sampling
 4 basis, so someone doesn't have to be there every day.
 5 DR. HARBOURT: No, it's a good idea, and
 6 really, what the suggestion is, is some type of stream
 7 modification, where you're putting in a small retaining
 8 structure to form a small pool that you can sample
 9 from. And that's something that, you know, the, we
 10 didn't look into. We were concerned that it's altering
 11 the environment. We're, really, just coming there to
 12 sample. We didn't know this condition was going to
 13 happen, obviously, when we instrumented, but it's a
 14 good idea, if we could get a buyoff from Fish and
 15 Wildlife, that we weren't changing the ecosystem, we'd
 16 be happy to, kind of, install that type of technology,
 17 if further monitoring was required.
 18 DR. HEERINGA: Dr. Randolph.
 19 DR. RANDOLPH: I'm not a hydrologist, so
 20 this may be, there may be an obvious answer to the
 21 question, but why didn't you put flow meters in each of
 22 these sampling sites?
 23 DR. HARBOURT: That's a good question.
 24 Current flow monitoring technologies has some kind of
 25 test. There's either under-bridge-mounted devices,

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1 that are very hard to accurately calibrate, and,
 2 typically, you know, like the USGS owns one or two of
 3 them, and they move them around the country. The other
 4 types of flow meters are, you locate them on the bottom
 5 of the stream, and they use a sound pulse or some kind
 6 of radio frequency emission, and it bounces off of
 7 particles in the stream. And they're reliable
 8 sometimes. In other times, a lot of these streams are
 9 flowing too clean and too clear to pick something up.
 10 So, they're unreliable. We've tried to install some of
 11 them, and we've had marginal success, especially at low
 12 flows, which is the question here, of course. All of
 13 the technology is stressed for low flows.
 14 DR. HEERINGA: Thank you very much, Dr.
 15 Harbourt for that clarification, and Dr. Ellsworth for
 16 bringing it to our attention. Dr. LaPoint?
 17 DR. LAPOINT: Thank you. This is Tom
 18 LaPoint. Low flow sites and intermittent streams,
 19 here's a perfect component where the biota needs to be
 20 linked to the response of the streams in this case. We
 21 can maintain it, or establish a distribution of flow,
 22 and that distribution can go from zero flow up to full
 23 flow for the year, and that's how we define
 24 intermittent streams, from ephemeral to full flowing.
 25 And the response in the types of organisms that live in

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1 there, then, in terms of the stress that stems from
 2 being in an ephemeral, in an intermittent situation,
 3 if the, to provide something positive, here, if there's
 4 a framework to put this in to consider these streams, I
 5 think I would refer you to Michael Houston's work,
 6 where he has a series of papers. And, also, this has
 7 been carried on to pesticide work and published by
 8 others, and where you look at the degree of stress and
 9 the degree of duration, or the length of duration, the
 10 duration, and use those two axes, then. Because, as I
 11 mentioned, here's where, and this feeds into the second
 12 part of this, or the second question on this, is, one
 13 cannot look at the stream flow and the degree of
 14 intermittency and understand stress to the biota,
 15 without understanding and linking the biota to the
 16 nature of the stream here. And that gets back to the
 17 micro mesocosm test as well. A lot of times we think
 18 that the result of a mesocosm test is some kind of,
 19 being glib now, I suppose, some kind of multi-metric
 20 fathead minnow. Well, it's - -
 21 DR. LAPOINT: It's actually a, you know,
 22 there are multiple types of organisms that are
 23 responding here, from phytoplankton to periphyton to
 24 microphytes then to the fish we've talked about. So,
 25 if the degree of match, if you wish, from the micro



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1 mesocosm, the experimental ecosystem tests, to the
 2 consequences for Atrazine exposure under these
 3 stressful conditions, then you have to look, and
 4 there's no other way to do it than to do this post hoc
 5 analysis, because the data are, actually, already here.
 6 We have an extensive database for all those mesocosm
 7 tests that went on. The ones that are going to come
 8 back for us is Meyer, say, if you look at that, the
 9 rich diversity is, largely, the very small organisms
 10 that have the potential for rapid recolonization, rapid
 11 development. They're probably hyporheic, which means
 12 they're living in the substrate as, at least as
 13 propagules, and once the water comes back in, they can
 14 come up in a very short time, literally, hours to a few
 15 days, and you can have a complete population again.
 16 So, that ties to how long the stream has been dry, and
 17 you can build a distribution, a nice distribution of
 18 those for how long, match that back, and maybe the
 19 distribution, then, on degree of how, the extended
 20 periods, for which those streams are dry, can be a
 21 stress index. And you might want to just consider
 22 those that are flowing, I mean, from that, you can see
 23 how many are in what component, and consider the upper
 24 90 percent, or upper 50 percent, or something like
 25 that, but at least, you could do it that way. And

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1 then, if they remain less intermittent, they have low
 2 flow for more of the year, then the match will be to
 3 the higher or-, higher level organisms in some of the
 4 experimental ecosystems. So, there's going to have to
 5 be, to answer this, in my opinion, it's going to have
 6 to look at, very carefully, the distribution of flows,
 7 and then relate that back to the nature of the types of
 8 organisms that responded in some of the tests, some of
 9 the experimental ecosystem tests. And I think that,
 10 honestly, will provide an answer there, so, thank you.
 11 DR. HEERINGA: Yes, Bob Gilliom.
 12 DR. GILLIOM: Maybe prelude to the
 13 discussion, I agree with about the application of the
 14 meso microcosm studies to the intermittent systems,
 15 which, I think, they do have applicability if applied
 16 carefully, is it seems like the first question in this
 17 topic is how and do, and I, and you've partially
 18 answered it here, intermittent streams fit into the
 19 priority of resource protection from both the
 20 scientific and policy point of view. So, if headwater
 21 intermittent streams are ecologically a key part of the
 22 system that are affected by Atrazine and other
 23 stressors, they've got to be dealt with. And then, the
 24 question's, how? If, on the other hand, somebody
 25 decides they're not, then some of these issues go away.

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1 I have a feeling that the answer will probably be, is
 2 they're important because of their role in the whole,
 3 overall ecosystem, and they represent a lot of stream
 4 miles in the country. But, they're probably going to
 5 take some different adjustments to the approach. And I
 6 think some of the ideas that were just brought out are
 7 some of the possibilities.
 8 DR. HEERINGA: Good comment. Dr. Young,
 9 and then, maybe Dr. Portier, and I'll think we'll move
 10 - -
 11 DR. GAY: Yes, just to follow up on that
 12 idea. Because of the way that the design is
 13 established, and because the intermittent and low flow
 14 conditions do exist, I think you want to leave them in,
 15 if at all possible. The reason you might not be able
 16 to leave them in is, whether or not you can determine
 17 whether the LOC's been exceeded or not. You know, that
 18 would be a case where you just couldn't get data, but
 19 as far as estimating this population proportion, you
 20 need them there. Because they do represent a whole
 21 class of streams, and you, and if you throw them out,
 22 you throw out all streams of that kind, basically, and
 23 all watershed that would've been selected by that
 24 criteria, and you begin to bias your results. So, for
 25 that reason, I understand all the reasons why they're

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1 problematic, but an effort to keep them in would, I
 2 think, be of value.
 3 DR. HEERINGA: Dr. Grue?
 4 DR. GRUE: Yeah, I'd just like to follow
 5 up. I agree with the comments associated with the
 6 intermittent streams, and I think critical to that,
 7 that Dr. Young just mentioned, and also, Dr. LaPoint
 8 is, are these actually ecologically part of the system,
 9 or are the low flow conditions being created by some
 10 land use practice that is atypical in the area. If
 11 these are ecologically driven, then they should be
 12 considered and considered a-, we'll have to make some
 13 decision in terms of how you're going to relate those
 14 conditions and the biota associated with those
 15 conditions back to the microcosm mesocosm tests, which
 16 are, for the most part, static tests. There aren't
 17 that many in there that are flowing tests. The other
 18 point that I wanted to make, in terms of stress here,
 19 if, in fact, these are ecologically driven systems,
 20 then, as Dr. LaPoint indicated, the species that are
 21 going to be pre-, present have, in part, adapted to
 22 these conditions. And they are geared to respond. So,
 23 I think, we have to be careful how we use the terms
 24 stress, because it sounds, you could look at that and
 25 say, well, you're taking species that has adapted to a

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1 flowing condition, and then you're putting it in an
2 intermittent condition. Yes, you've added stress,
3 because those species, or at least the portions of that
4 population have been adapted to a flowing condition.
5 If, in fact, these systems are, essentially,
6 intermittent, then the biota associated with those
7 conditions are there, because they've adapted to those
8 situations. And as such, I guess my point is for the
9 base ecological decisions, in terms of whether these
10 are really ecological systems, part, and then I agree
11 with Dr. Young's assessment, they need to be included.
12 How the Agency, then, decides to determine an LOC for
13 those is going to be the critical step.

14 DR. HEERINGA: Thank you, Dr. Grue. Dr.
15 Young.

16 DR. YOUNG: Just as a follow up, I would
17 say that you'd want them in, whether it's ecologically
18 driven or man driven. Only because, this won't be the
19 only man driven consequence out there, but you know,
20 you just got one of them by chance. And so, still,
21 that just goes into the whole mess of what you have to
22 deal with when you're looking at a nationwide type
23 approach. So, I'd leave it in, no matter what.

24 DR. HEERINGA: Dr. Portier, Ken.

25 DR. PORTIER: It's interesting to follow

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1 misclassification, you defined a data collection
2 protocol, which, unfortunately, in some of these
3 situations that you encounter, is inapplicable. So it
4 would be like the machinery, a piece of machinery
5 breaking down or going out of calibration in any sort
6 of, so, in some ways, these sites are out of protocol,
7 because you set up a measurement protocol under the
8 scientific design, and you can't capture it. So, I
9 think the distinction is, you want to leave them in,
10 because they're representative of the population, but
11 in some ways, in terms of handling them for inference,
12 you have a problem, because you, they're, sort of,
13 essentially, out of protocol. So, I don't think you
14 want to exclude them, necessarily, unless you make a
15 deliberate decision to, sort of, change your criteria
16 on site selection to make sure that you have water in
17 these systems year round. So, I, and I think that
18 extends to the comments that a number of the other
19 scientists have made, with regard to thinking about
20 them, somewhat, uniquely as a class of systems. I
21 mean, there's a whole gradation here that we're looking
22 at, and you've already, sort of, separated stagnant
23 waters from flowing waters, but this is, sort of,
24 something that's, again, to one extreme of that, of
25 those continuums, so. Yes, Jim Fairchild.

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1 the discussion. One of the benefits of being a
2 permanent panel member, as we sit through a lot of
3 these discussions, and so we see, kind of, different
4 viewpoints, a broader viewpoint, which is nice. And
5 this discussion, and especially, the discussion of low
6 flow stuff, kind of, brings me back to our last
7 meeting, which was, what, about a month and a half ago,
8 where we were looking at Atrazine and amphibians. And
9 so, while Dr. LaPoint, kind of, went down in the web,
10 and looked at smaller things that respond quicker, I'm
11 thinking that, for some of these systems, maybe the
12 species of interest of something like a frog, right,
13 something further up, that integrates a very complex
14 ecosystem or intermittent wet ecosystem, so we might be
15 looking at tadpoles and frogs instead of diatoms and
16 something else further down in the system. So, I just,
17 kind of, lay that in there as a link to our previous
18 discussion on the panel.

19 DR. HEERINGA: Thank you, Dr. Portier.
20 Dr. Young's comments, and maybe, just to be clear for
21 the discussion, and I think, you're really talking
22 about representation of these watersheds. And so, in
23 terms of, I, sort of, have the same view. At least,
24 it's important to, sort of, keep them in, because they
25 were, you defined a population which has some

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1 DR. FAIRCHILD: Jim Fairchild, regarding
2 protocol, I wanted to ask Dr. Harbourt that, you know,
3 typically, you are collecting at the bridge, but, you
4 know, for some physical reason, possibly the design of
5 the bridge, if it had a concrete base, and, actually,
6 was forming a dam with an a, an unstable channel, you
7 know, you could accumulate debris there until you get
8 the next strong storm event. But, on those states
9 where there was no water or samples, was there any
10 attempt made, or was there a protocol to go a thousand
11 meter upstream or downstream, to be sure that you could
12 get a sample, so that you didn't have to deal with
13 missing data, which is always a problem with
14 statistics.

15 DR. HEERINGA: Turn to Nelson, do you
16 want to, I know this isn't your purview, but, um.

17 DR. THURMAN: Yeah, honestly, that wasn't
18 a condition we had anticipated, and, really, there was
19 no protocol to say that if there's nothing there, to
20 move elsewhere. I think the intent was to try to, a,
21 sample the same places for consistency, and b, because
22 this wasn't the only site they visited in day. You
23 needed to do it fairly quickly. So, I think it was
24 more of an access thing, but that, you know, honestly,
25 that wasn't specifically written into the protocol.

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1 DR. FAIRCHILD: This is Fairchild, again.
 2 Well, just, for the record, I think that, you know, the
 3 whole issue of amphibians wetlands headwater streams is
 4 a critical issue that many states and the federal
 5 government are facing. And there's no doubt,
 6 ecologically, that these ephemeral systems aren't
 7 critical ecosystem components. And so, in future
 8 studies, I'd hope we'd learn from this that, you know,
 9 you need to consider low flow conditions and getting,
 10 at least, some representation, if it's within reason.
 11 These types of ecosystems are important. Fits outside
 12 what someone, you know, I hear the term flowing and
 13 stagnant, and it reminds me of swamp and wetland. You
 14 know, there's a certain connotation that comes with
 15 these things, but they are aquatic systems, and they
 16 are regulated. So, let's learn from this.
 17 DR. HEERINGA: Dr. Brady, I see Dr.
 18 Harbourt standing up, and he's either interested in
 19 starting his break, or he has something to offer. Are
 20 you willing to - -
 21 DR. BRADY: Sure.
 22 DR. HEERINGA: Dr. Harbourt, please come
 23 to the mike, though.
 24 DR. HARBOURT: Dr. Harbourt, here. Just
 25 quickly to address the thought of moving up off of the

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1 bridge. And one of our concerns that the samplers were
 2 there by themselves, and there's the safety concern
 3 about them getting out and away from the vehicles, away
 4 from the roads, and going out to investigate these
 5 sites. There's also an issue of, you know, private
 6 property, and we were in public right-of-ways where we
 7 were, and we really weren't allowed to trespass and go
 8 hunting around for potential samples away from the
 9 bridge.
 10 DR. HEERINGA: Logical. Sure, Jim
 11 Fairchild.
 12 DR. FAIRCHILD: Fairchild. That, you
 13 know, being from USGS, that always is a problem, but,
 14 and we, literally, cannot access private lands without
 15 the written permission. But, for a study of this
 16 scope, it does not take that much time to go out there
 17 and talk with the landowners, explaining them the
 18 purpose of the study, how the data is going to be used,
 19 and you know, that should be part of the future
 20 sampling protocol, in my opinion.
 21 DR. HEERINGA: Jeff Novak.
 22 DR. NOVAK: This is Jeff Novak with a
 23 suggestion for access to farms. We found in the ARS
 24 that the closest, or the fastest way to get access to
 25 landowners is to work through the County Extension

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1 Service. Once you make a request through the County
 2 Extension Agent, they can go among the owners along the
 3 stream system, find cooperators, make written or verbal
 4 agreements, and then you have access to that stream
 5 channel. The Extension Service per county was
 6 paramount for us to be able to get access to all these
 7 small stream channels. Thank you.
 8 DR. HEERINGA: Good advice, thank you
 9 very much. Well, at this point, what I'd like to do
 10 is, I'd like to call a break. We're just a little bit
 11 short of 10:30, so we've been very productive, I
 12 believe, this morning. I appreciate everybody's input,
 13 comments. Let's take a break until fifteen minutes of
 14 11:00 and then, we'll reconvene, and pick up with the
 15 charge question number nine. Dr. Randolph.
 16 DR. RANDOLPH: J. C. Randolph. Just a
 17 question about producing results. We're having some
 18 trouble with a printer next door this morning, and I
 19 just hope that we could get a functioning printer.
 20 DR. HEERINGA: Okay.
 21 DR. DOWNING: It's back and working now.
 22 DR. HEERINGA: Good, thank you. That may
 23 be the toughest request of the day.
 24 (WHEREUPON, there was a break.)
 25 DR. HEERINGA: Okay, welcome back

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1 everybody to the second half of our third morning
 2 session of FIFRA Science Advisory Panel meeting on the
 3 topic of the interpretation of the ecological
 4 significance of Atrazine stream water concentrations
 5 using a statistically designed monitoring program.
 6 Jim's informed me, we're working on the temperature
 7 fluctuation. It's going to be a, heat is going to be a
 8 little intermittent here. It's either high or we can
 9 decide to let it drop a little bit, but they don't know
 10 how far it'll drop, so.
 11 DR. HEERINGA: We'll, we're going to talk
 12 faster, so, that. Before we turn to charge question
 13 nine, Dr. Grue had one clarifying comment, and then, I
 14 think, Dr. Brady indicated that the EPA scientific
 15 staff had a few questions for us, just to make sure
 16 that we were clear, in terms of presentation on this,
 17 so, Chris.
 18 DR. GRUE: Yeah, I just wanted to clarify
 19 my comments about these apparent intermittent sites.
 20 And the feeling, I wasn't suggesting that they be
 21 excluded. I agree completely with Drs. Young and
 22 Heeringa about that. But I think, it's important for
 23 us to know what's really driving those systems. And I
 24 would argue that, right now, I don't think we really
 25 have a clear understanding. And, as such, it really

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1 seems to me that we need to move towards some
 2 additional monitoring on those sites to really get an
 3 understanding of what's going on.
 4 DR. HEERINGA: Thank you, Dr. Grue. And
 5 Dr. Brady, I think that you had some follow up
 6 questions, then?
 7 DR. BRADY: Yeah, we had, just, two
 8 follow up questions. First, I'm going to ask Dr. Olsen
 9 to pose, and that is on the question of how the Agency
 10 should consider these low flow sites. We're just
 11 trying to see, in our own minds, and be clear about,
 12 what the advice of the panel is.
 13 DR. OLSEN: Tony Olsen. I'll state it as
 14 my understanding of what the panel is recommending, and
 15 then you can clarify whether my understanding is
 16 correct. My understanding is, is that the low flow
 17 sites should be included in all the population
 18 estimation, but that they should, at this point, still
 19 be kept separate as a separate category, in terms of,
 20 let's say, the LOC things. And is that the
 21 understanding of the panel?
 22 DR. YOUNG: Wait, how can you do both
 23 those things?
 24 DR. OLSEN: Well, no, I mean, they're
 25 included by what they're doing, and, but it, basically,

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1 the ta-, the estimation table that I ended up
 2 presenting that had the different LOC categories, okay.
 3 One of those categories was, ended up being the three
 4 low flow sites, and then, what you're saying is, is
 5 that category should still stay there, that we
 6 shouldn't change the way the analysis was done. That's
 7 all I'm saying.
 8 DR. YOUNG: Right, but then, when you
 9 actually did the population distribution curve, didn't
 10 you include those in that curve?
 11 DR. OLSEN: They were also included in
 12 that curve.
 13 DR. YOUNG: Okay, yeah, that's fine,
 14 though, yeah.
 15 DR. OLSEN: So, that was, just wanted to
 16 make sure that we're absolutely certain on that.
 17 DR. HEERINGA: Dr. Grue.
 18 DR. GRUE: My point with that would be,
 19 I'm just not convinced that there's sufficient data on
 20 the Atrazine exposures for these sites to, really, do
 21 an assessment. And that's what I was suggesting, as
 22 far as additional monitoring. Really try-, suggesting
 23 that the Agency, in collaboration with Syngenta, get
 24 the data necessary, really get a good understanding,
 25 because they, depending on whether it's real or not,

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1 the interpolation of those data between sampling
 2 pulses, it, you've already shown, has a big impact on
 3 how you determine the concentrations that are relative
 4 to the LOC. And that's, simply, what I'm saying. I'm
 5 not convinced the data are there to do it, but I do
 6 agree, that the sites, themselves, should be included
 7 in the analysis. Whether or not you can do an
 8 assessment relative to the LOC at this point, I think
 9 is, to me, is questionable.
 10 DR. HEERINGA: I think, in terms of,
 11 Steve Heeringa, in terms of population
 12 characterization, I think what Linda and Chris are
 13 saying is that they should be reflected in there as
 14 representative of a certain number of sites, but for
 15 that particular category, within the larger population,
 16 I think the LOC status is indeterminate at this point.
 17 And it might be determined if, you know, but, again, in
 18 all of the issues we have, I think it's, sort of, like
 19 a don't know response in a larger sample, Tony, and,
 20 but clearly, it's representation, in terms of the
 21 population, given the definition of that population and
 22 measures used to establish is representative. Second
 23 question, Dr. Brady.
 24 DR. BRADY: Yes, thank you. This is Don
 25 Brady again, and I guess, this question goes to the

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1 second part, and just, trying to be clear in our minds
 2 what the advice is on whether the existing microcosm
 3 and mesocosm studies do adequately represent these low
 4 flow sites, just in terms of, is there possible to get
 5 some agreement or some clearer statement of that for
 6 us. Thank you.
 7 DR. HEERINGA: I think, see, Dr. LaPoint,
 8 and, now, did you hear the question with regard to the
 9 appropriateness of the meso and microcosm studies for
 10 this that Dr. Brady just read? Would you read it
 11 again, 'cause I'm not sure that Dr. Lerch has also
 12 heard it.
 13 DR. BRADY: Yeah, we, sure, we were
 14 trying to get clarity on what the advice of the panel
 15 was on that second question about how well the studies
 16 represent these low flow sites, just trying to be clear
 17 in our mind what we're hearing, here.
 18 DR. HEERINGA: Dr. LaPoint.
 19 DR. LAPOINT: Yes, in my opinion, now,
 20 not speaking at all for the panel, of course, I think
 21 they can be representative, and here, it's a bit of a
 22 deviation from what we've been talking about, because
 23 the micro mesocosm tests that deal with the smaller
 24 organisms, which by and large have a more rapid
 25 response time, also tend to be those that are more

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1 sensitive, they're the ones that, in static systems,
 2 would most likely reflect the, at least, the Atrazine,
 3 potential for Atrazine responses in these static
 4 systems. So, for low flow, or the intermittent ones,
 5 where they pool up, okay, that would be appropriate.
 6 For low flow systems, I think, either looking at the
 7 flowing macrofied systems would still be a situation
 8 that could be followed.
 9 And so, and for the ones that are
 10 intermediate, that aren't flowing, that flow sometimes,
 11 that, in my opinion, now again, would have to be
 12 something based on a distribution system of how often
 13 they're flowing, how often they're stagnant, and,
 14 somehow, it would have to be a judgment call, to tell
 15 you the truth, to pick some percentage of those that
 16 are flowing and use those, and then, that are stagnant
 17 and how often the water stays in there in the pool.
 18 'Cause that determines what, how flashy it is will
 19 depend on how much of a stress, and I don't disagree
 20 with that. I think that flashiness can be a stress for
 21 organisms that are ex-, they're used to, or adapted to,
 22 if you wish, continuous flow conditions. But, if it's
 23 an intermittent flow stream, then there, actually, are
 24 organisms that are quite well adapted to that, and that
 25 needs to be taken into account, then.

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1 I mean, the last part of it, I
 2 recognize, is not direct help, probably. It's more of
 3 a problem, and I hate always presenting a problem, but
 4 there are, there is a framework that this can be put
 5 into, and I would refer, I'll be happy to give some of
 6 the references on this, where it's been used before,
 7 looking at adversity axes, how strong the stress is.
 8 And on the other axis is how long that stress happens
 9 to be, or the duration of that stress. And on the
 10 basis of those two axes, the theoretical background,
 11 anyway, has led to a good understanding of what kinds
 12 of groups of species are adapted for those kinds of
 13 situations, where you have a moderate stress for a
 14 moderate period of time, actually, according to that
 15 framework, is where you might find higher diversity.
 16 And that fits with what Meyer was talking about for
 17 these systems, all right. If it's a high stress,
 18 either dryness or high Atrazine, you find that there's
 19 a set of organisms that may do well under those
 20 situations, but they can be allocated to those kinds of
 21 situations. So, I think it would be differentiated.
 22 But, that's my opinion.
 23 DR. HEERINGA: Other panel members, Dr.
 24 LaPoint, I think, has made a fairly clear statement on
 25 that. Would that represent our, well, Bob Gilliom and

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1 then Jim Fairchild then.
 2 DR. GILLIOM: Sometimes you think you're
 3 kind of understanding where the whole flow is, and then
 4 it goes a little bit different. A simple prelude to
 5 what I think would be a good way to go, eventually,
 6 could also be to, similar to, in effect, use the
 7 existing microcosm studies as they are, at the time
 8 interval that fits the lengths of flow periods and wet
 9 periods in the intermittent streams. Meaning, you
 10 might be going right to the twenty day mesocosm
 11 results, and have an LOC that's defined a little
 12 differently than comes directly out of the model,
 13 because the model, in these circumstances, isn't really
 14 designed to hook together intermittent conditions. So,
 15 it's seems like we're back to that thing of, at that
 16 point, why would you use the model, and you might as
 17 well default to the empirical data for that type of
 18 time scale that comes from the mesocosm studies, which
 19 are what it all started with anyway. So, it's, maybe
 20 the prelude, at a very simple screening level to what
 21 would be a more detailed analysis of the nuts and bolts
 22 of those individual mesocosm studies that might best
 23 apply to the species. So, it's kind of a variation on
 24 the other comment.
 25 DR. HEERINGA: Jim Fairchild.

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1 DR. FAIRCHILD: Fairchild, I agree with
 2 Gilliom's comments, and I think - -
 3 DR. HEERINGA: Hold the mike up a little
 4 closer, if you would, Bob.
 5 DR. GILLIOM: Since you agree.
 6 DR. FAIRCHILD: Right. I agree with
 7 Bob's comments, and, in terms of the fact that that
 8 data is probably out there. It may not be captured in
 9 the Brock mesocosm microcosm studies, but that data is
 10 out there in the literature. I'm not sure that it's
 11 going to fit your needs if you're really tied to this
 12 CASM model. But I agree with Dr. Gilliom that, why use
 13 the data in a model when you can go to the literature,
 14 get good data, and, actually, put it in the species
 15 sensitivity distribution, and then, compare that to
 16 your probabilities of exposures. There's a very direct
 17 way to do that.
 18 DR. HEERINGA: Dr. Brady, with regard to
 19 the two questions, you think they have them addressed?
 20 DR. BRADY: I would check with my panel
 21 members. I, is that, okay, thank you.
 22 DR. HEERINGA: Okay, thank you very much.
 23 That's very useful to clarify that. At this point, I'd
 24 like to move on to the charge question nine, which is
 25 the final question related to the second component of



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1 our review, the study design. Obviously, all of this
 2 is integrated, but the way we've broken it up, so, Dr.
 3 Brady, if you would read that into the record.
 4 DR. BRADY: The monitoring study sampled
 5 for Atrazine concentrations at four day intervals to
 6 characterize the Atrazine chemograph in these low
 7 water, Midwestern streams. The CASM Atrazine model
 8 used the chemographs with a stairstep interpolation
 9 between samples dates to relate Atrazine exposures in
 10 the streams to microcosm mesocosm studies in order to
 11 determine whether the exposures triggered LOC
 12 thresholds. What other approaches for interpolation
 13 should be considered, given the concentration duration
 14 endpoint? How frequently must sampling occur to
 15 appropriately capture the magnitude and durations of
 16 exposure associated with Atrazine? Sensitivity
 17 analysis of CASM Atrazine model inputs suggest that
 18 some uncertainty bound on model results is appropriate.
 19 The Agency used a 2X multiplication factor from the
 20 model's sensitivity analysis to estimate uncertainty in
 21 model output. The sample frequency analysis indicates
 22 that there is uncertainty associated with monitoring
 23 data that may not be accounted for by the model
 24 uncertainty factor of 2X. Given the importance of
 25 sample frequency in interpolation, please comment on

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1 conditional on the model, then, what kind of error.
 2 And there's probably, you know, George Box said, all
 3 models are wrong, some are useful. I think this is a
 4 useful model, but it's certainly wrong in some aspects.
 5 And so, some of the variability has to be associated
 6 with just the incorrect model period.
 7 Then you have the variability associated
 8 with the inputs into the model, and as a focus of this
 9 question goes on the Atrazine in particular. I would,
 10 I think some of the techniques that you've used so far
 11 to try to do some what if's, and look at various
 12 sampling approaches, and accompanied with some
 13 simulations to get measures of bounds associated with
 14 that would be useful. I think if you really want to
 15 capture this, you're going to have to use more auto
 16 samplers, so that you can really tighten up those, the
 17 timing, so that you can really capture more of the
 18 Atrazine that's occurring out there. So, and, I guess,
 19 that would be my greatest recommendation, would be that
 20 you try to incorporate a lot more auto samplers in
 21 there to get more information.
 22 DR. HEERINGA: Our first associate
 23 discussant is Dr. Chue, Michael.
 24 DR. CHUE: Michael Chue. Yes, I agree.
 25 The selection of interpolation method is very, very

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1 whether consideration should be given to placing
 2 additional uncertainty bounds on monitoring data to
 3 account for uncertainty in the ability of the sampling
 4 strategy to capture the magnitude and duration of
 5 Atrazine exposures. Please provide any suggestions for
 6 how to proceed with this approach.
 7 DR. HEERINGA: Okay, and our lead
 8 discussant on this somewhat complex question is Dr.
 9 Young.
 10 DR. YOUNG: Good, the mike was off, okay.
 11 Okay, on the first one, I think it's very unlikely you
 12 caught any of the peaks of Atrazine, given the flash
 13 nature of it, and the fact it could peak, and you're
 14 going out every four days, and it could occur over a
 15 ten or thirty minute period. So, I don't think you
 16 captured them, and the question is, how important is
 17 that. And I'll let the ecologists on the panel address
 18 that issue. Given that, I think that the stairstep
 19 approach is a reasonable approach to use. It does make
 20 a big difference, especially with those low and
 21 intermittent flow streams. And I just, I don't have
 22 any great insights into other methods to be used.
 23 With respect to the air in this last
 24 part, the 2X, the question is really predicated on
 25 assuming that you have the right model. So,

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1 important. A good interpolation method can help us to
 2 get better, a better estimation of what are missing for
 3 this time period. But, I really want to talk about
 4 something different, of course, about the interpolation
 5 method. Let's look at some special case. For example,
 6 during four days, 'cause we are looking at some very
 7 small watersheds, during four days, let's assume, and
 8 there is a, we, that something happened. We have some
 9 very short duration r-, storm event, and also, we have
 10 some applications, Atrazine applications. Okay, then,
 11 we may have a very high peak, high peak concentration
 12 during these four days. Now, upon the end of this four
 13 day time period, the flow may return to base flow. And
 14 then the concentration may, also, very small. That
 15 means, we can select a different interpolation method.
 16 For example, we can use stair-, stairstep, or linear
 17 interpolation methods, but I don't think we can find a
 18 good way to recover that peak. It's almost impossible
 19 without any additional information about a storm event
 20 and applications. So, here, I really want to emphasize
 21 one point. And that is, in addition to select of,
 22 select a better interpolation method, we also need to
 23 take into account some very important factors. For
 24 example, storm event and also, application timing. In
 25 this way, of course, actually, about At-, Atrazine app



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1 concentrations, we may not know exactly what are going
 2 to happen during this four days. But, we do know
 3 something might happen during as unusual or as stable
 4 conditions. I'm talking about, for example, during the
 5 four day, we may, we know, we may have some
 information
 6 about rainfall. We may have some in, also, we may have
 7 some information about application. Of course, if we
 8 don't exact application information, but during the
 9 intensive Atrazine application period. I think we may,
 10 if possible, we can add more, we can get more samples.
 11 This is a, actually, this is the second question about
 12 sampling frequency. About this one, actually,
 13 yesterday we also talked about, something about this.
 14 I asked why we selected a four day time interval.
 15 Basically, if we select a four day time interval,
 16 probably, most of samples will be in the dry time
 17 period of samples, 'cause, we may miss some very high
 18 peaks. So, I think the determination of the sampling
 19 frequency also should consider the major factors, for
 20 example, storm events, and Atrazine applications. So,
 21 in this case, I really want to suggest to some, instead
 22 of constant sampling time interval, I really want to
 23 suggest so some variable sampling time interval. That
 24 means, during and after a rainfall event, and also,
 25 after applications, we may increase the samples. In

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1 that way, we may be able to get some peaks, you know.
 2 That's my major comments. Thank you.
 3 DR. HEERINGA: So, you're clearly
 4 recommending some type of adaptive sampling scheme,
 and
 5 I think it's, you know, after this first certain major
 6 study, there's a lot of information to inform that, and
 7 I think, that's a good suggestion. Jim Fairchild is
 8 the next associate discussant in this.
 9 DR. FAIRCHILD: I'm sorry, could I ask.
 10 DR. HEERINGA: You want to defer, okay,
 11 we can come back. Dr. Gay, Paige.
 12 DR. GAY: Thank you, Paige Gay,
 13 University of Georgia. I think my comments, pretty
 14 much, are along the same lines. I had an appreciation
 15 for the staircase interpolation, except where there
 16 were higher concentrations and rainfall events. And I
 17 thought a more rigorous sampling regime closer to the
 18 applications times might be warranted, realizing that
 19 that does include more manpower, and monetary
 20 resources. But that, certainly, might be beneficial on
 21 some small scale to fill in some of these gaps. And I
 22 do recognize that missing total peak might not be as
 23 obvious as it might seem that that could occur, because
 24 it, as noted, usually, you, probably, would catch some
 25 portion of the peak. You know, even if it's on the

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1 very tail ends, that you would have some indication
 2 that some kind of event had occurred during that four
 3 day period, and how you could use the precipitation
 4 data, perhaps, to, in conjunction with an identifier,
 5 that there was some kind of change in the concentration
 6 to make an estimate, and that's just way beyond what I
 7 have the expertise to really think about, but
 8 identifying places in the chemographs where, based on
 9 the rainfall, where there seems to be something missing
 10 in the four day regime might be something to pursue.
 11 In looking at the linear interpolations based on PRZM,
 12 I became really unsure that the, out of 80 chemographs,
 13 66 yielded higher concentrations than the absolute site
 14 measurements. And these ranged from 1 to 1,320 percent
 15 higher, although, none of these estimates caused there
 16 to be an increase in the LOC. I was not sure that this
 17 didn't just introduce more uncertainty by trying to
 18 estimate fill in gaps using this method, than, that's
 19 just a, really, big range for me and introduces more
 20 error that you're not going to sufficiently capture.
 21 I, suggestions for interpolations, which I gleaned in
 22 the manuscript, were previewing conditional simulation
 23 time series interpolations and trying to discuss this
 24 is way beyond any kind of scope that I could get into,
 25 so I'm just going to defer on that. The Crawford data,

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1 I thought, was interesting, and certainly was worth
 2 pursuing, in order to try to estimate some kind of
 3 uncertainty factor, particularly, since one of the
 4 sampling regimes did kind of mimic what we had here.
 5 And, I think that the, with the exception of samples
 6 collected during the initial post-application period, I
 7 think the W46 might have had a higher rate of those,
 8 maybe. But, it was a pretty good fit, and I think it
 9 gives a really good thought that you could use that,
 10 and you know, with pursuit to get an estimation factor
 11 of the uncertainty, based on the sampling regime.
 12 Because, certainly, when you start applying this to
 13 other areas, you're just not going to be able to go out
 14 there every for days. It's just not going to happen.
 15 DR. HEERINGA: Thank you, Dr. Gay. Chris
 16 Grue, Dr. Grue.
 17 DR. GRUE: Chris Grue speaking. There's
 18 a significant tradeoff here between, you know, sampling
 19 frequency and logistics and expense. And that's been,
 20 that's been already discussed. And, I think, I'd argue
 21 that this study is unusual in its sampling frequency.
 22 You just don't get frequencies this often. So, to
 23 suggest that we're going to sample more frequently,
 24 probably, is not realistic. And, I make that point,
 25 maybe, based on some other, some other thoughts looking

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1 at the data. It may require some understanding beyond
 2 that I have, but, certainly, maybe, in the existing, in
 3 the existing data. For example, the auto sampler data,
 4 you know, how well that compares to the data that were
 5 collected on those sites. I think you can give us some
 6 insights. In the overall assessment, if I'm
 7 interpreting the data correctly, it didn't make any
 8 difference on the SSI's relative to the LOC's. So,
 9 that's some, that's some comfort. Yet, you're still
 10 left with, you know, some uncertainty, and I think the
 11 point made that, and we've discussed this, that the
 12 frequency of peaks, and the magnitude of peaks, are
 13 very important in deciding whether or not the ultimate
 14 SSI exceeds the LOC. So, what we don't want to do is
 15 miss peaks, or miss peaks frequently enough that it
 16 alters our interpretation of the position of the SSI
 17 relative to the LOC.

18 One thing that I think might be helpful,
 19 and is, you know, in looking at precipitation events,
 20 themselves, relative to the grab samples and the auto
 21 samplers, and others, do auto samplers accurately
 22 capture that. It may be that, as you move forward with
 23 your monitoring effort, just to develop some additional
 24 comfort level with this, that the auto sampler effort
 25 be increased to, again, confirm the, at least, initial

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1 results, that even if we miss some peaks, the magnitude
 2 of the effect on the position of the SSI relative to
 3 the LOC is, doesn't, really, appear to have a big
 4 impact.

5 Related to the staircase and the linear,
 6 those seem to be the two approaches that could be
 7 taken. I'm certainly comfortable with the staircase.
 8 It's certainly more conservative, or potentially more
 9 conservative than the linear. And, the idea of, you
 10 know, from a regulatory perspective, to build a certain
 11 amount of conservatism in the modeling or in the
 12 results, the process is certainly, is certainly
 13 realistic. And I'm going to, I know Dr. Ellsworth has
 14 some comments related to interpolation, and I'm looking
 15 forward to having him chime in at the appropriate time
 16 on this.

17 The other thing I just want to mention,
 18 with respect to the interpolation is, I think the
 19 approaches are appropriate, except where you're missing
 20 data. And we've talked about this, relative to the
 21 intermittent sites. I don't think, just say, well, we
 22 recommend staircase, but then, staircase across the
 23 board. I think staircase where you feel you have
 24 adequate data to apply any type of interpolation
 25 strategy.

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1 That kind of leads in, then, to another
 2 point, and that's the 2X. I'm really left unsure as to
 3 why 2X. I don't know if that was a-, to me, I
 4 couldn't, really, looking at the information, get a
 5 good feel, as far as 2X. In the introductory material
 6 relative to the development and application of the
 7 model, and it was a question I brought up earlier, in
 8 terms of position of the SSI relative to the LOC, and
 9 the, what appeared to be, now, some, not necessarily
 10 real, but somewhat modified chemographs, where those
 11 sat, relative to the LOC and the suggestion that, well,
 12 we can apply a multiplication factor here in terms of
 13 safety, but I'm not really clear on why 2X. Why not
 14 something else, what's, what is 2X. And, in fact,
 15 given that, at least it's been suggested, that there's
 16 a number of cons-, there's a certain amount of
 17 conservatism that's been applied to each one of the
 18 different steps. How does that come into coming up
 19 with the 2X. And, so that's, essentially, what I would
 20 like to see some additional clarification as to the
 21 basis for the 2X.

22 DR. HEERINGA: Mark or Nelson, I guess,
 23 the question as I understand Chris' comment or question
 24 is that 2X has been presented, was there sort of a
 25 quantitative argument, based on a set of data or

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1 results that led you to that factor, is it just that 2
 2 is better than 1, and less than 3? Well, that 3X is
 3 used in a number of other situations, but, so.

4 DR. ERICKSON: This is Russell Erickson.
 5 As Mark talked about in his talk yesterday, the 2X is
 6 the rough uncertainty factor that we carried over from
 7 the, the CASM model because of the uncertainty
 8 established with the toxicity value selection. And so,
 9 that it, basically, went out, based on the sensitivity
 10 analysis regarding random selection of the EC 50's
 11 going out to standard deviations for several of the
 12 chemographs that went out about a factor of two, and
 13 what it really means is that, if you, in application,
 14 if we're within a factor, then, within that factor of
 15 two, of the, of saying the LOC is exceeded that the
 16 LOC, actually, might be reached. Again, depending upon
 17 the nature of the chemograph, which and it isn't
 18 refined for that yet. But the, that the LOC, actually,
 19 might be reached at those sites for, again, the two
 20 standard deviation limit on the possibilities of the
 21 toxicity data. But, Mark's work was, actually, saying,
 22 and this question is, actually, addressing, not so much
 23 that 2X factor, which I just explained, but the
 24 additional uncertainty that might need to be opposed on
 25 the analysis because of the uncertainty in the exposure



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1 information. So, the 2X is, sort of, a starting point,
 2 as far as saying, if you're within a factor of two
 3 model uncertainty relative to the toxicity data, means
 4 you're, at least, in a gray area of where you're
 5 getting to where the LO-, an LOC might be exceeded.
 6 But, this actual charge question is more oriented, not
 7 that we can't discuss both, but this charge question is
 8 more oriented toward the, how you do the additional
 9 uncertainty related to the exposure.
 10 DR. CORBIN: And this is Mark Corbin, and
 11 I would just add, do you do that for the monitoring
 12 data relative to what Russ just described, maybe yes,
 13 maybe no. And that's what we're looking for feedback
 14 on, is that appropriate. But the 2X factor is
 15 separate. That's based on those environmental
 16 conditions and the toxicity data that Russ described on
 17 Monday, Tuesday, seems like Monday, sorry.
 18 DR. HEERINGA: Dr. Grue, go ahead, no,
 19 please, I think you're on the right track, here.
 20 DR. GRUE: So, are we looking at two 2X
 21 factors, or are we looking at one 2X factor, and it's
 22 applied at this point?
 23 DR. CORBIN: This is Mark Corbin. I
 24 think we're not sure, is what we're asking. I think
 25 for the model sensitivity analysis that Russ described,

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1 that was, sort of, a rough estimate. It's not - -
 2 DR. ERICKSON: It is, too, and the one
 3 we're applying, we're only applying it once.
 4 DR. CORBIN: Right, and we're only - -
 5 DR. ERICKSON: Okay, well, I, well, we're
 6 starting with one 2X factor that started with the CASM
 7 analysis, as I, sensitivity analysis, as I explained
 8 it, okay. So, that's, and that's certainly subject to
 9 discussion, as far as whether that's an appropriate
 10 factor, but that, that 2X factor, if you nominally take
 11 your exposure data from any field site, and are within
 12 that uncertainty factor, you, at least, have to take
 13 that, that site is at least subject to some concern,
 14 that the LOC might be evaluated within the bounds of
 15 that uncertainty. And so, we're really talking about
 16 one 2X factor, but then, an additional question about
 17 whether the uncertainties involved, like the
 18 uncertainties involved in the interpolation, the data
 19 interpolation should involve additional uncertainties
 20 to be imposed on the LOC evaluations to account for the
 21 uncertainty on the exposure side. The 2X is more on
 22 the effects side, where there's a starting point,
 23 should there be additional uncertainties expressed
 24 because of these exposure site issues, and those aren't
 25 necessarily 2X. I mean, nothing specific has been

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1 proposed. So, the 2X in this charge question is just
 2 referring back to the effects uncertainty factor. And
 3 the question here, more, is, should it be larger than
 4 2X to account for the, some of the uncertainties that
 5 Mark talked about in the, on the exposure site. I hope
 6 that helps.
 7 DR. HEERINGA: Dr. Grue.
 8 DR. GRUE: Yeah, Chris Grue. So, my
 9 understanding is that you're proposing a 2X based on
 10 the exposure data, and the variability in the expo-,
 11 that, the results of the microcosm mesocosm data,
 12 DR. ERICKSON: Yeah, the effects data.
 13 DR. GRUE: The effects data, yeah, thank
 14 you. And so, the question to us is, should we be
 15 imposing some additional safety factor beyond that
 16 because of uncertainty associated with exposures in the
 17 field. Is that, that's correct?
 18 DR. ERICKSON: Yes, that's correct.
 19 DR. GRUE: So, with respect to that, I
 20 don't know if other committee members are left with
 21 this, but I have, I'm having a hard time realist-, you
 22 know, kind of balancing the uncertainty with the
 23 conservatism that's been built into the process. And I
 24 don't know if it's possible to do this, but it's almost
 25 like, you know, a mass balance equation in the sense

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1 that, you know, at what points do we feel we're on the
 2 conservative side, and to what extent do we think we
 3 might be conservative versus where our uncertainty is,
 4 and how much correction factor do we need. And I don't
 5 know, because the, I think this is a-, at least for me,
 6 this is a difficult part of this question to answer,
 7 because don't know what's been built into the system a
 8 priori. I mean, if there's certain un-, discomfort
 9 associated with the uncertainties associated with
 10 exposure, then it may be appropriate to add on an
 11 additional safety factor here. But, I'm trying to look
 12 at the entire process, and just from comments that have
 13 been made, certainly from the registrant side, and I
 14 think it was made several times, in terms of, well,
 15 this is an extremely conservative approach, how do we,
 16 and I can understand that there may be a different
 17 interpretation from the regulatory side, but what is
 18 the sense in terms of from the regulator in terms of
 19 what aspects of the process introduce conservatism,
 20 what aspects of the process, to what extent, then, do
 21 we need to add additional, an additional safety factor.
 22 DR. ERICKSON: Well, would you like me to
 23 comment from the effects side, as far as where I think
 24 it is conservative, or do you want to just leave this
 25 as a comment and not a question?

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1 DR. HEERINGA: I'll leave that up to Dr.
 2 Grue, at this point.
 3 DR. GRUE: Well, I think, my point was,
 4 when I got to this section in the document, some
 5 additional explanation in terms of what the 2X was,
 6 what the basis for the 2X was, were we looking at
 7 additional, request for additional safety factor,
 8 whatever, would be helpful. But, also, some sense of
 9 the conservatism that's already been built into the
 10 process.
 11 DR. HEERINGA: I think, Dr. Erickson, if
 12 we could leave it at that for the time, and we'll get
 13 the other comments. And then, before we leave the
 14 question, if there's, if this has sharpened up and we
 15 need to revisit it, we will. The next, are you
 16 satisfied, Jim, or did you have anything that you want
 17 to add in this, Jim Fairchild?
 18 DR. FAIRCHILD: I do, and first of all,
 19 I'd like to apologize. You didn't catch me asleep.
 20 You, actually, caught me thinking.
 21 DR. FAIRCHILD: To answer that, that two
 22 stage question that, it appears that sampling every
 23 four days is adequate, based on the concentration
 24 duration profiles that have been observed. And at the
 25 frequency, as long as it's four days or less, appears

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1 more than adequate, based on the needs and the outputs
 2 of the CASM model. However, I might say that if,
 3 outside the CASM model, if one were sampling for truly
 4 empirical risk assessment purposes, then event based
 5 sampling might be developed using auto samplers
 6 programmed at prescribed intervals that acknowledges
 7 local patterns of planning Atrazine application and
 8 rainfall patterns, much as Dr. Chue said. This
 9 probably could explore-, be explored using the data at
 10 hand on a site specific basis. And it may produce data
 11 just of good quality with fewer samples and less
 12 overall expense.
 13 In regards to the uncertainty questions,
 14 I think, there are a couple approaches to this. One is
 15 to continue to run the CASM model under various
 16 scenarios beyond the chemographs and uncertainty
 17 levels, in effect, levels currently found in your
 18 studies to find out what results that leads to. The
 19 problem with that is, this is going to force you to
 20 select an SSI percent deviation that the EPA or the
 21 Agency's uncomfortable with. But, ultimately, I would
 22 expect that you would compare the outputs under
 23 different uncertainty scenarios, and go back to the
 24 original microcosm and mesocosm data, and compare that
 25 against the endpoints used by Brock, in addition to

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1 other endpoints that are associated with these studies.
 2 And ultimately, 'cause at that point, and again, I'm a
 3 very practical person, you are able to judge the model
 4 output with what ecological significance might be. And
 5 that should tell you if the 2X certainly, uncertainty
 6 factor is tolerable. Again, ultimately, though, it's,
 7 kind of, what is the Agency going to accept as a
 8 trigger of a level of concern.
 9 DR. HEERINGA: Thank you, Dr. Fairchild.
 10 Dr. Portier is our final associate discussant, and then
 11 if we have other comments, why.
 12 DR. PORTIER: And you have caught me
 13 writing, as I was trying to get my thoughts together on
 14 this. I wanted to pick up on what Dr. Grue said, and
 15 kind of, think about the issue of whether the stairstep
 16 method is truly conservative, because, I think, we have
 17 a feeling that it's conservative. So, I was trying to
 18 take it through the whole process of passing it through
 19 the CASM model, through the SSI index, to the LOC
 20 decision rule. So, compared to what we assume the true
 21 concentration duration profile is, the stairstep method
 22 tends to result in lower magnitudes of longer
 23 durations. And we've seen that when we look at events
 24 that have been caught with auto sampler. We tend to
 25 see a sharper peak, and a quicker return, and the

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1 stairstep method, kind of, flattens that out. When we
 2 look at the effects scores from the micro mesocosm
 3 effects assessments, we can see that concentration
 4 seems to have more of an effect than duration. And I
 5 say that, because the slope of that decision line is
 6 not very sharp, right. I mean if duration had a real
 7 effect, that slope would be short, and in fact, I keep
 8 looking at that chart and drawing different lines, and
 9 I almost feel like a better line is straight across,
 10 and forget duration, and just look at concentration.
 11 So, I have a feeling that concentration, kind of,
 12 should be a more important factor than duration in this
 13 effects score. The CASM model LOC method, the
 14 combined
 15 method, links the magnitude in duration in the
 16 chemograph through the CASM model, and then, with SSI
 17 averaging to the LOC.
 18 So, looking at the SSI, I spent some
 19 time this morning trying to understand what the SSI
 20 really does. And it's a, if you take one specie, and
 21 you assume that the baseline is 100, and then you look
 22 at, well, what happens if I reduce it by 10 percent, 20
 23 percent, 30 percent, what is that SSI response going to
 24 look like. It's really a convex curve, kind of. So,
 25 that the effect is not that big on small changes, and
 it's gets kind of big further along. So, if the effect



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1 of peaks has a real impact on biomass, but the SSI, and
 2 you're missing that big effect on biomass, and then the
 3 SSI is only, is not giving strong weights to the lower
 4 end, and it's giving weights to the upper end, we're
 5 kind of combining, it seems to me, you're combining
 6 anti-conservativeness here, right. You're kind of
 7 being more liberal. And I'm not exactly sure about
 8 this. So, I'm afraid that the effect of missing the
 9 maximum concentration can propagate through the CASM
 10 model and the SSI index, to result in an
 11 underestimation of effect. So, that's kind of one
 12 side.

13 The other side is, well, you do this
 14 whole calibration process. And the calibration process
 15 takes into account that stairstep issue. So, it could
 16 be that the LOC you get is adjusted for all of this.
 17 And because of the complexity of this whole thing, I
 18 really, now, the whole, this whole discussion really
 19 comes back down to how critical it is to really do a
 20 great job on the sensitivity analysis. Probably an
 21 order of magnitude more than what you've done to this
 22 point to really understand how these effects propagate
 23 through. I just, I can argue it both ways. I tend to
 24 feel that it's, it tends to underestimate effect. And
 25 I see, the audience, you say, no, it's the other way

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1 around, but.
 2 DR. HEERINGA: Jim Fairchild.
 3 DR. FAIRCHILD: Well, I think those are,
 4 that's a very good point, and, you know, it kind of
 5 strikes me in coming to this panel that we see the
 6 presentation of the CASM model. We see what this, and
 7 this projected SSI deviations are. And we're having
 8 trouble saying, you know, what is the significance of
 9 that. Well, why didn't the Agency ask them to go to
 10 the second level, and, actually, look at the consumer
 11 or a higher level using the model, which is exactly
 12 what it was created for.
 13 DR. HEERINGA: Dan Schlenk.
 14 DR. SCHLENK: Yeah, I just wanted, Dan
 15 Schlenk, just wanted to follow up on that. I thought
 16 that was a really good question as well as. I think,
 17 anytime you assume that you're targeting the only
 18 population of organism in a system, I think you have
 19 uncertainty automatically. And there's some other
 20 documentation that was sent from National Marine
 21 Fisheries that indicated that, particularly, some of
 22 Mike Lightey's work, where you saw a mixture effects
 23 with other, or you know, phosphates and some other
 24 compounds that may target the consumer, as opposed to
 25 primary producer that, again, I know, this is, we're

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1 focusing only on compound, but I think you have to have
 2 some uncertainty in that evaluation as well. So, to
 3 me, the twofold, I think, is a good starting place, if
 4 not, you know, and again, I know this is trying to deal
 5 with exposure and not effects, but, I think with the
 6 effects, and the fact that, you know, you may not be
 7 getting the right target, per se, as far as what you're
 8 doing your risk assessment for.
 9 DR. HEERINGA: Dr. Young.
 10 DR. YOUNG: I'd like to build on what a
 11 lot of people have said here, and also, to try to get
 12 back and drill down to the question of separating this
 13 extra variability out. One of the ways that you could
 14 begin to do that, based on the model, and I'm going to
 15 repeat one more time. You need to build in uncertainty
 16 associated with your model, which you haven't done yet.
 17 But given that, you do have information on storm
 18 events. You have information on a lot of things that
 19 you could do some type of a time series and estimate
 20 and kind of do some prediction of peaks. So, you could
 21 go back, and you could, to, as, get this, this
 22 assessment of variation, you could go back and create,
 23 using various methods, and I wouldn't stick with one,
 24 I'd try several different ones, to fill in that
 25 information. And, actually, see how high the peaks you

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1 would, to be, and especially, I think, to get the tops
 2 of the peaks, not just the middle levels or the end of
 3 it. And then, see what effect that has. And so,
 4 create several different scenarios, that would be
 5 consistent with the data, that would capture the peaks,
 6 and see what effect that has, and how much variability
 7 is associated with the LOC in doing that. And then,
 8 you could, could begin to assess whether or not you
 9 need to build in. And I would say, yes, you need to
 10 build in that, in addition to the 2X, because that is
 11 an additional source of variation.
 12 DR. HEERINGA: Dr. Ellsworth, did you
 13 have something to add on there.
 14 DR. ELLSWORTH: Tim Ellsworth, here.
 15 This is kind of an area dear to me. I like this topic,
 16 so, humor me here. The auto samplers provided this
 17 continuous sipping during a six or eight hour period,
 18 and that has a great impact on the peak estimation,
 19 like has been said. I actually went to the literature,
 20 and I found a paper for several different catchments
 21 where they had seven to fifteen minute sampling
 22 intervals for Atrazine. And, you know, I did, my
 23 estimate on that, conservatively, the peak over,
 24 compared to an eight-hour composite, the peak was about
 25 150 percent greater than what an eight-hour composite



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1 would estimate during a storm event. So, I mean,
 2 that's from other studies, but I'm just saying, that's
 3 a point of concern. So, even though you found that the
 4 peak, the auto sampler data showed you had a higher
 5 peak, than you got with the grab samples, the true peak
 6 is fairly, is bigger than that, considerably.
 7 And another thing, that Michael
 8 mentioned, the auto samplers, it says in the Syngenta
 9 report, caught 149 of 178 flow events, okay. So, that
 10 was with the auto samplers. They missed some, too,
 11 somehow. I don't know. But the grab samples,
 12 obviously, missed more than that, and we would have
 13 that information from the depth recorded, you know,
 14 idea, so you could get an idea. There's some
 15 uncertainty there, and how many of those chemographs
 16 had events missed. And I think the thing that was
 17 brought up earlier, here, is, you know, you targeted
 18 which areas to sample in the U.S., based on
 19 probability. You probably want to do something like
 20 that when it comes to Atrazine time series. You want
 21 to concentrate on, like Michael said, during the
 22 events, during that two month window following
 23 application, you know, where you're going to get the
 24 most for your money.
 25 The other thing that was mentioned by

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1 Dr. Young and others is this idea of auto correlation.
 2 The composite samples give you some indication at, you
 3 know, ten of these locations of that auto correlation.
 4 They're going to have a greater degree of auto
 5 correlation. There's some ways to, you know, you can,
 6 at least, bracket what the auto correlation would be
 7 for a point sample, given what you've got with the auto
 8 sample data. And I think it would be important to go
 9 back in and try to quantify for, and it's going to be
 10 flow event specific. It's going to be watershed area
 11 specific. The characteristics of that watershed,
 12 what's the slope, et cetera. I think it's going to be,
 13 those factors are going to come into play, but you
 14 could look at an estimate of auto correlation, and then
 15 you could come in on your graph sample time series, and
 16 start to put some uncertainty. You can predict what
 17 the concentration would have been with the most
 18 important part of that is, what is the uncertainty in
 19 between a four day grab sample that's in there. You
 20 know, you can come up with a pretty good estimate of
 21 what that uncertainty is to propagate through your
 22 uncertainty analysis.
 23 And then, the ideas of looking at
 24 secondary auxiliary flow data to help you improve that
 25 estimation or minimize that uncertainty any way you can

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1 would be useful.
 2 Finally, I'm, actually, there's two more
 3 things here. One of them is something I discussed with
 4 Dr. Erickson. And that is, what is the proper time
 5 weighting that should be used here, in terms of a daily
 6 sample. CASM has an average daily concentration that it
 7 uses. The actual concentration during a day fluctuates
 8 greatly, you know, consider a CASM model that had an
 9 hourly time step. Okay, if you put in a certain daily
 10 fluctuation and concentrations into that kind of model,
 11 and got a, and used it to calculate an average daily
 12 SSI for that day, what would be the equivalent
 13 concentration you'd want to put into this daily time
 14 step CASM that would create that same SSI. And it's
 15 not clear to me that it's simply the average
 16 concentration for a given day. You've got a non-linear
 17 model here. There's some upscaling that's definitely
 18 going on when you feed in that type of a measurement.
 19 So, and what you may find from that analysis is that,
 20 really, you can get away with, maybe, a two day
 21 composite. Maybe what you want is a composite sample.
 22 And maybe it's a two or a four day composite. Maybe
 23 those short range fluctuations are going to give you
 24 something similar to what you would get feeding in.
 25 You know, you might, actually, end up saving yourself,

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1 in terms of sampling costs doing that.
 2 The last thing here is on the
 3 uncertainty analysis. I've got several references.
 4 One of them, specifically, I think, applies really
 5 close to home here. It's a forest landscape ecology
 6 model looking at four scenes due to global warming
 7 uncertainty. So, they've got similar bioenergetics
 8 equations. They've got similar uncertainty in the
 9 input variables like we've got here for physical
 10 chemical properties. And they've got uncertainty in
 11 the model parameters between the different species.
 12 And, so, what they're doing is, I mean, they've got
 13 methods fast is one of them, that looks at, even though
 14 there are dependencies between the input variables and
 15 the model parameters, you can come up with good
 16 estimates on what are the sources of uncertainty in the
 17 model output. And you can bracket those and come up
 18 with good, you know, confidence on what that range of
 19 uncertainty would be. So, that's it, anyway.
 20 DR. HEERINGA: Thank you very much, Dr.
 21 Ellsworth. Yes, Bob Gilliom.
 22 DR. GILLIOM: This topic opens up a lot
 23 of things that you could have a lot of detailed
 24 discussion on, and I'll try to put some comments in my
 25 input to the discussants on this. The one issue I just



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1 wanted to return to for a second that, I think, was
 2 brought up by Chris, and it's been alluded to by
 3 others, is the importance of considering each source of
 4 uncertainty and bias, intentional bias for
 5 conservatism. In the whole scheme of the approach,
 6 starting with the Brock scores in the LOC. And without
 7 saying which decision should be made, it needs to be
 8 really, clearly, spelled out where there is, and is
 9 not, a decision that effects a uncertainty factor, or
 10 a conscious choice about conservatism. And I return,
 11 just for example, to the LOC decision, because, when
 12 you look at the LOC at four, and you look at the
 13 sensitivity to short-term events, it was relatively
 14 low. I'm going from the Syngenta presentation. Those
 15 upper level choices on LOC exceedance at four weren't
 16 that affected by using the PRZM fill in method, which
 17 produced high peaks. On the other hand, if you looked
 18 at the same issue down at the lower levels of LO-, if
 19 you had lowered LOC to one or two, there was systematic
 20 effect on those values with some of the very high
 21 peaks. So, there's an interactive sensitivity going on
 22 in all the choices that starts at choice one. And
 23 then, if that's all bought off on, and you're going
 24 ahead, fine. State that degree of choice clearly, but
 25 then acknowledge, and it may change how you do the

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1 later uncertainty with exposure, acknowledge that,
 2 then, you're building off that, and now you need to
 3 deal with it on those terms. And that may change which
 4 duration exposure is really what you need to quantify
 5 the uncertainty end. And that's, it's a big topic, but
 6 broad advice.
 7 DR. HEERINGA: Additional comments. I
 8 wanted to, my role as chair, Dan Schlenk had mentioned
 9 a communication he received, which he forwarded to the
 10 DFO, and the DFO will distribute it to the panel from,
 11 it appears, Tony Hawks of the National, is it National
 12 Marine Fishery Service. There was a short email
 13 message, which is part of the public docket, and then,
 14 an PDF of a report produced by the National Marine
 15 Fishery Service, which, I think, critiques the
 16 application of the CASM model. In addition, Syngenta
 17 has provided a scientific response to that critique in
 18 the National Marine Fishery Service report. I don't
 19 believe that I'm going to bring that into this
 20 discussion at this point, but I wanted to make
 21 everybody aware that those two documents are available
 22 in the public docket and will be made available to the
 23 panel fully, too. So, we're all aware of that in terms
 24 of that, so, okay.
 25 Additional comments or contributions on

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1 charge question number nine. I'm going to turn to,
 2 this is probably the, at least to this point, one of
 3 the more difficult, the safety factor, or uncertainty
 4 factor questions in these panel proceedings are always
 5 the one that lead to the most ambiguous responses.
 6 And, but I think that there's some evidence that the
 7 panel, even with their extensive review, here, is
 8 struggling with some issues of this, but I'll turn to
 9 Dr. Brady and then to the scientific team here, to see
 10 if there are specific points of clarification.
 11 DR. BRADY: Yeah, I would just ask down
 12 the table to the EPA scientists, is there any
 13 additional questions or --
 14 Okay, plenty of food for thought was the
 15 comment.
 16 DR. HEERINGA: Okay, what I'd like to
 17 recommend, then, is that we're a quarter of twelve.
 18 Let's take an hour and fifteen minutes for lunch, and
 19 reconvene at 1:00 p.m., at which time, I believe, that
 20 we're going to have another presentation that Nelson is
 21 going to do, setting us up for our consideration of how
 22 might this all be applied. And that results in our
 23 review of charge questions ten and eleven. So, we'll
 24 see everybody back at 1:00 p.m. then.
 25 (WHEREUPON, there was a break for lunch.)

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1 DR. HEERINGA: Welcome back everybody to
 2 the, I think, I'm confident the final afternoon session
 3 of our formal three-day meeting of the FIFRA Science
 4 Advisory Panel on the topic of the interpretation of
 5 the ecological significance of Atrazine stream water
 6 concentrations using a statistically designed
 7 monitoring program.
 8 I think that we are at the point where
 9 we are going to begin to address the final of the three
 10 topics that were part of this meeting. Again, it's
 11 integrated, but it's been broken down into three sets
 12 of presentations and charge questions. And, I guess,
 13 Dr. Brady, if Nelson Thurman is ready to go, well, why
 14 don't you go ahead, Nelson.
 15 DR. THURMAN: Okay, so, without further
 16 introduction, this is the last part, and this is, kind,
 17 this is very much a work in progress. In fact, there's
 18 work on my desktop back in the office that I haven't
 19 even been able to address yet. So, I'm going to try to
 20 give you an update, just kind of a reminder, we're
 21 looking at the third part of the IRAD was to identify
 22 those attributes that we use to identify where high
 23 Atrazine exposures are likely occur, particularly, in
 24 relation to exceeding the LOC.
 25 There's been a lot of comments that



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1 have, kind of, started down those lines, and some, I'm
 2 looking forward to hearing more of those. I'm just
 3 going to give you some of the preliminary ideas. It's
 4 not an all exhausted list of factors. In fact, I
 5 think, as you look at them, you're going to probably
 6 recognize advice I have as being a former field soil
 7 scientist in some of the initial things I've looked at.
 8 And that doesn't mean those are all we're looking at,
 9 but it's, at least, a start. And this is one where we
 10 very much look forward to your input on this and
 11 recommendations, 'cause I think this is, we're just
 12 starting on this. We've got some ideas, but we look
 13 forward to more input. When we look at
 14 this, there's actually two parts to this question, and
 15 I think we, there's been a lot of discussions already
 16 zooming in this. We know there's an index monitoring
 17 site within that HUC 10. And we know that, at least,
 18 two sites that index monitoring site exceeded the LOC.
 19 So, one of the questions that we have is, can we
 20 identify other stream segments, or that, are there
 21 streams of the water bodies that may, also, be
 22 exceeding that.
 23 One of the conditions of that IRAD was
 24 that, if they did, if Syngenta's monitoring did find
 25 sites that exceeded the LOC in at least two years, then

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1 they needed to go follow up and do some additional
 2 monitoring in that area, look for additional sites,
 3 look for sources, and there's a lot of characterization
 4 work that's gone into that. That's not part of this
 5 discussion because they're still working on that part,
 6 but that is additional information that we feel will be
 7 coming into inform us on that.
 8 The second part of the question is, are
 9 there characteristics of these watersheds that can help
 10 us identify other watersheds within the population
 11 vulnerable watersheds. So, that's the, within the
 12 target population, and we've talked a little bit about
 13 that, those implications. I think a lot of this
 14 discussion has already occurred. I'm just going to
 15 recap here. Tony noted earlier, it's feasible in a
 16 monitoring study at a single targeted site. And, so,
 17 we do know that there are two sites in Missouri that
 18 exceeded those LOC's. And, I think, they're, actually,
 19 in three years of studying.
 20 The next issue, and it's one important,
 21 it's important both for targeting the mitigation
 22 actions that have to be done in those watersheds, but
 23 also, identifying other stream set, segments may be
 24 similar for future monitoring studies and future
 25 efforts is, how well can we identify other streams that

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1 may, that may, similarly, exceed that LOC. And I'm
 2 going to start the, confine it, first, to talk about
 3 within those particular watersheds, but then, we're
 4 going to expand that beyond.
 5 You know, the first idea, there's three
 6 possible initial approaches you could take a look at.
 7 The first one is, okay, we had a target monitoring site
 8 within that HUC 10. Let's assume that all the waters,
 9 all the streams within that HUC 10 exceed the LOC.
 10 Now, there are obvious problems with that because, and,
 11 because the selection criteria automatically excluded
 12 some types of streams, and targeted others, so that,
 13 you would, basically, be lumping in streams that were
 14 excluded because of the initial criteria. And excluded
 15 for reasons where we didn't think it'd be likely that
 16 they'd have elevated levels of Atrazine.
 17 The second approach is to assume that
 18 all the stream segments within that water, that HUC 10
 19 watershed, that met the initial site selection criteria
 20 would, also, be exceeding in the absence of any
 21 information. A third approach is to have more
 22 monitoring at each of those stream segments. And then,
 23 kind of, another approach that goes beyond-, starts to
 24 extend beyond just these initial sites, but in other
 25 areas, is take advantage of other, improved geospatial

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1 information.
 2 Take advantage of the site specific
 3 information that Syngenta was collecting in these
 4 watersheds. Take advantage of new, things like the new
 5 NHD, National Hydrography Dataset, more detailed land
 6 use information and more up-to-date land use
 7 information, and see if we can better, better predict
 8 additional streams that might exceed that. So, I'm
 9 going to try to, I think, first of all, I'm going to,
 10 kind of, use this example to illustrate that, these
 11 approaches.
 12 This is the Missouri O2 watershed. The
 13 sa-, the stream segment five was the stream that was,
 14 was the segment that was sampled where the index
 15 location was. Obviously, if you took the first
 16 approach, say, all right, that index site represents
 17 all the streams, the entire streams, you can see the
 18 little here, this shows where your larger stream
 19 segments are in this. The same watershed in the upper
 20 left here, you see a lot more detail, the stream
 21 segments, they were color coded based on flow
 22 accumulation. The, well, it's, allegedly, orange,
 23 whatever color that is right there, that's the 92 NLCD
 24 row crop area. So, you can get an idea that, it is an
 25 area that has a fairly intensive amount of row crop



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1 there for each unit, so it's not one that's just, you
 2 know, the stream segments didn't just, necessarily, hit
 3 the one isolated spot within the watershed in that
 4 regard.
 5 So, the second approach would say, all
 6 right, let's just look at the stream segments that met
 7 the criteria. And if you look in the right-hand side,
 8 those stream segments shown in red are the ones that
 9 met the criteria. And so, that approach, basically,
 10 said, you know, they are similar in conditions to what
 11 we had here, and, therefore, you know, those would
 12 similarly meet the LOC in the absence of any further
 13 monitoring that is the likely approach to take.
 14 A few issues on that, you know, one of
 15 them is, is that you're making the assumption that
 16 those landscape characteristics that impacted this
 17 stream are uniformly present in these other segments.
 18 And, having spent time in the field, that's probably
 19 not going to be true. You're also silent on what's
 20 happening upstream here, or even, how far downstream
 21 those exposures may continue. So, that's, to us, that
 22 may not be, that's the most satisfactory approach to do
 23 that. There is another issue that Tony
 24 appr-, talked, mentioned in the looking at these site
 25 selection of HUC's. They ended up at the fifth stream

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1 go that site, you know, get the more detailed county
 2 level soils data, at least, not, at least, it wasn't
 3 electronically available. There are still a few
 4 counties where that's not available, and in talking
 5 with NRCS later in that, sometime in the next year,
 6 they expect all of them to be rolled out. We've
 7 already been talking to them about, you know, the other
 8 challenge, and I'm going to mention it now, because
 9 it's, comes up in why you only see certain things in
 10 this presentation, is, right now, you've got to process
 11 that county level data county by county. And it takes
 12 a while to download it and get it processed spatially.
 13 So, we've been, also, been talking about NRCS about,
 14 you know, ways of doing this in multi, you know,
 15 pulling together counties covering, at the least, these
 16 areas of interest, but, ideally, the entire country,
 17 because there's a lot of value in that. And I think,
 18 there's, NRCS people realize that, and, I think, we
 19 will eventually get there. But that's one of the
 20 issues.
 21 The other thing, in 2006, a revi-, an
 22 improved version of the National Hydrography Dataset,
 23 the NHD plus was released. Honestly, if this version
 24 had been available back in 2003, I suspect we would
 25 have been going this way, rather than the watershed

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1 segment here. That means one, two, three, four, for
 2 whatever reason, they couldn't find a sampling spot.
 3 Now, if the reason they couldn't find a sampling was
 4 purely based on, there were no bridges, here, then we
 5 might still be able to assume that there are
 6 similarities.
 7 But, if it turns out that when they went
 8 out there, corn is no longer grown in these areas, or
 9 something else along those lines, then there may be a
 10 reason why these would be different. And so, you see,
 11 there's a lot of, you know, issues related to this
 12 approach that we're not really satisfied with, and we'd
 13 like to see if there's a different way to approach
 14 that. We haven't had a chance to start looking at the
 15 detailed site information that has been collected for
 16 these areas. That's on our, you know, huge laundry
 17 list, which has grown a lot bigger after this week.
 18 But, I think, those are thing that we do need to take a
 19 look at. And, you know, I just want to say, I
 20 appreciate that, because it, these are things that we
 21 do need to pull together.
 22 And there's a couple of things I want to
 23 point, you know, point out. In 2003, county level
 24 soils data was not available for a large part of this,
 25 the Atrazine use area. So, there was no way you could

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1 approach we took. And I notice there's some nods in
 2 the back from the Syngenta folks. I think we've all
 3 recognized the value of this and the importance of
 4 this. And I think there is value in this dataset now,
 5 in terms of taking the information we've gleaned from
 6 this study, taking the characteristics that we can get
 7 in more detail, and seeing what it tells us, using the
 8 NHD Plus as a vehicle for predicting sites that may
 9 similarly have elevated levels of Atrazine. So, this
 10 is one dataset that we're really going to be taking
 11 advantage of. And I will point out, even with the
 12 improved version, you start looking at it, you know, in
 13 detail, there are still some areas that need
 14 improvement in the improved version. But it's a lot
 15 better than the earlier version that we had. So, it's,
 16 you know, as one of my colleagues who works in GIS
 17 tells me, you know, that sometimes the best thing to do
 18 in GIS is wait, and it gets better.
 19 DR. THURMAN: And I think, honestly,
 20 we've been, because of some of the issues we've had,
 21 we've been pushing some things that have led to some
 22 improvements and changes along the line.
 23 So, in taking a look at the second part
 24 of that question is, all right, we know that from that
 25 population of forty watersheds that were sampled, we



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1 can say, for instance, you know, nine percent with the
 2 confidence bound of this vulnerable set of watersheds,
 3 and as you folks have pointed out, that's what we need
 4 to make clear, the target population was not the entire
 5 Atrazine use area. It was this set of watersheds that
 6 are identified as vulnerable, based on the warp values.
 7 We can say about nine percent of those vulnerable
 8 watersheds had streams with Atrazine levels exceeding
 9 the LOC multiple years.
 10 The other question we, we've, we had put
 11 in the original charge, which is, you know, no small
 12 feat in itself is, can we say where? Looking at that
 13 larger population, are there characteristics we'd be
 14 able to pull out of the study, and as it's been noted
 15 before, the study wasn't specifically designed to say
 16 where, but there are things that, in terms of gathering
 17 information, that we'd like to see what we can pull
 18 out. See if we can have a better idea of identifying
 19 areas where there's a higher likelihood for the
 20 exceedances to occur.
 21 I'm going to start with warp, because
 22 that's what we use to identify that level of high
 23 vulnerable areas. The darkest blue and that you see
 24 here represents the highest vulnerable watersheds. The
 25 sites that were sampled are shown in red and orange.

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1 One of the things that we are looking at is that, once
 2 again, we're representing, these represent this highest
 3 vulnerable, this darkest blue layer you see here. One
 4 of the things we want to take a look at, in terms of
 5 going beyond is, first, let's focus on the forty
 6 watersheds themselves.
 7 What similarities do we see in the
 8 watersheds that have exceeded the LOC, and what
 9 differences do we see between those and the other sites
 10 that didn't? So, there's a lot of, I think there was a
 11 report that Syngenta has recently submitted that, other
 12 than taking a look at it, a very quick glance through
 13 it, we haven't had a chance to look in detail. But
 14 they've looked at thirty-four various variables. We're
 15 looking at a number of factors, and we suspect there's
 16 more that can be looked at and hoping for some
 17 feedback there. But, are there things that we can
 18 extrapolate to the larger pool of vulnerable watersheds
 19 that may help us, based on what we learn from the
 20 comparison of these forty that may help us identify
 21 other areas with similar characteristics.
 22 I think Tony Olsen mentioned this
 23 earlier, and I just want to emphasize. We didn't,
 24 really, and this, we're not, this is not a knock on
 25 warp. We did not expect warp to have, the warp to have

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1 a correlation with those SSI values. You know, for one
 2 thing, we're only looking at the upper end of that
 3 distributional warp values. And we don't have SSI
 4 values for the, for everything else. So, you know,
 5 you're looking at a small snapshot.
 6 So, we don't, necessarily, expect that,
 7 didn't expect that to occur, but, you know, it's one of
 8 those things, that, well, we have it, let's just check.
 9 You know, you might, you know, let's check the obvious
 10 first before we move on. The two Missouri sites, just
 11 to let you know, these are the two multiple years of
 12 the Missouri '01 site, and multiple years for the
 13 Missouri '02 site. That dash line there is your four
 14 percent SSI. And you see there on either end of the
 15 scale of warp values. And this happens to be the warp
 16 estimates on the sub-watershed area, which, in effect,
 17 I think, as Dr. Effland's pointed out, it's still
 18 driven largely by use. But, you know, this, you can
 19 see, if these two sites had both been on this end, that
 20 might tell us something. The fact that they're on
 21 either end suggests that there are other factors come
 22 into play.
 23 Before I leave warp, I just want to, I
 24 want to put this up, and Bob Gilliom may cringe at the
 25 way we did this. And it's one of these things that,

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1 it's a gut feeling I've had that I'd like to be able to
 2 test in a little bit more detail. In this particular
 3 instance, we zeroed out the use part to see what would
 4 happen when you looked at the other factors. You
 5 could've used the uniform use intensity and, pretty
 6 much, gotten the same value, but we wanted to take a
 7 look at where would the other factors, the other
 8 factors included warp, where would they have ended up
 9 if use had been uniform in this area. And what you see
 10 is a slight shift southward in this area. And you see,
 11 there's the two Missouri sites.
 12 And one thing to point out, if we had
 13 stopped at use only, and selected based on the highest
 14 use intensity, those two Missouri sites would not have
 15 been in there. And this is my, you know, one of my
 16 impressions that, I think, can be tested, but we
 17 haven't done this yet. I think warp may be giving us
 18 two sets of vulnerable watersheds.
 19 One, because use is such a large factor,
 20 in one set of vulnerable watersheds, the use is so high
 21 that overrides any of the vulnerability factors, and so
 22 that you end up having a high-, those included in the
 23 high tier, based on use alone in this. And the other
 24 vulnerability factors, the soils, the weather, and
 25 such, may not be as, that high in and of themselves.



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1 The second one is where, you still have
 2 high use, but it's not nearly as, it's not as high as
 3 your highest areas, if that makes sense. It's a little
 4 lower a tier of use, but your site factors are so
 5 vulnerable that they, that that becomes a driving
 6 factor and pulls that up. And that's one of the things
 7 that, I think, I want to look at evaluating here,
 8 because that may be one factor explaining these two
 9 Missouri sites in relation to the other. So, that's
 10 one thing we're going to look at on the warp.
 11 I think there's been another number of
 12 caveats and precautions made on this. In fact, the use
 13 is one of the major factors, and you know, honestly,
 14 use is one of the factors where the uncertainty is got
 15 a high, there's a high amount of uncertainty there, and
 16 just because of the nature of the way the data's
 17 collected, what's available. So, as we look at that,
 18 we realize that's one area of uncertainty.
 19 The other part that we note here is,
 20 what we've been doing, so far, is looking at a spatial
 21 component of vulnerability. There's a temporal
 22 component of vulnerability to this, too. And that's
 23 related to the use variability from year to year. So,
 24 that's something that we know that needs to be taken
 25 into account ultimately. And one of the reasons why,

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1 when we're defining that vulnerable population, we need
 2 to be specific with what that, actually, represents.
 3 So, there are a number of other factors
 4 that we have started to look at, and once again, this
 5 is going to show my field soil science bias. Because,
 6 the first thing I want to look at is the soil related
 7 factors that's going to be mapped in the field. And,
 8 there may be things that go beyond that, but to me,
 9 that's a good way of taking a look at some things. The
 10 soil maps represent an integration of landscape factors
 11 in the field, so, I like to start there, and it may not
 12 be the place where we, ultimately, end up. These are
 13 just a few of the things that were looked at.
 14 There are some things that crawl up the
 15 management factors that are easy to get to now, and
 16 there's some things that are not. Tile drainage is
 17 something that we really haven't found a good dataset
 18 that identifies tile drainage, and some of the people
 19 I've talked to, it doesn't really exist out there. In
 20 fact, you probably have farmers who don't know where
 21 there tile drains are, so that is, we're probably
 22 looking more at something that's going to be an
 23 indicator of tile drainage, or the indicator of the
 24 likelihood of tile drainage.
 25 Dr. Effland mentioned your B slash D, or

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1 A slash C, those slash hydrologic soil groups, which
 2 may be a place to start. Dr. Novak mentioned some BMP
 3 practices. That's something that we know has an
 4 impact, and we know that, as we look at those forty
 5 sites, we should be able to get more, you know, site
 6 specific information on that, but in terms of taking a
 7 look at a broader perspective, there's still a lot we
 8 need to try to find out there. So, anything, I mean, I
 9 think we've, these are areas that, if you want to look
 10 at research, and look at some areas that might be
 11 helpful, these are things that any suggestions, advice
 12 would be greatly appreciated in that, because we know
 13 that's, that's a factor, but how do you incorporate
 14 that management factor in this is something that's a
 15 challenge. Yes.
 16 DR. HEERINGA: Yes, go ahead.
 17 DR. NOVAK: May I speak?
 18 DR. HEERINGA: Sure.
 19 DR. NOVAK: Okay, this is Jeff Novak.
 20 There's people at the County Extension level that get
 21 paid to give you that information, so, it's their job.
 22 I mean, that's available for you, depending upon how
 23 deep you want to resource that information.
 24 DR. THURMAN: Okay, well, that's
 25 something, and you know, I see, you know, mostly, with

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1 a national approach, it's a challenge, but when we
 2 start looking at site specific, then, obviously, that's
 3 a source that we'll take a look at.
 4 I'm just going to show you a few things
 5 I've done so far. I do want to point out, you know,
 6 Syngenta suggested that the Missouri 1 and Missouri 2
 7 sites are unique, because of the clay pan, shallow clay
 8 pan, the slopes. These are things that can be tested.
 9 And so, there are ways to test that. And that's one of
 10 the things we're looking at. We think they,
 11 potentially, represent some conditions where that, a
 12 shallow restrictive layer could result in Atrazine
 13 exposures greater than LOC.
 14 And I think part of that is because,
 15 it's not just the magnitude, but it's a duration. And
 16 I think there are some things that would lend to doing
 17 that. And so, that is something that we're taking a
 18 look at. In fact, I think the next slide kind of
 19 fleshed out, a working hypothesis to try to test along
 20 those lines. And you know, the, I think, you saw on
 21 Tuesday a figure that illustrated where you have the
 22 shallow subsurface layers. You know, in effect, what
 23 happens is, your soil storage capacity is reduced
 24 because there's only a shallow topsoil layer that can
 25 absorb the water, so you get more runoff. Well, you



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1 might get runoff quicker than you would in other soils
 2 that did not have that restrictive layer.
 3 So, that may exaggerate your, the
 4 magnitude. At the same time, and I think, you saw some
 5 illustrations, where you might have toe slope
 6 contributions, some of the subsurface flow over that
 7 restrictive layer could be making contributions that
 8 would spread things out a little bit.
 9 We've taken a look at the flow data,
 10 Missouri, the sites, and this is an illustration from
 11 Missouri '01. You take a look, you can see there was
 12 three significant flow events. I didn't plot the
 13 precipitation data here, because I need to use a
 14 different program. Excel tilts whenever you try to add
 15 more in there.
 16 But, this is just, kind of, give you an
 17 illustration. One thing you see on this is the
 18 chemograph itself, the exposures, and what's missing
 19 here is, there's a point around 180 micrograms per
 20 liter up here, but you see this tail stretches out well
 21 beyond the spike and flow. So, you know, this suggests
 22 that something's happening that, after the flow event,
 23 something's continuing to happen there. This, also,
 24 suggests that when you start looking at, can we use,
 25 you know, the flow information to fill in, these are

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1 some of the challenges we need to take a look at, in
 2 terms of can we use that. But these are some of the
 3 things we looked at that suggest that this might be
 4 occurring. We need to look closer at that.
 5 I think it was something that Dr.
 6 Effland had pointed out. An argillic horizon is
 7 probably not your best indication of a restrictive
 8 subsurface layer. As a field scientist, an argillic is
 9 basically, an indication of clay movement down through
 10 the profile, and they can occur in sandy soils as well
 11 as clay soils.
 12 USDA does have a criteria that they use
 13 in evaluating soils, an interpretation called soil
 14 restrictive layers. And these are nearly continuous
 15 layers. It could be physical, chemical, or any number
 16 of things, you know, for instance, a permafrost, which
 17 we don't expect to find in the corn belt, anyway. But,
 18 that would restrict, not just movement, but it could
 19 restrict air, roots. So, what I want to point out here
 20 is that there is a criteria for identifying these.
 21 These criteria are, also, within the county soil,
 22 they're related to the map, soil mapping series. These
 23 are things that, we can use the county, this Argo data
 24 to pull up.
 25 What I point here is, here is a, some

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1 classes of restrictive layers, and what I've done is
 2 asterisk the ones that, based on my experience and
 3 knowledge of the ones that are going to be affecting
 4 water movement, restrictive drainage layers. So, these
 5 are the ones that we would take a look at using the
 6 county soil layer. You know, one thing I do want to
 7 say is that the assumption is that all the, each of the
 8 county soil layers has carried all of these
 9 interpretive criteria in them. I think, Dr. Harbourt
 10 was talking about not seeing the argillic horizon
 11 everywhere. And as I pointed out, pulled up some of
 12 the county layers, I noticed in some of those county
 13 datasets, the diagnostic layer, such as the argillic
 14 horizon, weren't filled in. So, that may be a
 15 possibility that we do need to take a look at as we go
 16 through, and, the same thing with the restrictive
 17 layers. But it does show some promise and, you know,
 18 from a field perspective, I like to look at there
 19 first.
 20 This, let me try to give you a context,
 21 this is the Missouri '01 site. The monitoring station
 22 is up in here. This is your Missouri '02 site, your
 23 monitoring station is here. The background colors
 24 represent the various major land resource areas. This
 25 light blue you see here, that's the portion of the

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1 central clay pan, major MLRA that occurs in Missouri.
 2 There is also a portion that is found in Southern
 3 Illinois, and I'll refer to that in a little bit.
 4 What I've done is, I've just downloaded
 5 those counties that include MLRA 113. So, the counties
 6 outside of that, I have, I just, what you see is
 7 missing it because I haven't looked at those counties.
 8 And the first thing I did is, all right, just show me
 9 the depth to the top of your restrictive layer. And
 10 just as initial cut, you know, the red, here, are those
 11 where your depths in the top of the restrictive layer
 12 begins, is less than fifty centimeters, and roughly
 13 twenty inches below the surface. And I looked at those
 14 as kind of intermediate, and those that were great,
 15 yellow, greater, the restrictive layer begins greater
 16 than seventy-five centimeters below the surface. What
 17 you see in this MLRA is, there's a preponderance of
 18 soils that have as shallow depth the restrictive layer.
 19 And the interesting thing is, when you start getting
 20 off that MLRA, there still are some areas with
 21 restrictive layers, but they tend to be deeper. So,
 22 this is something that we suggest that this may be
 23 something we need to look at.
 24 There are, there is a, you know, a
 25 higher density of soils with restrictive layers



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1 upstream from the monitoring sites in Missouri 2.
 2 There's not as much, I mean, there are some, but it's
 3 not as mu-, there's not as much in Missouri 1, but,
 4 just something that we've taken a look at. The other
 5 part is, okay, there's depth, but is there, what kinds
 6 of restrictive layers are there. As it turns out,
 7 within these, within this clay pan MLRA, those
 8 restrictive layers are classified as having a broad
 9 textural change, which means you have a fairly,
 10 permeable surface layer, and then you hit this clay
 11 rich, the clay pan, subsurface layer. So, that's how
 12 that's being identified. And you can see, once again,
 13 within that MLRA, and within the sites, it's the abrupt
 14 textural changes is what we're seeing there.
 15 The blue, as you see there, are
 16 restrictive layers related to bedrock. There is some
 17 oranges in there that are described as other dense
 18 materials. I think I actually lumped those together,
 19 and I believe, we documented them in a, in the White
 20 Paper. But you, again, say, well, there is something
 21 there. I mean, it looks like a certain type of
 22 restrictive layer that is occurring shallow. I, also,
 23 point out, there are some up in this MLRA. So, there
 24 are some other areas where we're starting to see this.
 25 So, one of the questions we had is, what are we, what

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1 available for that county in, for that site in
 2 Minnesota. So, at this point, we weren't able to
 3 compare those.
 4 The Indian 11 site, there is, what you
 5 see is green, which is a fragipan. So, there is a
 6 fragipan that's be-, that's tend to occur in this area.
 7 We see fragipan in some of these other areas, too. So,
 8 there are some other restrictive layers that are, occur
 9 there. But that at least gives us something that we
 10 can take a look at.
 11 We took a look at hydrologic soil groups
 12 C and D. In the original, both in terms of, whenever
 13 the warp model developers were looking at soil
 14 parameters, they had STATSGO, which will give you a
 15 percent of these hydrologic soil groups within the
 16 STATSGO mapping units. With the county data, you can,
 17 actually, say, map out the separate units and show me
 18 where they occur. What I'm showing here, once again,
 19 the clay pan MLRA is outlined in, kind of, a green
 20 here. And there's the Missouri 2 and Missouri 1 sites.
 21 The pink are hydrologic soil group C soils. The dark
 22 are the D soils. And then, there's a red, which are C
 23 slash D soils, and they're actually mapped as C slash
 24 D. That covers just about that entire, the entire MLRA
 25 consists of those type of soils.

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1 are we finding in the other thirty-eight sites? And
 2 so, once again, what I've done is, I've only processed
 3 the county soils layers for those counties that
 4 included the watersheds over sampled. So, anything
 5 around them, if you see nothing, it's probably because
 6 it didn't process the county. It just takes a while to
 7 do that. Some of this you see stretch out because it,
 8 probably, only includes a portion of that county.
 9 What it, basically, did, the screen here
 10 is, let's look at the soil restrictive layers within
 11 fifty centimeters of the surface, and what kinds occur
 12 within fifty centimeters of the surface. The reds that
 13 you see here, that's your soils that have brought
 14 texture changes. What you see right here, this is
 15 south of this particular watershed. This is where the
 16 other portion of the central clay pan MLRA occurs. So,
 17 there is some suggestion, at least in this county, that
 18 you, also, see those shallow restrictive layers, the
 19 abrupt texture change occurring there.
 20 The other thing is, and I know you've
 21 got to strain your eyes to see this. You don't see
 22 that shallow, abrupt texture change occurring in any of
 23 the other thirty-eight watersheds. To caveat that, the
 24 soil, the county soils data was not available for all
 25 the counties in this Tennessee site, and it wasn't

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1 I think Dr. Effland pointed out that a
 2 lot of, some of, you know, when you see, like, B slash
 3 D, A slash C, the hydrologic soil groups that are
 4 slash, a lot of times, that's an indicator of soils
 5 that, if they're used for agriculture, then there's
 6 tile drainage that gives you that better, the
 7 hydrologic soil group. Particularly, in your central
 8 clay pan area, the soils are dominantly hydrologic soil
 9 group D. Even when you start looking around where the
 10 monitoring site was in this Missouri 1, they're either
 11 dominantly hydrologic soil group D, or C slash D in
 12 that area. So, there is something there that, you
 13 know, may be looking, focusing on particularly
 14 hydrologic soil group D soils may be something that we
 15 could take a look at.
 16 And so taking a step back, and you see
 17 some of this, you know, right here, all I'm mapping is
 18 the C and D or B slash D. B slash D or C slash D, in
 19 this particular case, or D. And so, so, just taking a
 20 look a this, the D soils are dominant in these two
 21 sites. These are the three sites in southeastern
 22 Nebraska that we've discussed with the low flow,
 23 potentially, intermittent streams, dominantly D soils,
 24 compared to the site in Iowa and the other sites in
 25 Nebraska, which are predominantly in B soils. You see



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1 some areas up in here that are also C and D soils.
 2 Once again, what you're starting to see in here is the
 3 soils that are reflective of the upper part of that
 4 central clay pan MLRA in southern Illinois.
 5 Something to look at, we need to take a
 6 closer look at these, you know, what's going on in, up
 7 in here. My look is that a lot of those were actually
 8 B/D, C/D soils, and you can't really distinguish a
 9 color too well with the slide, particularly, going from
 10 the slide to the computer to the projector. But, those
 11 are more of your C/D, B/D soils, which would be
 12 suggestive of tile drainage in those areas.
 13 So, just based on preliminary, the
 14 preliminary, and I'll admit, most of it is mapping it
 15 on the GIS and eyeballing it and seeing what we see in
 16 this. The drainage respective layer, particular by
 17 depth and by type, hydrologic soil groups. A potential
 18 tile drainage identifier, and, you know, I was looking
 19 at the B slash D, C slash D as one approach. If
 20 there's any better approaches, we'll be glad to go in
 21 that.
 22 One of the things we, I think, we need
 23 to look at is, I'm looking at total watershed area.
 24 There may be some value of looking at the currents of
 25 these conditions under crop land, specifically under

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1 crop land, which may be more likely to impact your ru-,
 2 the runoff. So, that is something to consider. That
 3 is, primarily, what I was looking at are things that
 4 are mappable. There are some other physical properties
 5 we could look at, hydrologic, saturated hydrologic
 6 conductivity is probably a fairly good indicator worth
 7 looking at. And there are non-soil factors, I will
 8 admit, that we should be looking at, but this is just
 9 where I started. So, so, that's one of the reasons why
 10 I'm looking forward to the feedback from the panel,
 11 because I'm hoping for a lot more information, and I
 12 don't mind that laundry list, by the way. Don's not
 13 here. He might mind it, but I don't, I don't mind it.
 14 To wrap up and summarize, and kind of
 15 give you a description of what we're thinking about, in
 16 terms of evaluating, what are the potential conditions,
 17 and then where do we go from there.
 18 This happens to be describing what we're
 19 looking at for counties, using the soils data. It is
 20 any of the spatial data we would take a look at, is
 21 first we need to relate it to the watersheds, but I
 22 think, in particular, we recognize that, and the panel
 23 has already mentioned this a number of times, you got
 24 to look at sub-watershed, and, basically, look at the
 25 spatial variation at a smaller scale, particularly,

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1 around those, you know, the sub-watersheds are feeding
 2 into the sample points. So, we would be zooming in on
 3 a closer level in that regard.
 4 The idea is, first, compare those forty
 5 monitor watersheds. Look for differences that
 6 distinguishes the categories that we've had. For
 7 instance, distinguish the two Missouri sites, condition
 8 to distinguish those three Nebraska sites and the
 9 comment recommendation of determining whether or not
 10 that's an ecological condition or human impact
 11 condition, I think, is going to be very important for
 12 us to take a look at. Look at the sub-watershed
 13 differences.
 14 Look for things that are similarity
 15 between the sites within the categories that are,
 16 separate them from the remaining sites. And then, take
 17 that, and extrapolate it to the larger pool of
 18 watersheds, looking first at the most vulnerable areas.
 19 Are there other conditions that occur in that high
 20 vulnerability center. I pointed out, there's another,
 21 there's another area of central clay pan area in
 22 southern Illinois that, at least, at first look, there
 23 are some similar soil conditions. And we need to take
 24 a look at the slope and some of the other conditions to
 25 see whether that suggests that's another area similar

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1 to what we're seeing in Missouri 1 and 2.
 2 And, you know, one thing to take a look
 3 at is that, these are conditions, these are
 4 vulnerability conditions that may occur outside that,
 5 that initial 1172 watersheds that are in the high
 6 vulnerability condition, and then, you know, the
 7 question we're asking is, well, what if you do. We
 8 identify, what if we identify those in areas outside,
 9 you know. We need to figure out what kind of approach
 10 do you take there, and it may mean going back and
 11 taking look at use in those areas to see how close it
 12 is.
 13 One of the things we've talked about,
 14 and we want to do is to provide the warp model
 15 developers with this information that's been collected
 16 from here, because I think that it's viable input for
 17 them to go back and feed back into their model, and
 18 I've talked to Bob Gilliom, and I know there, there's
 19 already been thinking about some li-, things that we've
 20 been looking at. And so, I think there's some, still
 21 some potential for that. There's some potential for
 22 using NHD Plus and this datasets to zoom in on that.
 23 But at this point, I'm going to quit talking about what
 24 we've been thinking about, and I hope to get some
 25 feedback from the panel on suggestions on where to go



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1 and things to consider at that.
 2 DR. HEERINGA: I think this will be a
 3 relatively open discussion. So, rather than have a
 4 separate period of clarification, questions, why don't
 5 we just go directly into the panel's responses, and,
 6 again, if you do have a question of clarification that
 7 you want to pose before you give you your response,
 8 feel free to raise that, but at this point in time, I'd
 9 like to, maybe, ask Dr. Irene to read question ten into
 10 the record for us.
 11 DR. IRENE: Sure. Stephanie Irene.
 12 Question number ten, while the monitoring study was
 13 based on a watershed vulnerability assessment, the
 14 ultimate value is in identifying water bodies where
 15 Atrazine concentrations exceed the LOC. One approach
 16 is to use the updated version of the National
 17 Hydrography Database in HD plus, and apply the criteria
 18 used to select monitoring locations to identify streams
 19 that appear to have the potential to exceed the LOC.
 20 Please comment on the strengths and weaknesses of the
 21 Agency's proposed approach for identifying streams
 22 within watersheds that exceed the LOC. In what ways
 23 can the preliminary approach be improved? Please
 24 recommend alternative approaches, if any, that may be
 25 suited to apply the watershed based assessments to

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1 stream.
 2 DR. HEERINGA: Thank you, Dr. Irene. Bob
 3 Lerch is our lead discussant on this, and I think he
 4 has some presentation materials to go along with that
 5 that have been brought up, too, so Bob.
 6 DR. LERCH: Thank you. Yeah, I want to
 7 start out my comments, and first, before I'm in any way
 8 critical, I want to say that Mr. Thurman's
 9 presentation, particularly, the last part of it, really
 10 moves in the direction of a lot of my suggestions under
 11 this one. But, I, also, have, because my ARS unit
 12 works in this watershed, I have, what you might
 13 consider, insider information.
 14 DR. LERCH: And because it was one of the
 15 two that exceeded the LOC, and it was included in the
 16 White Paper, I felt I might have a little bit of
 17 liberty to use this as an example of how the existing
 18 criteria for choosing the monitoring sites would not be
 19 appropriate for looking at LOC reaches that exceed the
 20 LOC. So, I've put up here, this is the same example
 21 that was in the earlier presentation by Mr. Thurman of
 22 the Long Branch HUC 10.
 23 And it shows the segments that would
 24 have been chosen or were chosen by the monitoring site
 25 selection. And so, I'm addressing the specific aspect

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1 of the question of would this criteria be appropriate
 2 for choosing reaches that exceed the LOC. And I've put
 3 up the monitoring site selection criteria up there for
 4 people to look at. I will, also, preface this part of
 5 it saying the percent flow accumulation under urban
 6 land or under crop land, I don't, I'm not a
 7 hydrologist.
 8 I don't have a real keen feel for how
 9 that might have affected site selection. From a soil
 10 scientist standpoint, I would have, probably, chosen
 11 percent of urban land area, or percent of row crop
 12 area, but that's my simple mind at work. So, what I
 13 have here is a couple of questions that relate to this
 14 example.
 15 In a case where an LOC is exceeded in a
 16 sub-watershed, do the proposed criteria appropriately
 17 pick other stream segments in that same HUC 10 that
 18 would likely exceed the LOC? And then, is it
 19 reasonable to infer that if a monitor sub-watershed
 20 exceeds the LOC, so does the entire HUC 10? That
 21 question I wrote before I talked to Linda Young. I'm
 22 not a hundred percent sure, statistically, whether
 23 that's absolutely correct or not. But I will say that,
 24 this example illustrates the ability that maybe you
 25 could do that. If you could go to the next slide for

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1 me, please, Nelson.
 2 Okay, just a little bit of background.
 3 There's the land use from the 19-, or no, I should say
 4 from the 2004 dataset that just gives you an idea of
 5 the flavor of the distribution of land uses in the
 6 watershed, and then, the various sub-watersheds. Good
 7 Water Creek more well known in this group as MO '02, is
 8 a site we've been monitoring for 35 years. And then,
 9 there are two sub-watersheds, the red stars in there,
 10 the monitoring sites, that we have monitored within
 11 this watershed. So, we've got four sites total. One
 12 is in the upper part of the Long Branch. It's about 65
 13 square miles. The other's further down Good Water
 14 Creek in Youngs Creek at about 70 square miles. And
 15 then, at the USGS gage, it's kind of hard to see on
 16 this graph, all the way at the bottom of the watershed.
 17 So, that just gives you a flavor that overall, 60
 18 percent of the watersheds cropped, and it tends to be
 19 that that cropping intensity increases as you go
 20 upstream, little bit of exception at the upper part of
 21 Youngs Creek on that. Next slide, please.
 22 DR. LERCH: And so, here's some of the
 23 data, and I also have the Good Water Creek data that
 24 was sent to me this morning, and so, I'll let you know
 25 what that looked like. But this is 2005 Atrazine data,



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1 and I'll also preface this by saying, I did not do any
 2 interpolation on this. I just took our data and
 3 averaged it for those appropriate periods. So, this is
 4 not as rigorously computed as you all would have done
 5 in order to determine whether the LOC is triggered or
 6 not. But the upper Long Branch site there exceeded the
 7 rolling average criteria in every one of those 14, 30,
 8 60, 90 day. And I know that you're going to, I don't
 9 remember the designation, maybe, it's MO '05 is going
 10 to include that, and I think you can see, that was a
 11 good choice.

12 Then, moving onto Youngs Creek, we
 13 exceeded the rolling average on 60 day and 90 days, but
 14 not at 14 and 30, but the levels weren't trivial. And
 15 then, at the outlet to the watershed, or very near it,
 16 it exceeded, again, across all four criteria. So,
 17 obviously, at the bigger scale, it was quite
 18 integrative of the whole watershed, and also, infers
 19 that the entire watershed would have exceeded, or
 20 potentially, would have exceeded the LOC, based on that
 21 data.

22 Oh, and just to, since I didn't get in
 23 it to graphic, the Good Water Creek data, for that same
 24 period of time, 14 day was 7.4 parts per billion, 30
 25 day was 8.4, 60 day was 16.4, and the 90 day was 12.6.

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1 And I'll also say, our data was very, very close to
 2 that that was shown in Mr. Thurman's presentation, and
 3 that's always good to know. So, Good Water Creek
 4 exceeded a rolling average only for 90 day. So, that
 5 just gives you an example of the type of data that you
 6 can get in a real world example of what this monitoring
 7 data shows as you scale up. And I, also, recognize
 8 it's only a single example, and for a single year, but
 9 I thought that it might be instructive for people to
 10 see that.

11 So, in my mind, if you can go to the
 12 next slide, just in conclusion, then, it would seem to
 13 me, then, the existing monitoring selection criteria
 14 would not be adequate for determining these three
 15 reaches within the HUC 10. And, at least in this
 16 example, the HUC 10 scale monitoring supports the
 17 conclusion that if a monitored reach in the AMP exceeds
 18 an LOC, so does an entire HUC 10, that might be a
 19 little strong, and I don't know if it's supported
 20 statistically, and I'll defer to the statisticians, but
 21 it would appear to me that you could draw those kinds
 22 of inferences, based on the statistical design that you
 23 have for the AMP.

24 So, I'll stop with that part of it. I'm
 25 done with that, and just go on to a few other comments.

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1 Let me scroll down here. Uh, let's see, a couple of
 2 specific things, I think there was, also, something in
 3 there about the use of warp, potentially in combination
 4 with NHD Plus for identifying reaches within
 5 watersheds. I don't think that'd be a good use of warp
 6 because of the reliance on herbicide data or usage data
 7 of unknown accuracy. I, also, think because warp is
 8 really intended to be an average annual, kind of, long
 9 term Atrazine concentration predictor, it's not going
 10 to do a good job in smaller stream reaches. I think
 11 that might be pushing its applicability, and Bob
 12 Gilliom could help me address whether I'm correct about
 13 that.

14 I think Mr. Thurman really hit the nail
 15 on the head, in terms of where to go, in terms of
 16 looking at other watersheds or reaches within HUC 10's
 17 with respect to the soils data, and utilizing SSURGO
 18 certainly looks to me to be the, and again, I'm biased
 19 as a soil scientist, so I tend to think about SSURGO as
 20 a very valuable tool here for identifying, in the
 21 example given by Mr. Thurman, restrictive layers. I
 22 think, really, it moves in the right direction, and is
 23 supportive of or consistent with research that I've
 24 done in conclusions that I've drawn over the years.

25 There are, also, some approaches out

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1 there. I think the original one is an index model that
 2 was developed by NRCS WINPS2, pesticide screening
 3 tool.

4 It has some limitations, but there are attempts, and
 5 now that SSURGO's on board, to improve risk assessment
 6 index modeling, based on SSURGO for pesticide
 7 contamination, and I'd be happy to offer up some
 8 specifics on that. But it offers an approach to
 9 integrate all that SSURGO information and bring in some
 10 of the quantitative things that Mr. Thurman referred
 11 to, such as Ksat a depth to that restrictive layer, and
 12 then what is the Ksat, and be more quantitative,
 13 perhaps, than just, hydrologic groups. Which I think
 14 is actually a good, maybe, first tier screening tool,
 15 but then, as you dig deeper, maybe, get more
 16 quantitative, and SSURGO gives us the capability of
 17 doing that.

18 Other useful approaches, if you have
 19 long term hydrologic data, and I would say, at least,
 20 ten years, another thing to look at, potentially, is a
 21 runoff propensity index, which was something that Paul
 22 Blanchard and I proposed in a paper in 2000. It's,
 23 essentially, just a log of the ratio of the 90th to
 24 10th percentile of flow, which tells you something
 25 about how flashy that system is, and if you have good
 long term information, that's a useful indicator that



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1 might be, also, in that higher tier like soil
 2 hydrologic group in terms of distinguishing, at least
 3 as a first cut, large watersheds that may be likely to
 4 exceed the LOC.
 5 The NHD Plus dataset, also, seems to
 6 have a lot of merit, and I'm, perhaps, combining soil
 7 information and Atrazine use intensity information, and
 8 I do want to make a comment on the use intensity data,
 9 as well. With the hydrologic information, because now
 10 with NHD Plus, you can have the ability to characterize
 11 flow regimes that might also lead to LOC exceedances.
 12 How, exactly, you feel about combining all those
 13 things, I don't know. I would go with the risk
 14 assessment approach, based on SSURGO because I
 15 understand how to do that. I don't have a specific
 16 recommendation on how you'd integrate flow, soil, and
 17 the use intensity. But those with a hydrologic
 18 background might be able to see a way forward with
 19 that.
 20 I would concur, also, that the MO '01
 21 and '02 sites represent unique conditions, or at least,
 22 such that one could justify that it's a separate
 23 strata, or that there's something unusual about that.
 24 And then, looking for those unusual restrictive layers
 25 in other watersheds makes a whole lot of sense to me.

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1 My last comment goes to the herbicide
 2 usage data. I think, particularly, if the intent is to
 3 look at specific stream reaches within HUC 10, we
 4 really have to have better herbicide usage data that
 5 reflects changes year to year, as well as, watershed
 6 specific information. Farmer surveys can be one way to
 7 get that information, but it's awkward and it's slow.
 8 Another way to go about this is herbicide sales data,
 9 and you might consider requesting that of the
 10 registrant. The state of Iowa has a program in which
 11 they use sales information, and they have a defined
 12 procedure that could be followed to convert sales data
 13 to herbicide usage data. I believe they're the only
 14 state I know of that is doing that, but there is an
 15 example out there to follow, if, in fact, sales data
 16 were available.
 17 Yeah, and I guess, I would just say, in
 18 relationship to that, it, and this is the point I think
 19 that was made earlier, not necessarily today, but maybe
 20 it was on Tuesday, is that, because these sub-
 21 watersheds are what were monitored, we don't really
 22 have a good handle on exactly what the herbicide usage
 23 was in the monitored sub-watersheds. And that kind of
 24 goes along with the fact that we need better, more
 25 specific herbicide data. And that's all I've got for

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1 that.
 2 DR. HEERINGA: Thank you very much, Dr.
 3 Lerch. Next associate discussant is Dr. Gay, Paige
 4 Gay.
 5 DR. GAY: Paige Gay, University of
 6 Georgia. I think that Dr. Lerch has pretty much
 7 covered my comments in much more depth than I possibly
 8 could. It's nice to have someone familiar with that
 9 area to give us an expert view of that. I did, also,
 10 note that herbicide usage, if we're going to look at
 11 sub-watershed levels, would be pertinent to try to get
 12 a better handle on that.
 13 The NHD Plus database certainly will
 14 allow so many more parameters that I felt were kind of
 15 missing in the assessment that we've made concerning
 16 soils and hydrology to be incorporated into the
 17 assessment when trying to make some comparisons
 18 between
 19 sub-watersheds and determine likenesses or not,
 20 dissimilarities. So, I'm just not real sure how you
 21 would link that together, either, if you could
 22 incorporate some of those hydrologic and soil
 23 differences into your criteria, in between your, for
 24 selecting your final sites that are most vulnerable. I
 25 just, really, wasn't real sure how that would happen.
 I guess the major weakness that I saw

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1 was that it's just time, money, and manpower. That's
 2 just too much of, data available to manipulate, but
 3 it's wonderful.
 4 DR. HEERINGA: Thank you, Dr. Gay. Bob
 5 Gilliom.
 6 DR. GILLIOM: The result of, kind of,
 7 restatement of the problem out of the stratified design
 8 was to estimate the frequency of occurrence of HUC's
 9 that had one or more sub-watersheds that exceeded the
 10 LOC. My understanding of the future need to go ahead
 11 is that restated goals to estimate the number of stream
 12 miles that will have exceedances of LOC, I think. We
 13 can address that in a moment. If that's a goal, then
 14 my idea for how to get there is a number of steps that
 15 tie together some of what's been talked about.
 16 The first step, I think, would be to get
 17 to the, move to the NHD Plus, like's already been
 18 discussed. And then, just drop, from an analytical
 19 point of view, the linkage or constraint of going to
 20 the HUC 10. Each of those little basins is now it's
 21 own little guy out there on his own, and he's going to
 22 be in the NHD world with all these other basins. And
 23 they all have their own characteristics and everything.
 24 And then, in that framework, update all the possible
 25 causal factors that have already been discussed that



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1 you can get to improve the scale of information,
 2 SSURGO, more current use data, all those things, and
 3 there are, there's new land use data coming out this
 4 year. There's a lot of readily available, some of them
 5 easy marks, to go at, and then some that become more
 6 difficult on a more basin level.
 7 And then, with that in hand, I would
 8 prefer to see, for this step, the LOC restated in terms
 9 of concentrations for the moving averages, so they can
 10 be more transparently related to cause effect
 11 regression analysis. You could do it with the
 12 Steinhart similarity index, and that's your independent
 13 variable, but I'd prefer to see it go back to, what was
 14 derived the model anyway, I believe, were these
 15 specific numbers for certain moving averages, that
 16 match the same SI values, basically.
 17 At that point, I think, you want to
 18 expand the target area to the corn belt, and pick up
 19 all the other monitoring sites you can at different
 20 scales. Because, what we're aiming for is to,
 21 basically, refit a new, make a new work model that's
 22 designed for the region, and doesn't get thrown off by
 23 all the other regions around it, 'cause you're
 24 targeting the corn belt system, and tune in that fit,
 25 so you can give a more accurate probability type

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1 assessment of concentration conditions in this region,
 2 without having to deal with all the rest of the
 3 country, like was done in the main version of warp that
 4 we've been talking about.
 5 I think, by doing that, and fitting the
 6 model, specifically, to the target that you want,
 7 either the specific moving average, or the end score,
 8 if you want, you'll get a lot better idea and a,
 9 basically, a probabilistic answer of what's the
 10 probability, given these conditions, that any
 11 particular stream reach is going to go over whatever
 12 LOC you define. And I think that will work pretty
 13 well, and, actually, when I see the correlations just
 14 presented in a preliminary fashion of looking at the
 15 small sub-sheds, compared to the bigger watersheds that
 16 were in warp, originally, you know, that plot we've
 17 looked at, that's, actually, well within the
 18 uncertainty bounds of that model. It's got kind of a
 19 plus or minus order of magnitude concentration thing.
 20 I mean, these, all those were less than a factor of ten
 21 off.
 22 And within this upper range defined of
 23 the 80 upper 20th percentile, it's not surprising at
 24 all to have those kind of outliers. The air
 25 distribution in this regression model's log normally

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1 distributed, but it's fit, it's a model fit to the, you
 2 know, a transform of Atrazine concentration.
 3 So, you expect to see those high
 4 outliers. Now, the reasons for them can come into play
 5 with things like improving underlying causative
 6 factors, like this certain soil condition or drainage
 7 or whatever. So, I think if that process was done, it
 8 will enable comparing a couple different approaches
 9 going directly to SSI, and, also, going directly to the
 10 moving averages, and see how those work out with their
 11 comparability in producing level of concern estimates,
 12 and it won't take that long to get there to find out
 13 whether that's a productive approach or not.
 14 And it would be a region specific,
 15 returned, regression analysis, which is all warp is.
 16 It's just a step-wise regression model. So, there's
 17 no, it's not like CASM, which has a lot of stuff in it.
 18 It's just a step-wise regression model. So, that'd be
 19 my suggestion.
 20 (WHEREUPON, there was a brief recess.)
 21 DR. HEERINGA: Thank you, very well
 22 organized. Doctor Schlenk.
 23 DR. IRENE: Doctor Heeringa
 24 DR. HEERINGA: Oh yeah?
 25 DR. IRENE: Stephanie Irene. Can I just

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1 ask a clarification --
 2 DR. HEERINGA: Sure.
 3 DR. IRENE: question? Bob, you
 4 mentioned originally about stream miles. Is your
 5 approach, I'm not sure that stream miles are where we
 6 would be going and I'd like to ask the A Team if they
 7 have any comments on that.
 8 But is your approach applicable just to
 9 watersheds? Because I think we would be ultimately
 10 regulating our watershed basis.
 11 DR. GILLIOM: I'm certain I've seen in
 12 the white paper the stream mile objective. And it was
 13 talked about.
 14 But that's neither here nor there.
 15 I'm totally talking on a watershed
 16 basis. In fact I'm still a little confused over the
 17 prioritization of the segments in the sub-watersheds
 18 because you'll have a segment colored red for priority
 19 but there's upstream watershed that's colored light
 20 blue. I don't know what that means.
 21 Everything I talk about would be
 22 watershed based. And it can be translated into either
 23 whole watersheds, segment watersheds or stream miles.
 24 DR. IRENE: Yes. When I was listening to
 25 your discussion I kind of assumed that it could be



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1 applicable to just watersheds, but when you started out
 2 saying stream miles you kind of threw me there for a
 3 minute.
 4 DR. GILLIOM: Well I think it tends to be
 5 an interesting, a useful way to summarize the extent of
 6 the resource in different categories. Because if you
 7 say you have so many watersheds, well you have to say
 8 exactly what size category are watersheds and they're
 9 all nested.
 10 It gets really messy and this whole
 11 problem is scale dependent with a lot of confusion.
 12 So I'd rather hear about stream miles in
 13 a certain order stream category or something and think
 14 about the resource that way, even though all the
 15 analysis of cause and effect is watershed based.
 16 DR. IRENE: Thank you for the
 17 clarification.
 18 DR. GILLIOM: Yeah.
 19 DR. HEERINGA: I think that's useful,
 20 that quantification, that step and it's one of the
 21 pieces that a number of us, you know, I think we all
 22 realize we're dealing with units of varying size, that
 23 we assume varying degrees of homogeneity within those
 24 systems.
 25 And this is one way of sort of

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1 quantifying the total extent of sort of community
 2 exposure of community potential I guess.
 3 Doctor Schlenk.
 4 DR. SCHLENK: Dan Schlenk, UCR. Just to
 5 let the panel know, in discussions with Doctor Lerch we
 6 kind of came up with well, he came up with pretty
 7 much most of anything that I was going to add.
 8 The only thing I would add in sort of
 9 support is that from what I could understand of the
 10 database when going to the website and looking at the
 11 advantages, it looks like a no-brainer, I mean this is
 12 amazing stuff that you can use, particularly with the
 13 low flow and the limited flow type of area.
 14 So I would definitely with agree with
 15 the utilization of that in site selection as well.
 16 DR. HEERINGA: Doctor Lerch, a question.
 17 You showed measurement data from a watershed in
 18 Missouri. You had four monitoring points. I presume
 19 you have a number of these monitoring locations or is
 20 it just unique that you were here or is there maybe 20
 21 or 40 others?
 22 DR. LERCH: I'm glad you asked that
 23 question. It just so happened that we had been working
 24 in Goodwater Creek, the research unit I'm a part of for
 25 35 years.

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1 A project called the Conservation
 2 Effects Assessment Project came along about three years
 3 ago that is essentially a cost/benefit analysis of the
 4 conservation portion of the Farm Bill. And as part of
 5 that we scaled up our monitoring to the entire Salt
 6 River Basin which includes the bulk of the Major Land
 7 Resource Area 113, so we have I believe 13, not 40
 8 sites that we're monitoring.
 9 DR. HEERINGA: It's very useful because
 10 personally had not seen any data from the larger HUC
 11 that would suggest that sort of relative degree of
 12 homogeneity. And that may be unique but again across
 13 13 other locations it would give certainly some sense
 14 of just, you know, what sort of penalty are we paying
 15 when we scale from a set of observations at a bridge to
 16 a much larger growing area. Yes?
 17 DR. LERCH: Yeah, Bob Lerch. And that's
 18 why I wanted to show that, was to illustrate the fact
 19 that at least for this watershed and for that year's
 20 worth of data, that, you know, in hindsight I
 21 recognize.
 22 But part of the reason we did a multi
 23 scale was we wondered what the scale dependence of the
 24 atrazine concentrations would be, and I thought it
 25 would be instructive to share that.

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1 DR. HEERINGA: Bill, did you have some
 2 DR. EFFLAND: Yes, Bill Effland. I
 3 don't know how I ended up sitting next to Bob, I guess
 4 it was just by random chance, but the project that he
 5 talked about, the Conservation Effects Assessment
 6 Project is something that I've been working on for the
 7 last year, basically since January.
 8 It's older than, it's older than me,
 9 it's a few years older than I've been working on it,
 10 it's about three years.
 11 And but we were talking at lunch and I
 12 asked him, I said are you working on one of what we
 13 call the SEAT watersheds? And he said, oh yeah, I'm
 14 working on this one in Missouri and I said, oh, that's
 15 pretty interesting because I'm working on one in Puerto
 16 Rico which is very lucky for me.
 17 But the in some ways anyways but the
 18 point is that because of the enhancement of funding to
 19 the conservation in the Farm Bill, Congress has asked
 20 us to, you know, justify if you're spending this much
 21 money on conservation practices, what are we seeing in
 22 return?
 23 And so that's one of the originations of
 24 CEAP and CEAP is actually three components, it's a
 25 national modeling assessment. And the major agencies

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1 within USCA are ARS, NRCS and CSREES, extension,
 2 former
 3 extension now combined with the Cooperative State
 4 Research.
 5 And then we also have a lot of other
 6 partners. We have EPA working with us in some
 7 watersheds. We have USGS working with us. We have
 8 NOAA. The particular watershed that I'm working in in
 9 Puerto Rico, we have NOAA because we're linked directly
 10 to the coast, which is something unique about the Hovis
 11 Bay Watershed Project.
 12 We actually have almost 40, we have 37 I
 13 believe, 37 different projects around the country. Not
 14 all of them are involved in pesticide analyses, but
 15 quite a few of them are. On the one that I'm working
 16 on that we just started in Puerto Rico, we're looking
 17 at both groundwater transport and surface water
 18 transport of atrazine. We have some, actually have
 19 some data from USGS monitoring wells that have been in
 20 stalled and where ARS is installing more.
 21 So there's a lot of opportunities there.
 22 But at the same time there's also some cautions because
 23 for us to do these studies there's concerns about
 24 regulatory effects, you know, the regulatory impact.
 25 And so I just bring that up, but there's
 a lot of data sets. And then within ARS what we call

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1 their benchmark watershed studies that have been going
 2 on for decades, tremendous data sets.
 3 And if you can align some of that data
 4 or some of those sampling locations with some of the
 5 things you're doing, I think there's some real added
 6 value there. And it's something to consider. A lot of
 7 background information, I mean some more detailed
 8 information.
 9 And we're, you know, in some cases we're
 10 doing some very intensive surveys of producer
 11 information and those kinds of things. And that's
 12 where it starts to get the confidentiality is, you
 13 know, very critical.
 14 So we've got the national assessments
 15 which are essentially a very large modeling effort.
 16 And the we have the watershed studies.
 17 And then there's another component that
 18 you may be interested in. And that's the literature
 19 reviews that we've completed for a variety of different
 20 things. And these are all available on the web through
 21 the National Agricultural Library.
 22 But if just type in CEAP, C-E-A-P, I'm
 23 pretty sure it'll direct you to the NRCS website and
 24 then from there you can drill down and move around and
 25 find some other ARS connects through there and the

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1 CSRES and USGS and some other groups.
 2 And, you know, that's just a real
 3 tremendous resource and I was glad when I talked to Bob
 4 at lunch and he, oh yeah, I'm working on one of the
 5 watersheds and I was, oh, that's another one that I
 6 and I've visited some of these watersheds, not all of
 7 them, but I think it's something to consider in helping
 8 with addressing some of the questions that you have.
 9 And to see this kind of data it's just,
 10 for me it's very exciting to see that linkage there.
 11 DR. HEERINGA: Thank you very much,
 12 Doctor Effland. Doctor Young?
 13 DR. YOUNG: This has been a really
 14 interesting discussion and follows along with some of
 15 the lines that I, I've been thinking about.
 16 There are a few things that I just want
 17 to build on.
 18 I think it's first very important to
 19 decide what you're going to use as your basic unit.
 20 Whether it's going to be one of these sub-watersheds or
 21 a total watershed or what, because you've got to set
 22 your scale.
 23 And then there are immense amounts of
 24 data available and all kinds of GIS coverages. And
 25 they are usually on a whole host of different scales.

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1 So the first challenge is to get everything on that
 2 same scale in a statistically valid way.
 3 So consider the change of support issue
 4 and to get that under control and then it's, in
 5 listening to Bob talk earlier, I'm not quite sure what
 6 your response variable would be. I agree with a
 7 regression type approach.
 8 Whether you want to just model the
 9 probability of exceeding the LOC or estimate the LOC or
 10 estimate the SSI or what it is you're going to try to
 11 estimate, that needs to be sorted out. I would tend
 12 not to go with just above or below because you may want
 13 to change that above or below, you know, what that
 14 cutoff is.
 15 And then but begin to get a model
 16 where you, based on your current data, you can estimate
 17 the outcome for a particular unit, whatever that unit
 18 is.
 19 Then you could begin to do some ground
 20 truthing, some targeted sampling to validate the model
 21 to see whether under the conditions that you
 22 anticipate, you really are getting an excess amount of
 23 atrazine or not and begin. And of course you'd have to
 24 do it in more than one place, a one shot deal, you
 25 know.



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1 But nonetheless you could begin to
 2 focus, do focus sampling to do model validation where
 3 needed, or maybe supplement it with some of the data
 4 that are already being collected at the state.
 5 But how to great care has to be taken
 6 I think is just assembling the data, to be sure that
 7 you have a common support and that, then what
 8 regression does actually makes sense, that you decide
 9 to do makes sense.
 10 DR. HEERINGA: Thank you very much,
 11 Doctor Young. At this point I guess oh, Doctor Chu,
 12 Michael.
 13 DR. CHU: I think using NHD Plus is
 14 really great because from this database we can get a
 15 lot of useful information about the hydrology, you
 16 know, the stream flow network, the stream network, flow
 17 directions and accumulations, all useful information.
 18 But I'm just curious, I'm just wondering
 19 if you have any plan to do watershed scale hydrological
 20 modeling, because I have this question because it seems
 21 to me we have all the information or data for
 22 hydrological modeling.
 23 For example GS soil data and land use
 24 data. Also you're talking a lot about hydrological
 25 soil groups, hydrological soil groups. That means that

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1 actually we can use a very simple method. For example
 2 a method to do hydrological modeling. In this way we
 3 will have all the information about silt runoff
 4 distribution for each sub-basin.
 5 Also, we also can generate hydrographs
 6 for all sub-basins.
 7 So I'm just curious about if you have
 8 this kind of a plan. Thank you.
 9 DR. HEERINGA: Doctor Chu, so I can
 10 follow this too. The hydrologic modeling gives you the
 11 flows and you would have to marry that to the atrazine
 12 applications presumably and weather events, is that
 13 DR. CHU: Yeah, Michael Chu. If we have
 14 the flow information, for example, silt runoff for each
 15 sub-basin, distribution for each sub-basin and also the
 16 flow at an outlet of each sub-basin. In this way it
 17 will be very helpful for us to do the water quality
 18 analysis, assessment, yeah.
 19 DR. HEERINGA: Nelson, do you want to --
 20 DR. THURMAN: Well although it's not
 21 specifically related to atrazine, but yeah, we've been
 22 looking at approaches for hydrologic modeling,
 23 watershed scale modeling. You know, a lot of our
 24 pesticides assessments are based on screening,
 25 screening level, exposure estimates and a lot of it is

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1 using a PRZM which is, as you know is a field scale
 2 model and then emptying it into a water body model by
 3 exams.
 4 So we have been looking at, particularly
 5 as the data has progressed in terms of what we can do
 6 in terms of water scale modeling.
 7 It's separate but, you know, it's kind
 8 of separate but after, at some point all the data
 9 started, all the information starts merging together.
 10 But it's on our list of things.
 11 DR. HEERINGA: Okay, at this oh, Doctor
 12 Grue.
 13 DR. GRUE: I think I would just ask a
 14 question, back on slide 184, what's the N there, what's
 15 the basis for that graphic? Yeah, on the printouts.
 16 DR. THURMAN: The N is the number of
 17 sample years. So I think that N is 86.
 18 DR. GRUE: Okay, thank you.
 19 DR. HEERINGA: Yes, Doctor Olsen.
 20 DR. OLSEN: Yeah, I've got a couple of
 21 comments actually, mainly generated by Bob's comment
 22 earlier and other people talking about NHD Plus.
 23 I use NHD Plus a lot, not necessarily
 24 the full accumulation part, but for other parts of the
 25 survey design things. NHD Plus is great, but it's not

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1 perfect.
 2 One of the things that you will see, and
 3 I know this happens along the Kansas/Iowa border and
 4 there are certainly other parts of the country where it
 5 happens as well, is you'll see different densities of
 6 stream networks in two basic quad maps side by side.
 7 And it could be at least half the density or even more.
 8 So when you end up looking at these
 9 things you've got to be really careful, you've got to
 10 look, you've got to be aware that that occurs.
 11 But I do agree it's a great enhancement.
 12 I guess one of the questions is, is in
 13 some sense going down to using NHD Plus and sort of
 14 using the, let's call them the sub-sheds with each
 15 segment that are identified in there, you really have
 16 changed the scale down from HUC 10. And you only
 17 have
 18 one stream segment within that.
 19 And if you were going to monitor at that
 20 level you'd probably monitor at the outflow at the
 21 downstream end of that. And the assumption you would
 22 be making, if you wanted to convert it to stream miles,
 23 would be that that entire segment is above the level of
 24 occurrence. That's probably what, the sort of
 25 assumptions you might make.
 You could make the assumption to measure



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1 the upstream portion, but that's probably less likely
 2 to make that decision.
 3 So essentially in some sense you've
 4 simplified the problem of going from the HUC 10 to the
 5 sub-shed but you haven't gotten away from it entirely.
 6 But it does simplify greatly.
 7 The one Linda made a comment about
 8 sort of choosing the sort of the scale that you want to
 9 deal with. The segments in NHD in some sense were at
 10 the discretion of the mappers because you can see that
 11 in some of the stream segments up there. They're
 12 broken, you know, there's not an intervening stream,
 13 intervening stream intersection coming in. But the
 14 segment's broken into two different pieces.
 15 It could be because they're in two
 16 different quad maps and that's the only reason they're
 17 broken there.
 18 So there's, there's some things like
 19 that that goes on. And they are, the watersheds there
 20 are very different, can be quite different in size just
 21 because of the mapping density differences, let alone
 22 different parts of the country. Although the corn belt
 23 is a little more similar.
 24 So you're not going to be, you're still
 25 going to have some variation in these watershed sizes.

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1 The other part is, is in thinking about
 2 doing, pulling together the data for this, you
 3 certainly haven't gotten away from the issue of many of
 4 these sub-sheds have water flowing into them. And
 5 there are very few of these that are not, they're not
 6 headwater streams.
 7 And so when you're going through and you
 8 do the modeling, you know, do you want to accumulate
 9 data? Certainly you want to do it for the sub-shed
 10 itself, but you may end up also wanting to accumulate
 11 everything for the entire watershed above that as well,
 12 which means that you're going to have varying sizes of
 13 watersheds. And we may end up having to control for
 14 that in some way.
 15 And I don't have a solution to that, but
 16 you have to do that in some sort of a way.
 17 In terms of accumulating the data for
 18 this, let's say like the soils data, the natural way of
 19 doing it is, you know, creating a summary measure for
 20 the entire watershed or the sub-shed, so the percent
 21 seedy soils for example.
 22 Is there any utility in terms of
 23 accumulating that data in terms of buffer strips around
 24 the stream? So, does it make a difference whether
 25 you've got 100% CD in a 50 meter or 10 meter buffer

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1 around the stream versus the entire sub-shed? And I,
 2 you know, I'm not a soils person at all, but I know in
 3 some of the things that we've done in sort of the
 4 landscape modeling, buffering sort of the riparian zone
 5 seems to help in some of the modeling efforts.
 6 I guess we've struggled with the idea of
 7 the atrazine use data and if you wanted to put atrazine
 8 use data into this, we certainly have gone below a
 9 scale of most of the atrazine use data because it was
 10 county level data and that sort of stuff. But that's
 11 not good on the entire area, you're not going to change
 12 that too much.
 13 So the importance of dealing with sort
 14 of a, you know, the misaligned data modifiable MOP
 15 problem is going to become very important. And there's
 16 going to be still a lot of uncertainty in the use data
 17 there. And that's a nontrivial modeling exercise to
 18 get down to that.
 19 One of the things in terms of thinking
 20 about sort of building a model like this and Bob
 21 mentioned using something maybe other than the SSI
 22 deviation as sort of let's say the response variable in
 23 the rolling average value or something, one advantage
 24 of doing the rolling average is, potentially is, is are
 25 there sufficiently other sites from other monitoring

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1 programs where constructing a rolling average is
 2 feasible and you could use a broader subset of data to
 3 do that?
 4 I don't know whether that data exists
 5 well enough to do that or not.
 6 Obviously there was a hundred and some
 7 based upon what GS did for the work modeling, because
 8 that then gives you a broader set of data than just the
 9 40 watershed that we've got. Because if we have to, if
 10 we're basing it on the SSI deviation, at the moment
 11 you've got 40 watershed, they're at the upper end, if
 12 you include some other watersheds the question then is,
 13 do you have enough data to actually run a CASM model
 14 to
 15 get an SI deviation in some other area without doing
 16 additional monitoring.
 17 And I don't know the answer to that.
 18 But that certainly is one of the things that would come
 19 up.
 20 But actually that was a great, you know,
 21 sort of a great sort of sequence of ideas. And that's
 22 it.
 23 DR. HEERINGA: Thank you very much,
 24 Doctor Olsen. Doctor Robert Gilliom.
 25 DR. GILLIOM: Well I wasn't sure how you
 want to address any of do you want to get into any of

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1 those issues or just leave it on the table? I'm open
 2 either way and we can deal with it later.
 3 DR. HEERINGA: Well, you know, I think
 4 it's worth getting into it if you feel there's
 5 additional I mean if it's just an academic discussion
 6 at this point as opposed to, you know, sort of, I think
 7 the ideas have been brought forward and I think given
 8 Doctor Olsen's response there's clearly an
 9 understanding of where the issue lie.
 10 And if you felt we could offer some more
 11 clarification
 12 DR. GILLIOM: Well let me mention a
 13 couple things that fit into I think the earlier
 14 question that Doctor Irene asked too, which is kind of
 15 the segments and scale in watershed and things because
 16 it's kind of important to how you frame it.
 17 I mean what the nature of the watershed
 18 based regression model is, is that it treats each point
 19 as having a watershed in its complete entirety
 20 upstream. And it's estimating what you would see at
 21 the bottom of the watershed.
 22 So when you're in the first headwater
 23 watershed, how you assign that to stream miles is kind
 24 of a, kind of a rule making call. How are you going to
 25 do it to everything up to a certain point, okay? Then

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1 as you move downstream, a subsequent downstream point
 2 has its new big watershed. And what normally would be
 3 done in this kind of marching down the network case is
 4 that that intervening segment between your upper
 5 watershed and the next watershed point, would get
 6 assigned the predicted concentration for the downstream
 7 point.
 8 So you can do it whether you do it by
 9 watersheds or stream miles, the physical structure is
 10 there to make some choices.
 11 On the spatial issues of improving
 12 things like treatment of land near the stream, the
 13 buffer idea, all that, that's one of the critical
 14 things that several people have mentioned about testing
 15 with the improved data, like the SERGO data. And I'm
 16 not sure where the answer will be. I really don't.
 17 On the pesticide use data front, I think
 18 some of the ideas that came out and were talked about
 19 in the Syngenta presentation about using, at least
 20 going to current annual data, the crop reporting
 21 districts and attributing it would be a better thing
 22 than what we have now to go to the regional prediction
 23 mode.
 24 For what you do in the model development
 25 mode, which is more critical to model building and

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1 actually have more accurate data for the actual basins
 2 you're calibrating to, then you have these cost/benefit
 3 choices to make about how important it is to get actual
 4 data for that basin rather than use the more national
 5 remote control data.
 6 And that's a decision based upon kind of
 7 an uncertainty analysis and cost/benefit of effort in
 8 the study.
 9 So that whole sequence of decisions will
 10 take some time to work through. There's no question
 11 about it.
 12 And I think the scale question is really
 13 important to this problem. And in Bob's example that
 14 showed the nested scales, you know, you show that you
 15 can get these little basins that have their
 16 characteristics and they're more variable within that
 17 HUC. And then downstream as the concentration
 18 duration
 19 changes, you actually get more critical conditions
 20 because the curve smooths out.
 21 And we're probably going to find that
 22 there's these intermediate scales that have the most
 23 frequent issues with LOC because of the concentration
 24 duration curve. And then as you get way downstream it
 25 smooths out, so it's not an issue. You go way upstream
 it's so peaked that it's not. And it's probably going

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1 to be some mixture of these intermediate scales.
 2 So with that said, there's more to talk
 3 about, but I wanted to respond to a few of them anyway.
 4 DR. HEERINGA: Thank you. Jeff Novak and
 5 then Doctor Ellsworth too.
 6 DR. NOVAK: This is Jeff Novak again.
 7 This is just a question before I provide some advice.
 8 But to Doctor Olsen and Thurman, are you planning on
 9 acquiring the soil survey maps along the stream
 10 channels of your HUC's?
 11 DR. THURMAN: That's and by that you
 12 mean the county soils?
 13 DR. NOVAK: Well yeah, yes or no, are you
 14 planning
 15 DR. THURMAN: Yes.
 16 DR. NOVAK: on overlaying the soils
 17 map where the impaired streams are?
 18 DR. THURMAN: Yes.
 19 DR. NOVAK: Okay, that's a valuable piece
 20 of information. Now you mentioned that you're a soil
 21 scientist, you've spent much time in the field. I'm
 22 sure you've walked streams, you know soils that are
 23 mapped as fluvaquents.
 24 Okay, so you know what I mean, these are
 25 entisols that are mucky along the stream channel.



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1 They're so wet that they don't farm, but yet they're
 2 wide enough that some, in some counties they're mapped
 3 as a recognized soil map unit. They don't give them a
 4 name, they call them fluvaquents.
 5 This is potentially good information for
 6 you to get in either an area size, the extent of the
 7 buffer, these areas contain vegetation. Most times
 8 they're not farmed, they're not disturbed.
 9 So if you had that overlay and if you
 10 had an area that had these wetland areas, riparian
 11 buffers, those are the natural ones. So that would be
 12 like your first attempt to catch even an area using the
 13 soils map. You'd have to work with Mr. Thurman on that
 14 and I'm sure he has the background from how he's
 15 smiling there.
 16 I know I've spent many times trying to
 17 keep the gnats and the snakes away from me, and down in
 18 my area it's the gators.
 19 The second question I have is that in
 20 terms of the buffers themselves that are going to be
 21 manmade, that's a little bit more of a challenge that
 22 you probably will have to either get from aerial maps
 23 or from some of the ground truthing. And I know this
 24 is only one of the six or four questions that you
 25 asked, but that's why I wanted to know if you were

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1 going to utilize the soils information.
 2 Thank you.
 3 DR. HEERINGA: Doctor Ellsworth, Tim
 4 DR. ELLSWORTH: Tim Ellsworth. Real
 5 quick, two points that kind of are coming up here is
 6 there's, so there's these different scales, there's
 7 physical processes going on, kind of physical scales
 8 and then there's these management scales.
 9 One of them that's coming to mind is
 10 rainfall. You know, summer rainfall, the spatial
 11 distributions are highly variable. You have, you know,
 12 and you've got that interacting with where the corn
 13 acres are in one of these little sub-watersheds. You
 14 go down too small, you know, and you're going to
 15 increase your variability instead of actually
 16 increasing the power of the regression, you're going to
 17 lose it.
 18 I mean there's like an optimal spatial
 19 scale there and there's management scales in terms of
 20 what the information that's coming in is. All right,
 21 so just the fact that there is some kind of
 22 DR. HEERINGA: It's a good point. At
 23 this point in time what I'd like to do is I'd like to
 24 oh, Doctor Olsen.
 25 DR. OLSEN: Tony Olsen. Just one brief

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1 comment, you know, to Tom's question.
 2 In terms of the buffer zones I mean you
 3 brought up the point of actually finding out what the
 4 real buffers are that people are installing under best
 5 management practices and other things. And that would
 6 be valuable to do.
 7 I was also thinking about doing
 8 something fairly generic of basically just saying, hey
 9 look, what's within, you know, 30 meters of, you know,
 10 of the stream, just sort of doing the buffer just as a
 11 rough guess as to what sort of soils are nearby the
 12 streams.
 13 If soils nearby the streams matter a lot
 14 versus soils further away from the streams then
 15 because one of the things I saw up there on the map of
 16 the Missouri sites where we had all the red sites
 17 showing up, what I wanted to have, Nelson immediately
 18 put up there and I hadn't really thought about this
 19 until then, is I wanted to see the stream network
 20 because I thought I saw it.
 21 You know, so it seems to me that having,
 22 keeping track of things around some zone around the
 23 streams may be useful. Not to exclude the other ones
 24 as the entire thing, but as something that might
 25 actually have a better chance.

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1 Thanks.
 2 DR. HEERINGA: Doctor Novak.
 3 DR. NOVAK: This is Jeff Novak again.
 4 Yes, that's a very good approximation for there.
 5 But a person needs to be aware that not
 6 all streams are going to have buffers next to them. So
 7 you're again, in your hit and miss operation.
 8 Now Nelson, you spoke, you have a
 9 laundry list. Well I've got another thing for you
 10 here.
 11 If you look at these maps, aerial maps,
 12 from the color of the vegetation you can tell if
 13 there's forest up to the stream channel, you can tell
 14 if there is a pasture up to the stream channel. Now,
 15 depending upon what state you're in and what watershed
 16 and on what parent material you're in, the farmers will
 17 try to plough all the way up to that stream channel.
 18 But because of the setbacks, they're
 19 required to have in some areas up to a 50 feet buffer,
 20 most times that's going to be in a grass water, or
 21 grass type vegetation. Some farmers don't like trees.
 22 So Nelson, I know you don't want to hear
 23 this, but it's probably going to be where you might
 24 have to do this by maps and looking at each individual
 25 stream channel.



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1 We all need paychecks, thank you.
 2 DR. HEERINGA: I think we all need a
 3 break too. At least I do.
 4 What I'd like to propose is I think this
 5 has been a very healthy discussion. We've made good
 6 progress.
 7 Let's take fifteen minutes and in a
 8 little over fifteen minutes come back here at five
 9 minutes of three and we will return to the Charge
 10 Question 11, which is the final question. And we'll do
 11 a wrap up and I expect we will be done by 5:00 or
 12 before.
 13 So again, say five minutes of three,
 14 let's be back.
 15 (WHEREUPON, there was a recess).
 16 DR. HEERINGA: Okay, welcome back
 17 everyone to the final half of the afternoon for I think
 18 our final day of formal face to face meeting of the
 19 Science Advisory Panel.
 20 Before we move on to Charge Question 11
 21 I think there are a few additional comments that people
 22 wanted to get in on Charge Question 10.
 23 Doctor Lapoint and Doctor Grue.
 24 DR. GRUE: I held off on making this
 25 comment simply because I wanted to check with Tom to

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1 see if I was in part on target, and I may still be off
 2 target and Tom doesn't accept any responsibility for
 3 that but, or shouldn't accept any responsibility for
 4 that.
 5 But, you know, looking at the
 6 information we were provided by Syngenta, I think, I
 7 can't remember if it was early this morning or
 8 yesterday in terms of the influences of peak water, the
 9 peaks and atrazine concentration relative to the SSI,
 10 the comments this afternoon about the ability now with
 11 the new data, the soil data, and as Doctor Chu
 12 suggested, the hydrographic information.
 13 I was just toying with the idea, is it
 14 possible to incorporate that information to, with
 15 precipitation data to actually predict what those peaks
 16 would be for sites that have not been sampled? In
 17 other words, can you model that?
 18 You have peak data now, both from auto
 19 samplers and from graph samples. Realizing the biases
 20 that Doctor Ellsworth has pointed out in terms of,
 21 well, you might be a little bit low on the, or some
 22 percent low on the, on the peaks.
 23 But is it possible actually to model
 24 that? Is the information spatially, of sufficient
 25 spatial resolution that, you know, as you move forward

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1 out of this, these 40 watersheds, is it possible based
 2 on the enhanced soil data, the other factors that go
 3 into the vulnerability index, I'll just call it that,
 4 is it possible and the information that we already have
 5 on peaks and the drivers for that, is it actually to
 6 develop a predicted capability to assess what those
 7 exposures would be, to be able to run that through CASM
 8 and actually assess or make some predictions in terms
 9 of what the effects might be?
 10 DR. THURMAN: The simple answer is yes.
 11 It is possible. It depends on how much there is
 12 going to be a degree of uncertainty involved in that
 13 and the ground truthing.
 14 I mean honestly our risk assessment now,
 15 we do that at a screening level, but it is something
 16 and generally at a field scale, but as I've mentioned
 17 we've been looking at watershed scale approaches.
 18 So, yes it is. And it's something that
 19 we hope that we can improve upon the methods as we go
 20 along.
 21 The value of atrazine as the wealth of
 22 monitoring data you have for comparisons, so you know,
 23 it is something that can be done and a direction that
 24 could be taken.
 25 DR. HEERINGA: Doctor Lapoint, do you

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1 want to add something?
 2 DR. LAPOINT: Well Doctor Grue said it
 3 all. I mean we've talked a little bit about that, but
 4 I really think because he and I were thinking about
 5 this after we got this handout.
 6 And I think it would be quite good for
 7 looking at, again the kinds of watersheds, or I guess
 8 as we've been defining them now as sub-watersheds, and
 9 looking at rainfall data. And it could be even ground
 10 truth with some of the data you've already collected.
 11 You know, because we know what's happened in the past.
 12 And it might be a good way of screening some of the
 13 more, some of the additional areas that haven't been
 14 looked at.
 15 DR. HEERINGA: Thank you very much. At
 16 this point I guess I would like to move on to Charge
 17 Question 11 and ask Doctor Irene to read it into the
 18 record, please.
 19 DR. IRENE: Stephanie Irene. In order to
 20 identify areas beyond the 40 sites where higher
 21 atrazine exposures are likely to occur, the Agency must
 22 determine whether the watersheds that exceeded the LOC
 23 in multiple years are randomly distributed within the
 24 1,172 vulnerable watersheds or represent a unique
 25 subset of conditions.



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1 If the latter and the conditions can be
 2 identified, monitoring could be focused only in
 3 watersheds where those conditions exist.
 4 The Agency has proposed evaluating more
 5 parameters and other sub-watershed soil and hydrologic
 6 properties to determine the extent to which the
 7 monitoring results can be used to identify other water
 8 bodies exceeding the LOC.
 9 To what extent can WARP be used to
 10 identify other watersheds of concern? Give the
 11 influence of atrazine use and vulnerability and
 12 exposure, please comment on whether the extrapolation
 13 should be limited to the original 1,172 watersheds or
 14 include a broader use area.
 15 Please comment on the soil and hydrology
 16 parameters the Agency is evaluating for extrapolation
 17 to vulnerable watersheds. What additional soil and
 18 hydrologic parameters should the Agency consider? What
 19 additional approaches to the identification of
 20 watersheds that may have atrazine levels that exceed
 21 the LOC should the Agency consider?
 22 DR. HEERINGA: The first part of that
 23 we've had some discussion of already with Doctor
 24 Gilliom's presentation, but Doctor Effland, let's hear
 25 your initial overview response.

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1 DR. EFFLAND: Okay, thank you. Bill
 2 Effland here. The interesting thing about the WARP
 3 model, and I'm going to actually, I'm going to blend my
 4 response between a couple of questions here, I think
 5 because we're getting to where there's a little more
 6 integration and consensus.
 7 To me the WARP models are regression
 8 models, so the data that went into the model helps to
 9 define the parameters that are used as far as the
 10 coefficients of the, for the different variables.
 11 And in a former earlier career, I did
 12 some regression modeling of another variable. And one
 13 of the concerns that the statistician that talked to me
 14 about my work was that, you know, how transportable is
 15 this? As far as the coefficients go, how can it be
 16 applied in other locations?
 17 Because the data that I put in was for a
 18 very limited geographic region. And with the WARP
 19 model of course it was for the entire United States.
 20 And so I have some concern about just
 21 using the WARP model with the current coefficients, but
 22 bringing in new data, especially new use data since
 23 that seems to be an important component.
 24 So I guess I would be cautious about
 25 using that particular model. Maybe if the model

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1 developers, if USGS and folks are willing to, willing
 2 to go through the analysis with the newer sources of
 3 data and generate new coefficients for their regression
 4 equations, then maybe it would be more applicable.
 5 And the statisticians on the panel here
 6 can probably clarify that again. I'm mostly dangerous
 7 with statistics in most situations.
 8 A couple of things that I want to bring
 9 up that were brought up in Bob Lerch's presentation,
 10 but I think also apply here, one of the things is you
 11 keep talking about vulnerability, and I've never really
 12 seen an explicit definition of what vulnerability is.
 13 And so I wonder, and I think it would be
 14 worthwhile to explicitly state the vulnerability
 15 because in thinking about the fate and transport of
 16 atrazine, we can have vulnerability related to runoff
 17 or we can also move atrazine through subsurface flow,
 18 either in a tile drain system or through groundwater
 19 flow. Atrazine has been documented to move in the
 20 groundwater in tile.
 21 And so are you talking about runoff
 22 vulnerability or are you talking about subsurface flow
 23 vulnerability, or are you talking about both?
 24 And so I think that there's a need to
 25 clarify that term so that it's explicitly defined. And

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1 I've kind of struggled with that back and forth in
 2 looking at a lot of the material here, so I bring that
 3 up.
 4 And then I think maybe one of the ways
 5 to look at that is, and I think I heard this from the
 6 Syngenta presentation, they've conducted PRZM runs for
 7 all of the sites that you've been working with. And so
 8 you have some, you have some model information on
 9 runoff, so you can get an idea.
 10 And one of the reasons I bring that up
 11 is it also points to some questions I have about the
 12 chemographs. You can have a, you look at your
 13 precipitation data and you can have a precipitation
 14 event, but you may not necessarily have a runoff of
 15 event associated with that precipitation, depending
 16 upon intensity and duration of the precip, timing of
 17 the precipitation and then your landscape
 18 characteristics, slope and other things. And then
 19 maybe there are some best management practices or some
 20 other things going on in that particular and I'm
 21 going to focus just on the sub-watershed scale because
 22 I think that's where you're really looking.
 23 And so you have to look but I think
 24 it's worthwhile to go back and look at those PRZM runs
 25 as far as, you know, looking at that versus also



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1 looking at the precipitation that you have and helping
 2 to determine whether with some of your sites, did you
 3 have a runoff event and that's what contributed to the
 4 atrazine that you saw.
 5 Or maybe, you know, maybe you actually
 6 had application of atrazine, you didn't have a runoff
 7 event even though you had some precipitation, so you
 8 didn't see any concentrations in the stream.
 9 And so that's something and the reason
 10 that that came to my mind was I was looking at the
 11 collection of chemographs, and in some of your
 12 chemographs it's pretty clear that you get a runoff,
 13 you've got a runoff, you've got precipitation, a runoff
 14 event and you're getting a detection. And in others
 15 you're not or you're getting somewhat of a it's a
 16 fairly short delay but it seems to be somewhat of a
 17 delay.
 18 And then also if you look at some of the
 19 other chemographs you get that and I think that
 20 question came up earlier, you get a late season peak,
 21 and it's only a few of them. But it, you know, brings
 22 to mind, you know, what's unique about that particular
 23 site that with the majority of the sites you get your,
 24 it looks like you get precipitation events and you get
 25 runoff associated with those and then you get a

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1 detection of atrazine in the stream.
 2 But then in some cases, you know,
 3 several months later, it looks like normally July,
 4 August and I think the one that I, just the one that I
 5 picked out in random, sometime in mid-August you get a
 6 peak of atrazine there.
 7 So what is different about that
 8 particular site? And I think that also leads to
 9 another comment that I'd make is, have you thought
 10 about looking at these watersheds and seeing what
 11 characteristics are similar versus what characteristics
 12 are different as you have a lot of site information,
 13 you have slope and you have a lot of information about
 14 the cropping distribution, the cropping information.
 15 So I think that you can tease some more,
 16 I think there's some more information that can be
 17 pulled out of the PRZM runs that have already been
 18 conducted. And maybe you're going to need to do some
 19 additional PRZM modeling. And then also looking at
 20 the, looking at those chemographs and doing some more
 21 analysis of those.
 22 And I haven't heard a lot of discussion
 23 about I mean the chemographs seem to be fed into the
 24 CASM model and but I think there is also some valuable
 25 information as far as site conditions and sub-watershed

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1 vulnerability if you will.
 2 So that's something that I would
 3 suggest.
 4 A lot of the comments that I'd written
 5 down earlier have been addressed from question number
 6 10 about applying the more recent GIS data, scale
 7 effects, data resolution, and I didn't realize, and I
 8 should clarify, the paper that I distributed this
 9 morning, the Gotway and Young paper, I didn't realize
 10 that Doctor Young was the second author and I'd like to
 11 recognize her.
 12 And I've been looking at that paper for,
 13 well, for several months now on and off just trying to
 14 understand what they did. And I know Doctor Gotway
 15 from another meeting and I, you know, it's, I think
 16 it's exciting, you've got an opportunity to talk with
 17 one of the authors, it's usually not so easy to do
 18 that.
 19 So I would again, you know, encourage
 20 you to consider that, looking at the change of scale of
 21 support as they call it in that publication.
 22 Another thing that came to my mind is
 23 how to get a handle on restrictive layers and there is,
 24 you know, as much as I can defend the National
 25 Cooperative Soil Survey, I can also say that it's

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1 produced by humans and we know that humans have their
 2 variability, and so there are some missing data
 3 elements or some things that are more important.
 4 I will caution you, for example, that in
 5 some of the data there are some regional biases. For
 6 example, where I went to school in Iowa my graduate
 7 advisor was the person who set up the hydrologic soil
 8 groups for the data for the state of Iowa. And one of
 9 the comments he made to me was, we're not going to have
 10 a whole lot of these things in our B or C soils, you
 11 know.
 12 And so he basically, you know, through
 13 his influence has influenced the interpretations of
 14 some of that.
 15 So just to caution you on that.
 16 But the point about the restrictive
 17 layer is that, I would like to make is that I think
 18 that if there is missing information in the database,
 19 there's also other ways to get to the same point, to
 20 get to the same endpoint. And the soil classification
 21 that Jeff Novak mentioned earlier is one way to do
 22 that. If you want to look at, if you understand the
 23 system, there are ways and I'm sure that Nelson can
 24 and he's probably thought about this already, but I
 25 just, I bring that comment in, there are ways to tease



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1 that information out of other components of that
 2 database.
 3 And it is, it's an extremely valuable
 4 database and it's going through constant revision. If
 5 you pulled SERGO data off the web, one of the things
 6 you want to make sure you do is register that you're a
 7 user of that data, because if they change that data set
 8 you'll get an email that says, hey, we've updated that.
 9 They won't tell you what they changed but they may have
 10 filled in a field, they may have filled in a field that
 11 you're interested in. And you'll go back to, ah,
 12 here's finally, you know, information on depth to the
 13 restrictive layer or whatever.
 14 So it is a very valuable source of
 15 information and it is being used in a lot more ways
 16 than the original people that started that program ever
 17 realized, ever imagined.
 18 Just a couple more comments.
 19 The question about tile drainage and
 20 trying to come up with a GIS coverage for tile
 21 drainage, and I'm not positive of this but I'm pretty
 22 sure that Dave James at the National Soil Tilth Lab,
 23 with one of the other scientists there at the Tilth Lab
 24 in Ames, published a paper a year or so ago, and I
 25 can't put my hands directly on the reference, but I

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1 remember seeing either a poster or an abstract or
 2 something about looking at this was for the
 3 Mississippi watershed, but since you're working, you
 4 know, at least for this particular area you're working
 5 in the midwest, so I think some of that information is
 6 available. It may not be as readily available as some
 7 of the things that USGS posts on the web as far as
 8 their geospatial data and that USDA also posts and
 9 other groups.
 10 But I think there are some potential
 11 sources for that, and so that might be one other way to
 12 look at it.
 13 And I'm a little, I'm not quite
 14 convinced about the using the dual hydrologic soil
 15 groups. I would like to see some more coincidence to
 16 that.
 17 But I will say that even if you go out
 18 and I think somebody made this comment if you go out
 19 and try to find out where tile drains are in a field,
 20 in some cases the people that farm that field cannot
 21 really help you identify them. And in other cases they
 22 know very well where they are because they've updated
 23 them, they've been maintaining and they've replaced
 24 them and they've put in newer ones.
 25 So, I think there are some potential

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1 sources for that and that's something to consider.
 2 And then one last comment, and this
 3 actually opens up a whole new, it opens up a whole new
 4 laundry list for you, Mr. Thurman. And I apologize for
 5 this but since Doctor Brady is not here, we'll go
 6 ahead, and I'll go ahead and start down this path.
 7 One of the really exciting that's going
 8 on in the geospatial realm these days, and you folks
 9 have picked up on it, and actually I learned something
 10 with the NHD Plus because I use the NHD data a lot, but
 11 I didn't know there was an NHD Plus. And so I learned
 12 something from this encounter.
 13 And that use of the digital elevation
 14 model data, okay, and as Tony pointed out, the DEM data
 15 for the United States, the USGS has done an excellent
 16 job of giving us the best available data, but it is at
 17 different spatial resolutions. In some cases it's 30
 18 meter data, in some cases it's 10 meter data and in
 19 some cases it's actually finer resolution data than
 20 that, related to a new technology called LIDAR and some
 21 of that data is available. And that's an extremely
 22 fine scale, but for some of the sub-watershed modeling
 23 I think it's very useful.
 24 But there are some other things that can
 25 come out of the terrain data and terrain analysis

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1 procedures. And you've looked at some of those with
 2 flow accumulation. The top model that's used in the
 3 Dunn Overland Flor Information, that is also used in
 4 the terrain model.
 5 And one of the thoughts I had was just
 6 to there's some simple kind of metrics you can have
 7 as far as if you're looking at a watershed or a sub-
 8 watershed, what's the difference between the maximum
 9 elevation and the elevation at your outflow, at your
 10 lowest point where you're looking at? So it gives you
 11 some idea of within that sub-watershed or watershed,
 12 what's your range in topography basically? What's your
 13 range in elevation?
 14 And there's a lot of other variables.
 15 There are some excellent books, there's a book on
 16 terrain analysis, principles and practices, there's
 17 several publications out and I'd be glad to share any
 18 of those with you.
 19 But I think if you're going to zoom in,
 20 why not take advantage of that digital elevation data
 21 and some of things that maybe that can do for you?
 22 And just as an aside to what Doctor Chu
 23 mentioned, if you're going to do hydrologic modeling,
 24 you know, we've got models like, well you have basins
 25 which is built on SWAT, the soil water assessment tool,



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1 and that's basically linking another modeling system
 2 that we have, the erosion productivity impact
 3 calculator or now it's called environmental policy
 4 integrated climate ethic model, which is an old model
 5 that I've had.
 6 But all those are runoff models that are
 7 curve number driven, but they're linked into, now into
 8 a geospatial context and so there's value there and I
 9 think this digital elevation data is something that is
 10 also a very valuable additional source for you.
 11 And I guess that's, with that I'll, I
 12 don't have any additional comments.
 13 DR. HEERINGA: I used to think the
 14 military had the ownership of the acronyms but I think
 15 the soil scientists have got them beat.
 16 Okay, thank you very much, Doctor
 17 Effland. Jim Fairchild.
 18 DR. FAIRCHILD: Fairchild. The question
 19 really was asked basically how good a job did the model
 20 use to predict watersheds that exceeded the level of
 21 concern for atrazine exposure and duration?
 22 And I think, you know, I'm fairly
 23 confident with the used of the WARP model in
 24 identifying vulnerable watersheds, but it is clear that
 25 there are several outliers that weren't expected to

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1 exceed the level of concern and that is the Missouri
 2 sites particularly, and I found that very interesting.
 3 And even though there was predicted that
 4 there was possibly some sub-basin variation in atrazine
 5 concentrations, it turns out that in the Missouri case
 6 there was not, that basically it was reflective of the
 7 entire watershed.
 8 So where to go next? At this point, you
 9 know, I think that realizing that the Agency is
 10 resource limited, I would hope that they would stay
 11 within the original set of 1,172 watersheds.
 12 I'd devote some effort to actually
 13 putting more effort into examining the Missouri
 14 watersheds as well as the Nebraska watersheds that
 15 weren't necessarily expected to trigger the LOC.
 16 But I still have a concern. I think
 17 that the Missouri situation may be a little bit
 18 atypical, that I still have this question of how
 19 representative is the selected sub-watershed and stream
 20 segment? How reflective is that of the hydrologic unit
 21 in its entirety?
 22 And I think that we've heard several
 23 ideas tossed out additional data, techniques that might
 24 be used to possibly explore how representative they are
 25 in terms of representing the entire HUC. But, you

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1 know, you've got this given data set with this begging
 2 questions and I hope that you wouldn't redirect too
 3 much of your effort outside of the original effort.
 4 I guess there's a couple of concerns
 5 that I still have and this is kind of more of a general
 6 comment, and one of those is we still have this
 7 uncertainty in terms of the timing of rainfall in
 8 relation to atrazine application.
 9 And this is such a critical factor, and
 10 I know it's very, very difficult to obtain. But, you
 11 know, given the relative interests of corn growers and
 12 some of the other groups who are here, I would hope
 13 that Syngenta and the Agency might move ahead with
 14 some
 15 cooperative opportunities to try to get a little bit
 16 better data on the timing of precipitation and atrazine
 17 application at the field level.
 18 And I'll leave that at that.
 19 And then the other is basically the
 20 quality of data in terms of corn harvest. And earlier
 21 it was mentioned using remote sensing data, possibly
 22 aerial photography to go back post HUC and try to fine
 23 tune the estimates of corn and corn harvest related to
 24 atrazine application.
 25 And I think that there might be more of
 that data out there than the Agency is aware of. I

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1 know you're very, very busy but I would encourage you
 2 to explore that.
 3 And then the last thing that I want to
 4 mention is that I hear a lot of talk about best
 5 management practices. And, you know, there has been
 6 questions about how effective they are and that's the
 7 whole basis of ARSC program. And there is a lot of
 8 data that says that they are effective in many cases,
 9 properly designed according to soils, the slop, you
 10 know, on a sub-watershed or watershed basis.
 11 However we've got a changing market
 12 condition with corn ethanol and the price of corn. And
 13 it's my concern that a lot of these CRP lands are going
 14 to come out and go back into production. I don't know
 15 how the use of the 1992 land cover data, how well that
 16 reflects current CRP. But I suspect that we're going
 17 to see a lot of marginal land come back into
 18 production.
 19 And I know that you all are aware of
 20 that but it really does make me concerned about
 21 atrazine exposures and possibly people not necessarily
 22 taking full advantage of BMP's just because they're
 23 concerned that it could cost them on the return side.
 24 So, that's all I've got to say.
 25 DR. HEERINGA: It's a good point. I



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1 guess \$3.80 diesel fuel is the other factor that works
 2 the opposite way.
 3 Doctor Lerch.
 4 DR. LERCH: This is Bob Lerch. I've just
 5 a couple of comments, some of which just reiterates
 6 things I've said in the previous one, so I won't be too
 7 lengthy here.
 8 I suppose I'll slightly differ from my
 9 colleague, Mr. Fairchild, in a sense that because you
 10 could use GIS tools to evaluate HUC 10 watersheds
 11 outside of the 1,172 for things like the restrictive
 12 soil layers and computation of something like say the
 13 runoff propensity index, which is just a ratio of the
 14 19th percentile flow to the 10th percentile or the
 15 presence of hydrologic soil groups C and D.
 16 If you didn't identify the watersheds
 17 outside the original 1,172 it would give you confidence
 18 that that was in fact a good selection, but it's an
 19 opportunity to be sure that that's not the case. If it
 20 is then those could be included for future monitoring,
 21 because I think that could be a GIS based exercise.
 22 In terms of the second one, what
 23 additional parameters, et cetera, the only I'd have
 24 there is the application of potentially of risk
 25 assessment index models based on SERGO data. I think

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1 the other thing is improved herbicide usage data to get
 2 down to the scale in annual variation that I think is
 3 going to be needed.
 4 And then the last one, this is Bob
 5 Gilliom's suggestion of essentially rerunning the step
 6 wise regression for WARP to tool it for the specific
 7 need of identifying watersheds or stream reaches that
 8 exceed the LOC.
 9 DR. HEERINGA: Thank you very much, Bob.
 10 Doctor Portier, Ken.
 11 DR. PORTIER: I don't think there's a lot
 12 to be said. I'll pick up on the issue that Doctor
 13 Fairchild mentioned and I thought of it myself, that the
 14 temporal change in use may actually be a key
 15 discriminator of vulnerable watersheds, rather than use
 16 or intensity.
 17 So the original WARP uses a crop
 18 intensity score which may be only part of it, but
 19 actually a change in intensity may be a bigger, bigger
 20 issue. A watershed that's under a lot of stress,
 21 either typically with increased crop acreage is going
 22 to be one that's disturbed and should have more.
 23 I guess I disagree on the limiting to
 24 the 1,172 for the issues that I mentioned yesterday in
 25 the sense that the 1,172 are kind of defined on the

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1 data that we ran in the current WARP. And if you use
 2 new data it may be a broader or a smaller area,
 3 depending on what the new usage data says.
 4 So some of the factors in WARP won't
 5 change but some of the factors will. And it'll change
 6 the area.
 7 And then the final thing is well I
 8 guess we can say now that we all believe that there's
 9 some aspect of climate change going on right now, so
 10 issues like potential drought or drought probabilities
 11 and/or excess rain probability issues need to be
 12 factored into this as well.
 13 So I'm kind of, maybe my comments are
 14 more on kind of thinking not so much statically of
 15 what's happening today, but what we expect to happen as
 16 things go out and think of vulnerability in that
 17 aspect.
 18 DR. HEERINGA: Doctor Young.
 19 DR. YOUNG: The only thing I would add
 20 right now is the fact, the way that the selection of
 21 the points within the watersheds were derived. They
 22 cannot be considered representative of the full
 23 watershed, because there was a restriction to only
 24 those that were more vulnerable.
 25 And so I think a lot of care has to be

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1 taken in trying to generalize in any way to the
 2 watershed from the sampling points.
 3 DR. HEERINGA: Comments from other panel
 4 members on this final question? Doctor Ellsworth.
 5 DR. ELLSWORTH: Tim Ellsworth. One very
 6 brief one that ties in with what Jim was saying.
 7 You know, we've been on some plots
 8 harvesting corn stover, you know, and there's 500
 9 gallons of ethanol sitting out there just in the stover
 10 after you get a 200 bushel corn crop off. And they've
 11 got 12 million acres in Illinois of that stuff sitting
 12 out there.
 13 It's coming in the next several years
 14 and what happens when that starts to get harvested in
 15 terms of runoff and just the idea is management is also
 16 a factor.
 17 DR. HEERINGA: Those are good points
 18 about farming practice changes which are obviously very
 19 rapid. Yes, Doctor Novak.
 20 DR. NOVAK: Well, I can comment directly
 21 on that removal of residue since I'm part of the REAP
 22 team within the USDA-ARS.
 23 Currently we have no money for that
 24 research. We have some locations that are doing it on
 25 a dime, nickel and dime budget. But generally what



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1 they're finding is that after the third year of residue
 2 removal, that's 100% residue removal, the fertility of
 3 the soil goes to zero. So your system crashes.
 4 So that's a short term effect but it's
 5 available nonetheless. And it's something maybe to
 6 consider.
 7 Now how you get numbers on that, I'm
 8 sure they're going to be available by how much residue
 9 is being removed per county.
 10 But I saw a questions up here that I'd
 11 like to address about additional soil comments or
 12 comments on additional soil properties that might not
 13 have been addressed.
 14 And what I'm noticing in my areas of
 15 research, and we've looked at some of the chemographs
 16 here, is that the antecedent soil moisture conditions
 17 prior to the application of the pesticides, is very
 18 important or when that rain comes down, is it absorbed
 19 by the soil because it's so dry?
 20 This goes back to Doctor Portier's point
 21 that if the watershed is under drought, you're not
 22 going to get much runoff unless it's really an intense
 23 storm.
 24 But generally what I'd like to suggest
 25 is, can you get access to the states' climate data, the

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1 drought offices to do the overleafs for the drought
 2 potentials for the state?
 3 And then if you can I believe they have
 4 the individual weather stations within the state that
 5 report the soil moisture conditions at that time. So
 6 you may have it within a county or an area. The soil
 7 moisture conditions then would give you an idea of the
 8 potential for runoff.
 9 This effect on climate change and
 10 residue removal and bioenergy is the really hot area in
 11 ARS right now.
 12 But thank you for listening.
 13 DR. HEERINGA: Thank you for that
 14 addition. I think again it's a very, very important
 15 notion to be thinking about the changes, particularly
 16 in corn cropping and other biomass products.
 17 Additional comments?
 18 I wanted to see if we could get a little
 19 clarification on, we have different views on the
 20 extension of this, and I don't think we're necessarily
 21 disagreeing, we have this sample population which was
 22 defined for the purpose of the monitoring study.
 23 And I think that a number of panels
 24 have suggested that, really at this point we're
 25 stepping beyond sort of basic data collection

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1 potentially to data accumulation, assimilation and
 2 modeling, and therefore the price, the cost of going
 3 beyond that original group of 1,172 is not large. And
 4 I think we're not seeing a lot of advantage in staying
 5 with the 1,172.
 6 I think going back to an earlier
 7 question, the notion of heavily sampling that lower
 8 80th percentile, a fairly costly sampling to try to
 9 detect a few false negatives, again you have to put a
 10 lot of resource to really quantify false negative
 11 rates. And I'm not sure that that would have been
 12 advisable because we could have said we represented it,
 13 but with such low precision that it wouldn't have been.
 14 But I think here, is it the sense of the
 15 panel then, and I'll let other people respond to this,
 16 that with regard to focusing on this 1,172, 1,172 was
 17 set as a survey population for the sampling reference
 18 and I think that was a useful activity, it's given us a
 19 reference, but with regard to any subsequent modeling
 20 and sort of assessment of vulnerability there really
 21 is, well, there's a marginal cost of assembling the
 22 data, but it's not the same marginal cost of expanding
 23 the sampling into these lower.
 24 Anybody who would like to comment or
 25 react to that?

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1 Doctor Young.
 2 DR. YOUNG: I agree with that. The thing
 3 that is going to basically it seems, if I have the
 4 consensus correct, and I may not, but it's my
 5 impression that a number are suggesting extensions
 6 using some type of regression approach.
 7 And so once you do that it's important
 8 that you have the full range of the explanatory
 9 variables represented, that you're actually going to
 10 want to eventually draw inference to.
 11 So you have a foundation, but that's
 12 going to cover all scenarios. And so for expanding the
 13 model to cover the region, and for validating the model
 14 you'll want to pick places that have particular
 15 combinations of explanatory variables in an effort to
 16 do some validation.
 17 So it would be more targeted field work
 18 as opposed to a sample survey, but it's, the purpose
 19 would be very different.
 20 DR. HEERINGA: At this point I think,
 21 Doctor Irene and the scientific team, whether we have
 22 answered this question?
 23 DR. IRENE: I will defer to the people
 24 who know the answer.
 25 DR. THURMAN: I think we've gotten great



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1 feedback on that. I think there's a lot of things for
 2 us to work with and wrestle with and take into account.
 3 And so it's been very helpful for us.
 4 DR. HEERINGA: And just for the record
 5 too, there are a number of potential sources that Bill
 6 Effland mentioned, some references that he might not
 7 have had at his fingertips, but if they are recognized
 8 you will see them in the report. And that would apply
 9 to any of the discussants here too.
 10 Okay, at this point what I would like to
 11 do is, before we close, I'd like to go around to see if
 12 there are any additional general comments that the
 13 panelists would like to make.
 14 I think we've been fairly free within
 15 the context of the charge questions to do that, but
 16 I'll just give everybody one more chance.
 17 And let me actually begin right here
 18 rather than let Chris think a little while longer and
 19 also Paige too, so we can
 20 DR. PORTIER: Are you indicating I think
 21 with, I speak without thinking?
 22 DR. HEERINGA: No, I'm indicating that
 23 you're a thoughtful person and that you
 24 DR. PORTIER: I've already prepared. The
 25 only thing that comes to mind that we haven't talked

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1 about, and I thought about it this morning is the
 2 sensitivity of the process to the SSI.
 3 The SSI is probably one of a dozen kinds
 4 of similar, similarity indices that you could use to
 5 measure the community structure and change in
 6 community
 7 structure.
 8 And we haven't really talked about how
 9 sensitive your index is. I don't think it would be,
 10 but I suspect there's a number of ecologists that are
 11 going to want you to prove that to them.
 12 So you may actually have to give a
 13 little bit of not a lot of a little bit of thought
 14 to that.
 15 DR. HEERINGA: Doctor Schlenk, Dan.
 16 DR. SCHLENK: I have nothing to add.
 17 DR. HEERINGA: The corn expert is coming
 18 up.
 19 DR. HANDWERGER: As a physician/scientist
 20 my interests are so far removed from the subject of
 21 this meeting that I've chosen to heed the words of
 22 Abraham Lincoln who said, it is better to remain silent
 23 and be thought a fool, than to speak out and remove
 24 all doubt.
 25 So, but I found this meeting to be very
 interesting. I think I was able to follow about half

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1 of it.
 2 I was raised at NIH next door to the
 3 Nobel Laureate, Julie Axelrod who once said that if an
 4 experiment required statistics it probably wasn't a
 5 very good experiment.
 6 And I actually believe that.
 7 DR. HEERINGA: Doctor Isom, okay Doctor
 8 Young.
 9 DR. YOUNG: I just, you know, I feel like
 10 as a part of the panel that we always emphasize what
 11 can be improved and what could be done differently and
 12 things to think about.
 13 But I do think that both Syngenta and
 14 EPA are to be congratulated on a Herculean effort for
 15 data collection in a considered and careful way, and
 16 for preparation to this point.
 17 There are many challenges left, but I
 18 think you have a really good start on finding some
 19 important answers.
 20 DR. HEERINGA: Doctor Chu.
 21 DR. CHU: I think this is really a good
 22 opportunity to learn many, many things during this
 23 three, actually three day meeting.
 24 I just want to mention one thing. In
 25 recent years I did a lot of hydrological modeling

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1 studies. I just looked at the stream studies and it
 2 seems pretty much similar to ours, the small creeks,
 3 the small streams.
 4 So we did an analysis for example about
 5 the collection of the stream flow and processed the
 6 stream flow data, development of reading curves and
 7 also we developed some special computer software to
 8 process the stream flow data.
 9 So if this kind of information will be
 10 helpful for this project, I would be very happy to
 11 provide any details.
 12 DR. HEERINGA: Thank you, that's
 13 appreciated and I remember having seen some of your
 14 presentations in a meeting a year and a half or two
 15 years ago on some of your stream hydrology work and it
 16 would be beneficial, so --
 17 DR. CHU: Thank you.
 18 DR. HEERINGA: thank you. Doctor
 19 Effland.
 20 DR. EFFLAND: Actually I don't have any
 21 additional comments, I think I've probably said enough.
 22 And after hearing that quote I'm sure that I have.
 23 DR. LERCH: I do have one other scenario
 24 to throw out that, in terms of another definition or
 25 another setting in which vulnerability for contaminant



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1 transport and herbicide transports exists.
 2 And it's in karst topography. Losing
 3 streams or conduit flow through sinkholes in another
 4 extraordinarily vulnerable setting in which surface
 5 water becomes groundwater and that groundwater often
 6 becomes surface water yet again.
 7 And there are some areas, southern
 8 Illinois, southeastern Missouri, parts of Arkansas, et
 9 cetera, that do have significant row cropping over
 10 karst and I think that's an especially vulnerable
 11 exception to the general rule that's out there.
 12 It would also be a challenge from an
 13 ecosystem standpoint because you're now and I think I
 14 got the lingo here you're dealing with producers,
 15 you're dealing with anthropods and isopods and that
 16 sort of thing in very sensitive karst ecosystems that
 17 would be impacted by these contaminants.
 18 And that would be an extraordinary
 19 challenge for any model. But I just throw that out as
 20 a potential scenario that does exist out there that has
 21 not been addressed.
 22 DR. HEERINGA: Doctor Ellsworth.
 23 DR. ELLSWORTH: Yeah, I'm just going to
 24 echo Bill. I think that goes for me.
 25 DR. HEERINGA: Bob Gilliom.

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1 DR. GILLIOM: I feel like I should be
 2 taking a hint from you guys and just I'm being really
 3 careful here.
 4 I will second the kudos for the huge
 5 effort that went into the field work from you guys and
 6 so forth. That, the whole effort to pull off that
 7 monitoring was major.
 8 One question I have that's more of a
 9 framing question I was interested in still getting from
 10 the Agency relates to the question I'd asked earlier
 11 that you cleared up on the toxicity issues.
 12 And the question I had asked before was
 13 whether or not the animal part of the toxicity issue
 14 had been addressed for the degradates before then
 15 moving right away on to just the plants and just the
 16 parent compound. The answer was, yes, it had been
 17 addressed in the sense that even for the animals, not
 18 just the plants, those degradates weren't significantly
 19 adding to the toxicity.
 20 So that answers that.
 21 And so the only, the only other question
 22 I have in terms of framing the panel's responses is,
 23 what's the Agency's position on what happens if new
 24 information comes? And I'm not talking about the
 25 amphibian thing specifically, but if new information

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1 comes out of studies that are ongoing with, you know,
 2 fish reproduction or the whole your Agency is going
 3 through on the endocrine disruptors and what's the
 4 process for how that gets added on as new information
 5 to what's going on with this process that's aimed at a
 6 plants only exposure assessment?
 7 DR. HEERINGA: Doctor Irene, if you
 8 choose to.
 9 DR. IRENE: Yeah. Well, you know, if new
 10 in there are several to this.
 11 If new information comes out in the
 12 literature that literature would be evaluated to meet
 13 certain criteria and then if it met the base criteria
 14 for using it in a risk assessment, we would consider
 15 that information and, you know, I mean we can always
 16 make an addendum I believe tot he risk assessment,
 17 because science is an ongoing, you know, field that
 18 just, you know, keeps developing.
 19 On the other hand, if there are some
 20 significant findings on particular chemicals the
 21 registrant is required to send in the 6A2 data. So we
 22 can get new information via many sources. And that
 23 would cause us to reevaluate to do, you know, another
 24 evaluation of what we had already done to see if there
 25 would be any significant change in the risk assessment

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1 that we had already done based on the new information.
 2 Did I get that right, J. C.? Anything
 3 else you want to add?
 4 Yeah, yeah, I mean that's, it's sort of,
 5 you know, it's an ongoing process so I think that as
 6 science is an ongoing and developing and a work in
 7 progress.
 8 So does that satisfy you?
 9 Okay, thank you.
 10 DR. HEERINGA: Jim Fairchild.
 11 DR. FAIRCHILD: I too would like to thank
 12 the panel and the Agency and all the speakers for the
 13 presentations and exchange this week. It always
 14 strikes me that I always learn far more than I
 15 contribute when I come to these types of meetings and
 16 it's just wonderful to go through this type of
 17 exchange.
 18 And I guess I would have one last
 19 question or thing that I would like to see the Agency
 20 follow up with and that is to extend the CASM model to
 21 the second, to the consumer level and try to determine
 22 by distribution of what a 5% and 10% deviation of SSI
 23 actually means at higher trophic level.
 24 DR. HEERINGA: Thank you very much.
 25 Doctor

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1 DR. RANDOLPH: Well I also very much
 2 appreciate the enormous effort put in by both the
 3 Syngenta staff and the EPA staff. And again I thank
 4 you for some very excellent presentations.
 5 One thing that I've thought about and
 6 this is something I don't think will be feasible or
 7 helpful on the short term, but it might be on the
 8 longer term, and it's from the suggestion that Doctor
 9 Lerch made a bit earlier involving the registration of
 10 individual use of herbicide sales.
 11 I've heard several comments that said
 12 the use data are not very good. I suspect they're
 13 actually pretty awful, just intuitively, the level of
 14 aggregation, the quality of reporting, I just think
 15 that's probably not a very good data set.
 16 But, the longer term question is, if EPA
 17 were to implement a registration system, and
 18 particularly with some followup that not only did you
 19 buy the product, but how and when did you use it, so
 20 that you have actual use data.
 21 It occurs to me that if we have this
 22 meeting a few years down the pike, those data might be
 23 really useful. So it's just something I've been
 24 thinking about.
 25 I don't know the cost of implementing a

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1 program like that relative to the benefits from it. It
 2 might cost more to do than it would be worth, but I
 3 think it's something to think about.
 4 DR. HEERINGA: Doctor Novak.
 5 DR. NOVAK: Yes, this is Jeff Novak. I'm
 6 going to coin Bill Effland, I think I've spoken enough
 7 and my professional biases and ignorance has at times
 8 come out.
 9 But I'd like to conclude with two
 10 personal comments.
 11 First thanking the EPA for inviting
 12 three soil scientists to interface with them, to
 13 exchange ideas on what we know and what we don't
 14 know,
 15 and how our specialty and knowledge base can assist
 16 them with accomplishing their goals.
 17 So I thank you very much, it's nice to
 18 be recognized.
 19 On a personal issue I'd like to give
 20 this as another thank you because it allows me to use
 21 this as a professional accomplishment to serve as a
 22 role model for my children. They're continually asking
 23 me, what am I doing besides studying dirt? And now
 24 that I can say or, and pig something but now that I
 25 have this under my wing I thank you. It's good, it
 helps my kids understand what I do.

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1 DR. HEERINGA: Do your children have any
 2 expertise in toxicology or things of that
 3 DR. NOVAK: No, but they want to be
 4 Buckeyes.
 5 DR. HEERINGA: Okay, they won't qualify
 6 for assessment.
 7 Okay, Doctor Lapoint.
 8 DR. LAPOINT: Again, the amount of data
 9 that's been generated by EPA and Syngenta and
 10 contractors in support of registration for atrazine is
 11 astounding. And it, to me the value of this has been
 12 seeing the work that's conducted, the research that's
 13 been conducted and the model development using the
 14 experimental ecosystem data. I think it's excellent.
 15 And I especially want to congratulate
 16 the work on the bioenergetics modeling because I think
 17 given the mode of action of atrazine, the bioenergetics
 18 is really one working with, yes, the sensitive
 19 organisms, the plants, but then it also builds in the
 20 community aspect because if the primary producers are
 21 affected,, that translates up to the consumers.
 22 So it's been excellent.
 23 And I agree with Jeff, Doctor Navak,
 24 that I've certainly learned a lot and it's been
 25 excellent.

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1 Thank you.
 2 DR. HEERINGA: Thank you, Doctor Lapoint.
 3 Doctor Grue.
 4 DR. GRUE: I'll just second the comments
 5 that have been made by others. You always learn more
 6 than what you potentially contribute. And again, as I
 7 did in my opening remarks, acknowledge EPA and
 8 Syngenta
 9 for the tremendous amount of effort they put into the
 10 preparation for this SAP.
 11 DR. HEERINGA: Doctor Gay.
 12 DR. GAY: Paige Gay. I would like to
 13 thank you for extending an invitation to me to be here
 14 for this week.
 15 I have learned so much from each and
 16 every one of you and I know that I will use it wisely
 17 in the future.
 18 And I hope that my comments in the
 19 monitoring section of this study have a little bit of
 20 weight anyway, and I would certainly like to see a
 21 better characterization of the low intermittent flow
 22 sites.
 23 DR. HEERINGA: At this point I think I'll
 24 turn to the EPA scientific team that's been here for
 25 three days with us.
 Doctor Irene.



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1 DR. IRENE: Yeah, I'd just like to start
 2 off and then I'll let anybody else from the team speak
 3 who wishes to.
 4 Unfortunately Doctor Novak took my line
 5 away from me. I was going to start by saying we had an
 6 awful lot of dirt people at this meeting and I've never
 7 been but I've learned so much from you so I think
 8 it's absolutely great.
 9 I actually think I want to express a
 10 heartfelt thanks to the panel members. It's been a
 11 long three days, but you've just been terrific. And I
 12 think the input and the ideas that you've given to us
 13 to pursue are really fabulous. I know I've learned a
 14 lot. I'm sure the rest of the team has learned a lot
 15 also.
 16 And the other thing is that if we really
 17 took to heart everything that you asked us to pursue we
 18 certainly would have job security for quite a long
 19 time. So I think we all appreciate that too.
 20 But truly, thank you very, very much.
 21 It's been a wonderful, wonderful meeting, it's one of
 22 the best I've been at and I've been at many.
 23 And you've been great, you have helped
 24 us out a lot and I thank you and I wish you a safe trip
 25 home and I wish you a very happy holiday also.

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1 And I also would like to ask any other
 2 members on the team or Bill Jordan Don, would you
 3 like to say anything?
 4 DR.. BRADY: I would just like to add my
 5 thanks and it was, as you've all said, some really good
 6 discussion and exchange of ideas that went on here.
 7 Thanks very much.
 8 DR. IRENE: Nelson, Russ, Mark, have I
 9 said it all? Thank you again.
 10 DR. HEERINGA: Well, we'd like to thank
 11 you. And again I think it's been said around the table
 12 form people directly, but I want to express our
 13 appreciation to each of you.
 14 We can look at this and recognize just
 15 the volume of work that's behind every draft, behind
 16 every table is just a tremendous amount of work and
 17 thought that has to go into that.
 18 And so the quality of the presentations,
 19 the materials that were given to us in advance, the
 20 clarity of what we've seen here. If you've been
 21 involved in this process for a number of years, this
 22 really has come up to speed now and I think that that's
 23 great.
 24 And I want to also thank the
 25 representatives from Syngenta who presented data and

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1 their responsiveness on some of the questions that
 2 obviously were sort of indirectly being raised through
 3 the EPA staff who was interpreting their data, it has
 4 been a very I think open and responsive session on
 5 that.
 6 So again, thank you to all of the
 7 members of the public and the audience who've attended.
 8 I've seen many of the same faces for three days and I
 9 can only imagine, I guess it's 24 hours in the same
 10 chair, but I hope for you as well as for us that there
 11 has been some learning experience in this process.
 12 At this point before we wrap up, I'd
 13 like to turn to Jim Downing, the Designated Federal
 14 Official for the meetings for some final administrative
 15 notes.
 16 MR. DOWNING: Yes, thank you. I just
 17 wanted to mention that documents that have been
 18 presented today throughout the meeting will be actually
 19 added to the docket for the meeting. And so within a
 20 few days that will be available. Some documents that
 21 came in on Tuesday are already up.
 22 So you've be able to view all of those
 23 materials shortly, okay?
 24 And of course the docket will contain,
 25 you know, everything pertaining to the meeting, all the

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1 materials, the background materials as well as what's
 2 been considered here in the last three days in addition
 3 to the final report with in 90 days of today.
 4 So it'll all be there for everyone to
 5 see.
 6 I just also want to express my
 7 appreciation for everyone's participation. I think
 8 it's been great.
 9 I would especially commend this panel
 10 for charging into quite a volume of material to digest
 11 in a relatively short period of time, and to be able to
 12 make some great assessments and recommendations to the
 13 program.
 14 And I think as you've heard, we at EPA
 15 have really appreciated everything that you've shared
 16 with us. And I think it's going to be extremely
 17 valuable as we go on.
 18 And, you know, the interesting thing
 19 about all of this is we are not at the end, it's not
 20 over because we've got more to come.
 21 So anyway, so I guess with that yes,
 22 Stephanie?
 23 DR. IRENE: I just want to apologize to
 24 Syngenta. I am so sorry for not acknowledging your
 25 part. I'm exhausted, okay?



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1 So please forgive me, but I do want to
 2 thank you for your presentations, for your
 3 clarifications and all the work that you did also, and
 4 we look forward to continued work together.
 5 And I do apologize for that.
 6 MR. DOWNING: Sure, no problem.
 7 So I guess with that unless there is
 8 something else that I have forgotten, we will consider
 9 the meetings adjourned.
 10 DR. HEERINGA: Okay, we're adjourned.
 11 Panel members, everybody, safe travels
 12 if you're traveling today or tomorrow.
 13 Panel members, if we could just meet
 14 briefly in the breakout room to discuss the preparation
 15 of our written summary of the minutes of the meeting.
 16 (WHEREUPON, the meeting was adjourned at 3:55 p.m.).
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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 06. 2007

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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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