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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

DOCKET NUMBER: EPA-HQ-OPP-2007-0934

UNITED STATES ENVIRONMENTAL

PROTECTION AGENCY

CROWNE PLAZA HOTEL

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DECEMBER 4, 2007

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1 U.S. ENVIRONMENTAL PROTECTION AGENCY
2 FIFRA SCIENTIFIC ADVISORY PANEL (SAP)
3 OPEN MEETING
4 INTERPRETATION OF THE ECOLOGICAL SIGNIFICANCE
5 OF ATRAZINE STREAM-WATER CONCENTRATIONS
6 USING A STATISTICALLY-DESIGNED MONITORING PROGRAM
7 December 4, 2007
8 MR. DOWNING: Okay. I'd like to call
9 the meeting to order, if we could. Good morning. I'd
10 like to welcome everyone to this meeting of the FIFRA
11 Scientific Advisory Panel. I'm Jim Downing, the
12 designated federal official for this SAP meeting.
13 As you know, this is the first of a planned
14 four-day meeting on the interpretation of the
15 ecological significance of atrazine stream water
16 concentration, concentrations using a statistically
17 designed monitoring program. As the DFO for this
18 meeting, I serve as liaison between the panel, seated
19 around the table here today, and the agency. And I'm
20 responsible for ensuring that the provisions of the
21 Federal Advisory Committee Act, FACA, are met.
22 I want to thank Dr. Heeringa, to my left, for
23 serving as the chair of this meeting. I also want to

1 seated over on this side, who will be giving
2 presentations during the meeting this morning and even
3 actually later in the, in the week.
4 Let me explain a little bit about the
5 function of the SAP and the panel composition. By way
6 of background, the FIFRA SAP is a Federal Advisory
7 Committee under FACA that provides independent
8 scientific peer review and advice for the agency on
9 pesticides and pesticide-related issues regarding the
10 impact of proposed regulatory actions on human health
11 and the environment. The FIFRA SAP only provides
12 advice and recommendations to EPA. All decision-making
13 and implementation authority remains with the agency.
14 Now, we talk a little bit about financial
15 conflicts of interest. As the designated federal
16 official for this meeting, I have a critical
17 responsibility to work with the appropriate agency
18 officials to ensure that all appropriate ethics,
19 regulations are satisfied. In that capacity, the panel
20 members are briefed on the provisions of Federal
21 Conflict of Interest Laws.
22 In addition, each participant has filed a
23 Standard Government Financial Disclosure Report. I,
24 along with our deputy ethics officer for the Office of
25 Prevention, Pesticides, and Toxic Substances and in

1 consultation with the Office of General Counsel have
2 reviewed these reports to ensure all ethics
3 requirements are met.
4 Now, let me speak a little bit about public
5 comments and public commentors. For members of the
6 public requesting time to make a public comment today,
7 please limit your comments to five minutes unless prior
8 arrangements have been made. And we do have some
9 commentors today who've made arrangements to make a
10 little bit longer presentations than five minutes. For
11 those that are not pre-registered, those that I already
12 know about, please let me or another member of the SAP
13 staff know if you are interested in making a public
14 comment.
15 I'd like to mention that sitting over at the
16 table over here, we have Shirley Percival, who's in the
17 red jacket there, as well as Steve Knott, the Executive
18 Secretary of the SAP. Either one of them or myself
19 could take your name and what -- how much time you want
20 to speak and come up and at the appropriate time in the
21 agenda, to present your public comments.
22 There is a public docket for this meeting. All
23 background materials, questions posted to the panel by
24 the agency and other documents related to the SAP
25 meeting are available in the docket. Slides of today's

1 presentations will be available in a few days.
2 Background documents are also available on the EPA Web
3 site. The agency prepared for this meeting lists of
4 contact information for the docket. So the Web site,
5 the FIFRA SAP Web site, really kind of mirrors the EPA
6 docket for this meeting.
7 After this meeting has concluded, the SAP
8 will prepare a report consisting of responses to
9 questions posed by the agency considering all
10 background materials, presentations, and public
11 comments. The report serves as the minutes of this
12 meeting, and they will be completed within 90 days
13 after the close of the meeting. Again, I wish to thank
14 the panel for their participation, and I'm looking
15 forward to both a challenging and interesting
16 discussion over the next three days.
17 DR. HEERINGA: Thank you very much, Jim,
18 for that introduction. Welcome, everybody. My name is
19 Steve Heeringa; I am the chair of the FIFRA Science
20 Advisory Panel. Professionally, I am an applied
21 statistician with a specialty in population-based
22 research. I am not a technical expert on the subject
23 matter at hand, so my role in the next few days will be
24 to see that this meeting proceeds smoothly, and then we
25 get a full and complete scientific discussion of the

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1 issues and the questions that have been posed to the
2 panel.
3 I would like to introduce this morning or
4 have them introduce themselves, the members of the
5 panel who do provide the expertise on this specific
6 topic. I'll begin to my left with Dr. Ken Portier.
7 DR. PORTIER: Good morning. My name's
8 Ken Portier. I'm director of statistics at the
9 American Cancer Society National Home Office in
10 Atlanta. I'm also an applied statistician. I'm a
11 permanent panel, panel member, and I have a lot of
12 interests in environmental sampling and probabilistic
13 risk assessment.
14 DR. SCHLENK: Good morning. My name's
15 Dan Schlenk. I'm a professor of environmental
16 toxicology at the University of California Riverside.
17 And my interest is in fate and effects of pesticides on
18 aquatic organisms.
19 DR. HANDWERGER: My name is Stuart
20 Handwerger. I'm professor of pediatrics and cell and
21 cancer biology at the University of Cincinnati College
22 of Medicine. Clinically, I'm a pediatric
23 endocrinologist, and my research is in developmental
24 and perinatal endocrinology.
25 DR. ISOM: Good morning. I'm Gary Isom.

1 I'm a professor of toxicology at Purdue University. My
2 area of interest is neurotoxicology, and I'm a
3 permanent member of the panel.
4 DR. CHAMBERS: I'm Jan Chambers. I
5 direct the Center for Environmental Health Sciences at
6 the College of Veterinary Medicine at Mississippi State
7 University. My area of expertise is pesticide
8 toxicology, metabolism, and neurotoxicology, and I'm a
9 member of the permanent panel.
10 DR. YOUNG: I'm Linda Young. I'm
11 professor of statistics at the University of Florida.
12 My research interests are in spatial statistics and
13 especially environmental modeling as it relates to
14 public health.
15 DR. CHU: Good morning. My, I'm Michael
16 Chu, assistant professor and hydrologist at Grand
17 Valley State University in Michigan.
18 DR. EFFLAND: Good morning. Bill
19 Effland, soil scientist with the USDA Natural Resources
20 Conservation Service. My interests are in resource
21 inventory and assessment monitoring and modeling.
22 DR. LERCH: I'm Robert Lerch. I'm a
23 soil scientist with the Agricultural Research Service
24 in Columbia, Missouri. My research interests are
25 contaminant fate and transport and watershed

1 management.
2 DR. ELLSWORTH: My name's Tim Ellsworth.
3 I'm from the University of Illinois. I'm a soil
4 physicist and geo-statistician. My interests are in
5 chemical fate and transport in soil and spatial
6 sampling.
7 MR. GILLIOM: My name's Bob Gilliom with
8 U.S. Geological Survey. I direct the pesticides
9 studies for our national water quality assessment
10 program and I'm a hydrologist.
11 MR. FAIRCHILD: My name is James
12 Fairchild. I'm an aquatic ecologist with the U.S.
13 Geological Survey in Columbia, Missouri. My primary
14 interest is in pesticide effects on population
15 community and ecosystem loads, and aquatic systems.
16 DR. RANDOLPH: My name is J.C.
17 Randolph. I'm a professor of environmental science in
18 the School of Public and Environmental Affairs, Indiana
19 University of Bloomington. I'm an ecosystem
20 oncologist. My interests are ecological modeling
21 spatial analysis.
22 DR. NOVAK: I'm Jeff Novak, soil
23 scientist with the U.S. Department of Agriculture Ag
24 Research Services at the Coastal Plains Research
25 Center, Florence, South Carolina. After completing

1 several years with the ARS, the best I can describe my
2 research interests is that I am an all-purpose soil
3 chemist dealing with heavy metals, pesticides,
4 environmental fate and transport of other organic
5 contaminants. If the problem comes down the hallway,
6 it usually ends up in my office.
7 DR. LA POINT: Good morning. My name is
8 Tom La Point. I'm a professor of environmental
9 toxicology at the University of North Texas. My
10 specific area of interest is risk assessment,
11 pesticides, and stream systems.
12 DR. GRUE: My name is Chris Grue. I
13 lead the Washington Cooperative Fish and Wildlife
14 Research Unit, the University of Washington with the
15 School of Aquatic and Fishery Sciences. And my area of
16 expertise is fish and wildlife toxicology.
17 DR. GAY: My name is Paige Gay. I'm
18 with the University of Georgia. I'm an assistant
19 research scientist there. My focus is water chemistry,
20 and I am interested in water quality and the impact
21 that agriculture has on it.
22 DR. HEERINGA: Thank you very much,
23 panel members. We'll have a chance to have
24 introductions of the EPA staff in, in just a moment
25 here. But I want to again, at the start of these

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1 meetings, express my appreciation to all of the experts
2 who are assembled here and to those of you in the
3 audience for taking time from your schedule for this
4 meeting. It's obviously a very busy time for many of
5 us, but I appreciate your attendance and participation.
6 I think, as always the FIFRA SAP staff has done an
7 excellent job of assembling a panel to address the, the
8 topic at hand, so thank you again to all of you.
9 At this point in time, I'd like to turn to
10 Bill Jordan of the Office of Pesticide Programs at EPA
11 for a few remarks. Bill.
12 MR. JORDAN: Thank you, Dr. Heeringa.
13 On behalf of Debbie Edwards, the director of the Office
14 of Pesticide Programs, I'd like to extend a warm
15 welcome to members of the panel and also to members of
16 the public who are attending today's meeting. For
17 those of you who are permanent members as well as those
18 of you who are ad hoc members, if this is your first
19 time or your 50th time with us, we want to say thank
20 you very, very sincerely. The kind of work that you
21 do, reviewing complex scientific issues, providing us
22 with excellent advice is critical to the agency's
23 ability to carry out our responsibilities to protect
24 public health and the environment.
25 As I go deeper and deeper into my career as a

1 civil servant, I stop more often and reflect back on
2 the way that things have played out. And one thing I
3 want to talk about this morning is that the Scientific
4 Advisory Panel has been giving us recommendations on
5 how to strengthen the scientific foundation of our
6 regulatory decision for nearly 30 years. I personally
7 have attended and participated in many of the meetings.
8 I attended and watched many more. And I can say that
9 from first-hand experience, your advice has made an
10 enormous difference for us. I -- you've, you've helped
11 us see places where we have gotten off track. Where we
12 have not known what to do, you have given us advice on
13 where we ought to go next. And when we've done good
14 work, you have endorsed our efforts, and all of that
15 has really strengthened EPA's risk assessments for
16 pesticides.
17 I think that the work that EPA does on
18 pesticide risk assessment is considered among the best
19 in the world, and the SAP deserves a large share of the
20 credit for that. For members of the public, I want to
21 say that your presence too and your participation in
22 the SAP process makes an important difference. Getting
23 public input on the review of science issues is
24 valuable, because we recognize that for everything that
25 we at EPA may know and, and the expertise that the SAP

1 members bring, there are still additional things to
2 learn. And so we welcome particularly when the public
3 brings additional information to help improve our
4 deliberations. And having the public here at the SAP
5 meetings is part of OPP's and EPA's overall commitment
6 to transparency, to making sure that our, the basis for
7 our decision-making is fully explained.
8 I want to say thank you to Jim Downing and
9 Steve Knott and the other members of the EPA team who
10 help support the SAP. We appreciate what a critical
11 role you play in the overall success of these meetings
12 and, in our view, you're among the best in the agency,
13 in putting on these advisory committee sessions.
14 Finally, I want to say thank you to our
15 colleagues from the Office of Research and Development
16 and the Office of Water who've helped the Office of
17 Pesticide Programs prepare for this meeting.
18 Scientists from ORD will join us in making
19 presentations to the SAP over the next several days,
20 and your contributions of time and knowledge have
21 really helped improve the quality of our scientific
22 analysis.
23 I want to say a few words about what we're
24 bringing to the SAP this week. This week's meeting
25 tackles another very complex scientific issue, that is,

1 how to assess the potential for atrazine to affect
2 adversely ecosystems, aquatic ecosystems. By way of
3 context, EPA has an extensive database with which to
4 assess the ecological risk of atrazine. Unlike most
5 chemicals, we have over two dozen microcosm and
6 mesocosm studies on atrazine. These data allow us to
7 assess the chemical's effects on aquatic communities.
8 In contrast to the typical pesticide database, which
9 usually contains toxicity studies on individual
10 species, this mesocosm database allows us to look at a
11 higher level of biological organization.
12 And in addition to the understanding of
13 toxicity, we have one of, if not the largest databases
14 on residue levels in surface water for atrazine. And
15 these data permit us to make a much better risk
16 assessment on atrazine than we can do on nearly all
17 other pesticides. At this -- SAP will show you how we
18 use these data to develop what we regard as the state-
19 of-the-art ecological risk assessment.
20 Second, atrazine presents some unique
21 challenges for risk assessment and for risk management.
22 It's one of the most widely used pesticides in the
23 United States. People use it because it works. It's a
24 very effective herbicide, and it has important
25 benefits. But because it is so effective, it can

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1 adversely affect nontarget plants. And because it's
2 used so widely, it's used in many different ecosystems.
3 And we understand and recognize that the level of
4 atrazine that may enter surface water will differ
5 depending on the ecosystem. In other words, risks will
6 vary from place to place, and we need to take that into
7 account in our regulatory decision-making.
8 So our goal is to understand the magnitude
9 and the extent of the potential risk and how those
10 risks vary from location to location. One challenge
11 for EPA was to develop a monitoring program that will
12 give us adequate information from which to estimate the
13 geographical scope of potential atrazine risks to
14 aquatic ecosystems. Where are the most potentially
15 vulnerable watersheds? How do we design a survey to
16 ascertain the percentage of potentially vulnerable
17 watersheds that may be at risk? After selecting a
18 watershed to monitor, how do we determine an
19 appropriate stream reach within which to collect
20 samples? How often should samples be collected? These
21 are all issues that you'll hear how we addressed in the
22 monitoring program that we helped work out with the
23 pesticide company.
24 The second challenge was to figure out what
25 levels of atrazine in water would pose a risk to

1 aquatic communities. Due to how atrazine is used, its
2 presence in stream water is really quite variable.
3 Typically, atrazine levels are highest in the spring
4 and summer after applications and storm events;
5 however, the time course of atrazine exposure can be
6 quite complex. Some sites may have one peak exposure.
7 Others may have several exposure events. Some may
have
8 several moderate peaks; others may have a mix of small
9 and large peaks. Given these variable chemical residue
10 profiles, what we'll refer to as chemographs, how do we
11 determine which ones represent exposure that are likely
12 to have adverse effects on aquatic communities? Again,
13 you'll hear our approach to that, and I think we've got
14 some interesting ideas about how to answer those
15 questions.
16 We've taken the atrazine database; we've
17 tried to analyze it using a collection of existing
18 standard tools and techniques to produce what we think
19 is an ecological risk assessment that's the first of
20 its kind in terms of complexity and sophistication.
21 The atrazine risk assessment, you'll learn about this
22 week, is a joint product of the Office of Pesticide
23 Programs, the Office of Research and Development, and
24 the Office of Water. We've taken tools developed in
25 different parts of the agency, and applied them to

1 produce answers to the questions -- what extent -- to
2 what extent do atrazine residues in surface water pose
3 ecological risks, and how many watersheds are there in
4 which such risk might be occurring?
5 We've combined three distinct pieces. First,
6 an approach to evaluating the microcosm and mesocosm
7 results to characterize the potential of atrazine to
8 cause adverse effects on aquatic ecosystems, i.e., an
9 approach to establish EPAs level of concern for aquatic
10 communities. Second, we have an approach to relate
11 complex atrazine exposure profiles to EPA's level of
12 concern to interpret the chemographs observed in the
13 monitoring programs. And third, we have the results of
14 the monitoring program that's specially designed to
15 characterize the extent to which watersheds in highly
16 vulnerable areas have atrazine levels that exceed our
17 levels of concern.
18 I want to emphasize that all of the tools
19 we've used, experimental microcosm and mesocosm
20 studies, aquatic community response models,
21 probability-based sampling design to the monitoring
22 program, all of these tools are based on a long record
23 of established techniques and methods within the
24 scientific community, including efforts undertaken by
25 EPA.

1 What's new is how EPA has combined these
2 different tools. As I hope you'll see, we believe that
3 the ecological risk assessment that we are going to be
4 describing this week represents a significant advance
5 in understanding where and how atrazine may be
6 affecting the aquatic environment. We're looking
7 forward to your advice and recommendations on our
work.
8 Thank you.
9 DR. HEERINGA: Thank you very much,
10 Bill. I want to turn next to some opening comments on
11 goals and objectives for the next three or four days
12 with Mr. Donald Brady, who is the acting director of
13 the Environmental Fate and Effects Division, Office of
14 Pesticide Programs.
15 DR. BRADY: I would like to -- as the
16 acting director of Environmental Fate and Effects
17 Division, would like to express our appreciation in
18 anticipation of the discussions that will occur over
19 the next few days as our presentations unroll and the
20 discussion and comments come. So Nelson, if you could
21 go just to slide 3. I have just a few slides to set us
22 up Slide 3 -- is that? Okay. Thanks.
23 As the title of this SAP indicates, we're
24 meeting this week to seek input on the agency's
25 approach and methodologies for interpreting the results

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1 of an atrazine ecological monitoring program. Next
2 one.
3 As a condition of re-registration, the
4 atrazine registrants were required to develop an
5 ecological monitoring program to determine the extent
6 to which atrazine concentrations in streams may be
7 exceeding levels that could cause effects to aquatic
8 communities. In consultation with EPA, the primary
9 registrant, Syngenta, developed a three-year monitoring
10 program and recently provided EPA with the results of
11 this program. After reviewing the results, EPA
12 developed a white paper, which contains its
13 interpretation of the ecological significance of the
14 atrazine concentrations that were found at the
15 monitored sites. Next one, please.
16 In this SAP meeting, EPA will be asking the
17 panel a number of questions concerning approaches used
18 to interpret and characterize responses of aquatic
19 communities to varying atrazine exposures. Statistical
20 methods associated with the monitoring study design and
21 data interpretation and options for characterizing
22 uncertainties in the monitoring results. After these
23 issues are addressed in the upcoming review, EPA plans
24 to return to the SAP with an updated analysis of the
25 monitoring results and an analysis for determining

1 whether the data allow the agency to locate other sites
2 that may have the potential for exceeding the atrazine
3 level of concern.
4 Over the remainder of the week, SAP members
5 will have an opportunity to listen to public comments
6 concerning this subject followed by the agency's review
7 and analysis of the results of the monitoring program.
8 Afterwards, we will reveal specific -- we will review
9 specific charge questions that the SAP has been asked
10 regarding the agency's analysis and conclusions. As
11 Bill stated, we at EPA rely on the FIFRA SAP as an
12 important means to assure that we make sound decisions.
13 We're looking forward to a candid and open exchange as
14 we proceed with this meeting. Thank you for this
15 opportunity to address the SAP and for your efforts on
16 behalf of the agency and the public which it serves.
17 DR. HEERINGA: Thank you very much, Mr.
18 Brady, appreciate the clarification of goals and
19 objectives. We'll continue -- Dr. Stephanie Irene, who
20 is the -- with the Environmental Fate and Effects
21 Division in the Office of Pesticide Programs, will
22 provide us an introduction and background to the three-
23 day session.
24 DR. IRENE: Good morning, Dr. Heeringa,
25 and the panel members, and the public. I, too, would

1 like to thank the panel members in advance for your
2 input on the material that we will be presenting to you
3 at this SAP. We realize that this is a very busy time
4 of year, and we sincerely appreciate your taking the
5 time to consult with us on these complex issues. Dr.
6 Heeringa, if it's okay with you, can I introduce the
7 panel members?
8 DR. HEERINGA: Please, if you would.
9 DR. IRENE: Okay.
10 DR. HEERINGA: I was going to actually
11 suggest that. Thank you.
12 DR. IRENE: Okay. Okay. I'll just go
13 in the order in which they're sitting. Mr. Nelson
14 Thurman, he is the senior advisor in the Environmental
15 Fate and Effects Division in the Office of Pesticide
16 Programs. His area of expertise is in fate and
17 transport exposure assessments and geospatial analysis.
18 Sitting next to him is Mark Corbin, and he's the senior
19 scientist in the same division and just like Nelson, he
20 has expertise in fate and transport exposure
21 assessments as well as geospatial analysis. Then we
22 have Tony -- Dr. Tony Olsen is a branch chief and
23 senior statistician in the Office of Research and
24 Development Laboratory in Corvallis, Oregon. He has
25 expertise in survey design and environmental sampling.

1 Then next to him is Dr. Russell Erickson, who
2 is an aquatic toxicologist in the Office of Research
3 and Development in the Duluth Laboratories. And
4 sitting behind me is Mary Frankenberry, she is the
5 senior statistician in the Environmental Fate and
6 Effects Division, and she has been involved with
7 various aspects of atrazine analyses, including the
8 atrazine amphibian study, the atrazine drinking water
9 program, this monitoring study, and she has also worked
10 on the triazine cumulative assessment. So she has
11 quite a lot of experience with this for many years.
12 Although she will not be presenting today, she will be
13 very helpful in answering any questions in her area.
14 Okay. That's it -- that's about it; right? Okay.
15 Okay, Nelson, slide 7, please. Okay.
16 Monitoring study objectives. I would like to
17 briefly state the monitoring program objectives before
18 reviewing the history of this project and the focus of
19 this meeting.
20 The first objective of this monitoring study
21 is to link atrazine exposures in the environment to the
22 levels of concern for atrazine samples taken in
23 monitored streams in corn and sorghum areas of the
24 Midwest. To do this, the agency first had to develop a
25 level of concern which was accomplished by first

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1 evaluating the micro and mesocosm studies available for
2 atrazine and scoring the results of these studies based
3 on the criteria developed by Brock et al. in a paper
4 published in 2000. I will be presenting a brief
5 overview of that information and then you'll be hearing
6 from Dr. Russell Erickson about the use of the
7 community effects model to interpret the monitoring
8 results. He will describe the model itself and the
9 sensitivity analysis performed by EPA on this model.
10 The second objective was to determine the
11 extent to which watersheds have streams that exceed
12 effects-based thresholds for atrazine. Here, you will
13 be presented with the monitoring study, the sample,
14 sampling design that was selected, and the methodology
15 used to select the 40 sites representing potentially
16 vulnerable watersheds.
17 To address the third objective, a
18 presentation will be made on the approach that is being
19 developed to identify areas where the waters that
20 exceed effects-based atrazine LOCs or levels of concern
21 are likely to occur. This includes the evaluation of
22 sub-watershed factors to identify streams exceeding the
23 LOC and identification of other watersheds with similar
24 properties. Objectives 2 and 3 will be presented by my
25 colleagues, Mr. Nelson Thurman, Dr. Tony Olsen, and

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1 Mark Corbin. EPA has not completely accomplished the
2 full extent of the third objective, but Nelson Thurman
3 will present approaches that could be used to develop
4 that information. When that work is eventually
5 completed in 2008, we expect to return to the SAP for
6 additional consultation. Next slide, please.
7 Summary of risk concerns. Atrazine was first
8 registered in 1958 and is one of the most widely used
9 herbicides in the United States. The mode of action
10 for atrazine is to reversibly block photosynthesis,
11 thus inhibiting primary production in sensitive aquatic
12 plant populations and plant communities. Atrazine is
13 persistent and mobile in the environment and can be
14 found in surface water, groundwater, and in aquatic
15 environments located in areas of high atrazine use.
16 Potential effects are likely to be greatest
17 where concentrations recurrently or consistently over a
18 prolonged period of time, exceed 10 to 20 micrograms
19 per liter. Next slide, please.
20 I'll give you some of the recent regulatory
21 history of atrazine. In 2003, the Atrazine Interim Re-
22 registration Eligibility Document, which is abbreviated
23 IRED, required the registrants to develop a program to
24 monitor for atrazine concentrations in consultation
25 with EPA and to mitigate environmental exposures if the

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1 EPA determined that mitigation was necessary. The IRED
2 further stated that the program will include the
3 identification of the level of concern identified by
4 the agency. The registrant was to develop a protocol
5 for the monitoring program that identifies criteria for
6 monitoring, site selection, development of a protocol
7 for a monitoring program that specifies the frequency,
8 location, and timing of sampling, triggers for
9 mitigation, and description of mitigation measures that
10 will be taken if triggers are exceeded. This
11 monitoring and mitigation program would be designed,
12 conducted, and implemented on a tiered watershed level
13 and was required to be consistent with existing state
14 and federal water quality programs. Next slide,
15 please.
16 The focus of the SAP. This kind of SAP
17 meeting focuses on the potential ecological effects of
18 atrazine on primary producers of aquatic plant
19 communities and flowing water bodies in corn and
20 sorghum growing areas in the Midwest. EPA will be
21 asking guidance from the panel on the methodology used
22 by the agency to determine the level of concern for
23 atrazine which incorporated both magnitude and duration
24 of effects.
25 The agency has also reviewed and analyzed the

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1 results of the registrant-conducted monitoring program,
2 and the agency will be seeking guidance on the methods
3 used to interpret these results as they relate to the
4 monitored water bodies which triggered LOC exceedances
5 and the approach proposed by the agency to estimate the
6 extent of the LOC exceedances in streams located in
7 watersheds with similar vulnerability and use
8 characteristics.
9 Other topics under review for atrazine, such
10 as potential human health effects, amphibian studies,
11 endocrine disruption, and monitoring of community water
12 systems that serve as drinking water sources are also
13 being addressed separately. In addition, there are
14 other monitoring programs that will not be presented or
15 discussed today but will be vetted in the future. For
16 example, atrazine is currently being monitored in
17 sugarcane growing areas in Louisiana and Florida, and
18 those have not undergone agency review yet. Also in
19 the future, the agency will evaluate the need to
20 develop monitoring programs focused on the effects of
21 atrazine on aquatic plant communities in static water
22 bodies and in estuary and marine environments. Next
23 slide, please.
24 Thank you. The glass -- okay. Thank you.
25 Requirements from the 2003 IRED. Based on EPA-

1 identified aquatic community levels of concern, the
2 IRED required the development of a method to relate
3 aquatic community responses to atrazine exposure
4 profiles. Russ Erickson's presentation will cover that
5 topic.
6 The second requirement was to estimate the
7 extent of watersheds that have flowing water bodies
8 which exceed effects-based thresholds for atrazine.
9 This topic will be covered in a series of
10 presentations, first by Nelson Thurman, followed by
11 Tony Olsen, and then Mark Corbin.
12 And the final requirement, which is to
13 identify watershed attributes that can be used to
14 identify where high atrazine exposure areas are likely
15 to occur, that's still under development at this time.
16 However, Nelson Thurman will be presenting some
17 approaches that the agency is looking at to address
18 this objective, and another SAP is being planned to
19 present these final results when the methodology is
20 finalized. Slide 12, please.
21 Level of concern. The atrazine assessment
22 endpoint was determined to be changes in the primary
23 producers in aquatic plant community structure. This
24 is the most sensitive endpoint and is expected to
25 protect fish and invertebrates from direct effects of

1 atrazine as well as the effects of atrazine that could
2 have on habitat and food sources of aquatic animals.
3 The four atrazine degradates which are DIA or di-
4 isopropyl-atrazine, DEA or diethylatrazine, DAA or
5 diaminochlorotriazine, and finally hydroxyatriazine are
6 not considered in the endpoint selection since the
7 potency to aquatic plants is orders of magnitude lower
8 than that for the parent molecule.
9 The ecological effect of concern for aquatic
10 communities and/or ecosystems was based on effects
11 demonstrated in atrazine microcosm studies.
12 Later, I will be presenting some information
13 on the micro and mesocosm studies, and Russ Erickson
14 will present the discussion of the challenges on how to
15 extrapolate these results from the micro and the
16 mesocosm studies to the appropriate time exposure
17 series. He will describe the use of an ecological
18 model to simulate response in generic Midwestern second
19 to third order streams.
20 Next slide, please.
21 Key reference data. The micro and mesocosm
22 studies that were available for evaluation consisted of
23 77 endpoints from 25 studies of varying species in 24
24 ponds or lakes, 20 artificial streams, and 33
25 microcosms. Eight results were on macrophytes, 29 on

1 periphyton, and 40 on phytoplankton. These data were
2 obtained from Brock et. al., Giddings, and the agency's
3 Office of Water's Draft Ambient Aquatic Life Criteria
4 Document. A major assumption here is that these micro
5 and mesocosm data collectively describe a relation of
6 effects to exposure that is applicable to the field
7 sites of interest. Next slide, please.
8 To better understand the impact of exposure,
9 duration, and magnitude on aquatic communities, the
10 effects reported in these studies had to be correlated
11 to specific exposure durations and magnitudes. First,
12 the 77 study results were quantified as to severity of
13 effects of atrazine on the aquatic plant community.
14 Brock, et al. analyzed the majority of the study
15 results and quantified them as follows. In addition to
16 the studies that Brock did not use, those studies were
17 also quantified according to the Brock scoring system.
18 A score of 1 was no effect in that observed differences
19 between treatment and controls show no clear causal
20 relationship. 2 means a slight effect and if there was
21 an effect, it could not be measured and it was
22 transient. A score of 3 meant a pronounced short-term
23 effect. There was a clear response of sensitive
24 endpoints, but total recovery occurred within eight
25 weeks after the last application.

1 A score of 4 meant pronounced effects in a
2 short-term study. Clear effects such as strong
3 reductions of functional endpoints and elimination of
4 sensitive species were observed, but the study was too
5 short to demonstrate complete recovery within eight
6 weeks after the last application of the pesticide, thus
7 the recovery moment is unknown. Finally, a score of 5
8 was equal to a pronounced long-term effect. A clear
9 response of sensitive endpoints and recovery time of
10 sensitive endpoints is longer than eight weeks after
11 the last application. Effects were also observed at
12 various subsequent samplings. The important point to
13 remember from this slide is that there is a clear
14 distinction between categories 1 and 2, which show no
15 to slight effects and categories 3, 4, and 5, which all
16 define significant or pronounced effects. Next slide,
17 please.
18 Quantification of study results continued.
19 This slide represents the distribution of the study
20 results into severity categories. As you can see, the
21 majority of the endpoints fell into the 3 to 5
22 category. There were 27 results in one category -- in
23 categories 1 and 2, versus 50 results in categories 3,
24 4, and 5.
25 Next slide, please.

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1 Concentration duration of micro and mesocosm
2 study results identified by Brock scores. The 77
3 effect scores representing the results from the 25
4 micro and mesocosm studies for atrazine were plotted
5 against the study specific test concentrations and
6 exposure durations in the figure shown on the -- being
7 projected now. The LOC is not a single level of
8 atrazine-causing effects but is dependent on both
9 magnitude and duration of atrazine exposure. As you
10 can see, the effects observed in the micro and the
11 mesocosm studies generally become more severe with
12 increasing exposure, time, and magnitude. The two
13 groups of scores seem to be discriminated in setting an
14 LOC of 1 to 2 versus 3 to 5 and they are largely
15 separated. However, you can see that -- at around the
16 ten -- I don't have a pointer but -- at around the ten
17 parts per billion, there's a line that goes across and
18 that pretty much discriminates most of the studies
19 between those scores 1 and 2 and scores 3 to 5.
20 There is some -- no, that's okay -- I
21 probably don't know how to use it anyway. Okay. Just
22 about at the ten level, you can see that there is a
23 pretty good discrimination between the 1 and 2 and the
24 3, 4, and 5. Of course, if you had very, very high
25 levels of a short duration, you can also have a very

1 high magnitude effect. And the same thing here, you
2 have a fairly low-level, which is around ten, but it's
3 over a long duration of time. So I think this slide
4 very well demonstrates that magnitude and duration are
5 the significant components of levels of atrazine in the
6 environment causing ecological effects.
7 The challenge is how to interpret the results
8 of the registrant-submitted monitoring study in light
9 of these micro and mesocosm results. This will be
10 discussed in more depth in the presentation by Russ
11 Erickson, which will be given after the public
12 comments.
13 Okay, finally, I'd just like to review the
14 agenda for today. First, there will be the
15 presentation of public comments, followed by the use of
16 the community simulation model for extrapolation of
17 atrazine levels of concern among exposure time series
18 by Dr. Russell Erickson. This will be followed by
19 three presentations encompassing the topic of
20 determining -- the topics of determining the extent of
21 waters exceeding the effects-based thresholds for
22 atrazine.
23 First, to do this, we had to have a
24 discussion by Nelson Thurman on the monitoring study
25 design and the results. Then Dr. Tony Olsen will talk

1 about the survey design and the population estimation,
2 and then Mark Corbin will discuss the uncertainty
3 analyses of the monitoring data. Finally, Nelson
4 Thurman will discuss approaches to address the
5 question, where are the waters that exceed effects-
6 based atrazine thresholds. That's it.
7 DR. HEERINGA: Thank you very much, Dr.
8 Irene, for that introduction. Before we move on with
9 the agenda, I would like to turn to members of the
10 panel. We've heard some opening statements about
11 objectives and introduction and overview. Are there
12 any questions for either Mr. Brady or Dr. Irene? Okay.
13 At this point in our agenda, let me just make a comment
14 for everybody's benefit. You have a copy of the
15 agenda. Dr. Irene has nicely described its
16 decomposition into sort of three major topical areas
17 for presentation. A little different from traditional
18 SAP meetings, we're going to have public comment
period
19 at the start, which I think is appropriate, because
20 there is a significant amount of information that
21 public commentors want to get into the discussion.
22 Obviously, at the EPA's discretion, as we go through
23 these meetings, if there's relevant information that
24 needs to be brought back, I'll permit them to call upon
25 specific public commentors or to permit them to return

1 but generally, the period of public comment is such.
2 It's a point where we can hear presentations from
3 public participants from industry regarding the study,
4 regarding their own work and will -- at this point, if
5 there are any members of the audience who have not
6 registered to make a public comment but would like to
7 do so, it'll have to be short, as Jim mentioned
8 earlier, Jim Downing mentioned earlier, about five
9 minutes, please see Jim Downing. Otherwise, we'll
10 proceed in the order that is listed on the agenda.
11 And to start, I would like to ask Steven
12 Taylor, who is a CEO of the Environmental Resources
13 Coalition. Mr. Taylor, if you're here, please public
14 comment; our microphone is right over here. Introduce
15 yourself.
16 MR. MARSHALL: Good morning. We're
17 going to set up, I think, just a brief slide
18 presentation, if we might do so.
19 DR. HEERINGA: Sure. Do you need any
20 technical assistance finding connections or --
21 MR. MARSHALL: I might give you a little
22 bit of background as I do this. Actually, my name is
23 Gary Marshall, and I am -- I serve in two or three
24 different roles. I serve for the Missouri Corn
25 Growers' Association as their CEO and executive

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1 director. I also am a member of the executive
2 committee for the Triazine Network which has been
3 engaged in the atrazine issue for a number of years.
4 And today, I'm here as chairman of the Environmental
5 Resources Coalition. Mr. Taylor is one of our, one of
6 our employees, and he sent in a request for us to be
7 able to make a presentation.
8 DR. HEERINGA: Okay.
9 MR. MARSHALL: And Mr. Mark White and
10 myself will be giving the presentation today. But our
11 reason for being here is that we've been involved
12 obviously in atrazine issues for a number of years,
13 myself since 1994. So it's nothing that actually is
14 new, and if you go back even prior to that, my basic
15 background was in -- with the fertilizer, seed,
16 herbicide industry working directly with farmers. And
17 today, in fact, I work with 15,000 Missouri growers
18 that grow corn in Missouri. Just to give you a little
19 bit of a brief background information, we grow about
20 3.3 million acres of corn in Missouri and, this year,
21 the total sales from that 3.3 million acres will be
22 over one-and-a-half billion dollars. So it's an
23 extremely important crop to the state of Missouri and
24 atrazine is an extremely important part of our
25 herbicide management program.

1 And now, we have our overheads up here and
2 basically, the Environmental Resources Coalition is a
3 unique partnership; it has members of both the grower
4 community, the growers themselves, our association. We
5 have some outside interests as well, and our efforts
6 are to look at water quality issues across Missouri,
7 and to help farmers implement the types of management
8 practices that keep their products where we put them on
9 the fields doing the type of job that we want them to
10 do. Basically, we utilize sound science and we help in
11 maintaining, improving, and enhancing the land and
12 water quality resources across the state.
13 We utilize different grants. We have -- our
14 corn growers association itself has invested several
15 million dollars over the last seven or eight years to
16 do water quality types of projects, including
17 monitoring. And we've become very involved
18 particularly in the northern part of Missouri in
19 looking at various water quality efforts and --
20 Mark, if you want to go over to the second
21 slide. What makes it unique for us is the fact that it
22 has a lot of significant economic interest for our
23 producers to the tune of about $78 million a year in
24 terms of both what the product saves us, in terms of
25 loss to weeds and the cornfields but also in terms of

1 switching products. It's the most widely used
2 herbicide in Missouri, and we utilize it in a lot of
3 different instances, in minimum tillage and
4 conventional tillage. And we utilize it in ways that,
5 with other herbicides, it help to maximize the effects
6 of the product that, that we are currently using. So
7 we use it with a lot of chemistry that's brand new even
8 though this product has a number of years worth of
9 history. And again, that $78 per acre is pretty
10 significant, $78 million a year that it saves Missouri
11 producers, very, very significant.
12 We do a lot of partnership work. We work
13 with 319 funds of EPA dollars. We have had some direct
14 appropriations. We've worked with USDA-ARS. We work
15 with University of Missouri in Columbia. It's a very,
16 very unique partnership and different folks coming
17 together working directly with producers and helping
18 producers implement best management practices again,
19 designed to utilize the products that we have available
20 to them and to keep those resources where they're at,
21 and to minimize them getting in to our water systems.
22 We started off with a project called the
23 WRASP Project or the Water Research Stewardship
24 Project. That enabled us to do a lot of water quality
25 monitoring around Missouri; give us a very good idea of

1 how products move. We look at not only atrazine but we
2 look at a number of different herbicides. We look now
3 at nutrients and how those nutrients move in our waters
4 and in our soils in the states.
5 So it gave us a much better idea of how to
6 utilize these products and we've, I think, been very
7 successful in what we've done. As a couple of
8 examples, in northern Missouri we've worked
9 significantly in a watershed called Smithville Lake
10 that has over 300,000 acres in that watershed, and also
11 in the Mark Twain Lake area that has over 1.3 million
12 acres. And in those acres, those watersheds, we've
13 been able to utilize the products, and we've been able
14 to minimize any potential concerns that we have with
15 any products that might be out there.
16 Farmers want to do the right thing. They
17 want to utilize the correct products in the correct
18 amount and in the correct ways. And what we're doing
19 essentially is helping them to develop best management
20 practices to allow them to utilize these products and
21 to keep utilizing these products. And I think maybe
22 the best thing for me to do at this point in time is to
23 turn the rest of the presentation over to my colleague,
24 Mark White. Mark has some extensive knowledge and
25 involvement specifically in these watersheds, and some

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1 of the watersheds that you'll be discussing here over
2 the next few days. And Mark, I'll turn it over to you,
3 and let you move from this point.
4 MR. MARK WHITE: Thanks, Gary. As he
5 mentioned, my name is Mark White. I'm the director of
6 agronomic services for the Environmental Resources
7 Coalition. My main job is to administer the
8 stewardship activities in the State of Missouri that we
9 have underway. My background is in the fertilizer
10 industry and working with herbicides at retail
11 locations, and I have a precision farming background as
12 well. But I've been with the company now going on
13 eight or nine years, and have enjoyed it so far.
14 As Gary mentioned, some of the projects he
15 talked about, the WRASP project and the SIP project,
16 the stewardship activities going on Missouri, the
17 foundation for those projects is that Missouri farmers
18 want to take a proactive approach to issues that are in
19 their backyard.
20 The first project we initiated along with
21 Missouri Corn Growers is called the Watershed Research
22 Assessment Stewardship Project. Basically, we sought
23 to find the answers, how are herbicides leaving the
24 field, and then given those answers, use them to solve
25 problems. The project was designed by using terrace

1 channels as individual studies for different BMPs on
2 how to manage herbicides in our farmers' fields. And
3 we used automated samplers at the end of those terrace
4 channels to collect the run-off from all the rain
5 events; it was a five-year project.
6 In addition to the edge of field studies, we
7 had a very intensive stream and lake sampling schematic
8 going along with that. Tried to give us a overall
9 picture of how herbicides are transported throughout
10 the entire watershed. After we gathered information on
11 how our BMPs, Best Management Practices, performed at
12 the field level, we took what we thought were valuable
13 solutions and decided to get that information out into
14 the watershed, into our growers' hands, so we started a
15 second project called the Stewardship Implementation
16 Project. And it's a watershed-based approach. We
17 tried to get our information out to all the growers
18 within a given watershed that's been targeted. We used
19 partnerships, including federal and state, as Gary
20 mentioned. Missouri corn growers were a large partner,
21 but, in addition, EPA, state DNR, Department of
22 Agriculture, and USDA-ARS were all partners in this
23 project.
24 We utilized field-scale demonstrations on
25 farmers' fields to demonstrate our practices. And our

1 philosophy was economic or monetary incentives don't
2 always gain the adoption we want in a watershed. So we
3 had to prove it to these farmers that our alternative
4 BMPs were as good or better than the current management
5 practices they were using. So with that, we went out
6 and sought out the best or perceived best farmers in a
7 watershed and then challenged them in a friendly
8 manner, in a side-by-side comparison. We would use our
9 management practices on half of a field, and they would
10 do their management practices on the half of the field.
11 And then at the end of the season, we would compare
12 those both economically and environmentally. We did
13 provide technical support to the farmers in this
14 challenge as well, and then we took the information
15 learned and tried to propagate it throughout the
16 watershed.
17 The foundation for our approach with these
18 farmers was the tried and true integrated pest
19 management approach. Individual prescriptions based on
20 actual field evaluation, only applying what we need,
21 where we need it, and when we need it. Just an example
22 of how we use side-by-side demonstrations, we took
23 these two, two yield and then compiled our economic
24 data to then prove it back to the farmer that what we
25 had done and that our alternative practices were indeed

1 working. Not to get into detail on this slide but the
2 gist of it, it just shows that all of our project
3 treatments, alternative herbicide programs, at the end
4 of the day, were as good or better than the average of
5 all the conventional treatments that the farmers put up
6 themselves, and in general, were more economical. And
7 this fact has helped us gain adoption with these
8 farmers in the watershed. We've actually seen a shift
9 to these practices because of this.
10 Another large part of the project is the
11 outreach component, and we spend all summer bringing
12 farmers and retailers in industry through our fields
13 and demonstrations, talking with them, and trying to
14 prove our philosophy. And additionally, throughout the
15 winter months, we spent a lot of time educating growers
16 as well about other watershed issues, and what's coming
17 up in the next year.
18 I'd like to say that we feel these two
19 projects have been successful in the state of Missouri.
20 Both data gained from the WRASP Project and the SIP
21 projects played a part in removing four of the major
22 water bodies from Missouri's 303(d) list for impaired
23 waters. And two of those, Gary mentioned, a large Mark
24 Twain Lake in northeast Missouri but also Rose City
25 Lake, Cameron Grindstone Lakes, and Smithville Lake,

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1 all drinking water reservoirs in the state of Missouri.
2 We're proud of that fact.
3 This slide just gives you a little idea of
4 where we're currently focusing our stewardship
5 activities. This is by no means a comprehensive slide,
6 but right now, these are the areas we're working in
7 north Missouri. And they also represent some of the
8 larger cropping areas in the northern part of the
9 state. With that said, here's a map of where the four
10 identified monitoring locations for Missouri are that
11 you'll be hearing about later on today and in the next
12 few days. I believe upper left -- Missouri 01,
13 Missouri 02, and then their companion sub-watersheds,
14 Missouri 04, and Missouri 05. Most of these watersheds
15 are typical for northeast Missouri. However, we feel
16 that Missouri 01 has some atypical attributes about it
17 that we would like to address to the panel.
18 And here it is, the green shaded areas
19 represent actual corn acres or fields planted to corn
20 in 2005. Total acres in the watershed of roughly 7300
21 total corn acres that year to nearly 3000 large --
22 large percentage of corn acres in this relatively small
23 watershed, and in my -- in the upcoming slides, I'd
24 like you to remember this region of the watershed right
25 up here. One grower in the watershed actually farms a

1 majority of these acres, right up in here.
2 This is a picture of where the monitoring
3 location for that watershed is currently; this was a
4 picture previous to the eco-monitoring program and just
5 gives you a good idea of what the stream looks like.
6 Here's one of the reasons we feel that there's some
7 atypical attributes in this watershed, and it's just an
8 untimely coincidence, but in the northern part of this
9 Missouri 01 watershed, a producer was installing a lot
10 of practices that for the short term were altering the
11 landscape. These would include construction of
12 terraces, as you can see here. I think he's even
13 installing some waterways and other types of things,
14 but the scope of this is what's important. He was
15 doing this on a very large scale on many acres and, in
16 reality, of the stream you saw, the corn acres in this
17 watershed, probably 25 percent of those corn acres were
18 actually undergoing this type of process in 2005 and
19 2006.
20 Additionally, the same producer is installing
21 pivot irrigation systems, and that in and of itself is
22 not uncommon, but it is uncommon for this area. And
23 finally, again, peculiar to this watershed, there's a
24 large amount of corn silage production going on, not
25 just typical corn production. And as you can see,

1 silage is harvested early in the season, and a lot of
2 the residue is removed from the ground itself. It just
3 provides more exposure time to the environment.
4 And we feel, when you stack all of these
5 different attributes on top of one another, at least
6 for this point in time, for these two years, it did
7 lead to high turbidity in this stream. We also feel
8 that that'll probably take care of itself as those new
9 practices are installed, I mean, he wasn't installing
10 conservation practices but in the short term, to get
11 the long-term gain, we had some short-term concerns
12 here. Additionally, this stream tends to act in an
13 intermittent fashion and it -- it just -- the growers
14 in this area have to ask themselves; did the turbidity
15 and the intermittent nature of the stream affect the
16 ecology in this region?
17 So in conclusion, during the sampling periods
18 in Missouri 01, there were some uncommon agricultural
19 practices going on specific to that watershed. Those
20 included the land improvements on over 25 percent of
21 the corn acres in the watershed, irrigated cropland,
22 and the intensive corn silage production, which again,
23 is on a sloping plate and soil. We don't feel that
24 these are necessarily in and of themselves uncommon,
25 but when you put all of them together in this small

1 watershed in this soil type, we feel it led to a
2 peculiar problem in our state. And that's all I have
3 for you. I'd like to thank you for your time.
4 DR. HEERINGA: Thank you very much for
5 the presentation, Mr. Marshall, Mr. White, and we'll
6 get that corrected on the agenda. Before you leave,
7 any questions from the panel about the materials that
8 have been presented? Yes, Dr. Fairchild.
9 DR. FAIRCHILD: James Fairchild. I had
10 a question. Which -- what particular year were these
11 physical changes in Missouri 01 being implemented?
12 MR. MARK WHITE: Predominantly in 2005
13 and 2006.
14 DR. FAIRCHILD: Both years?
15 MR. MARK WHITE: I mean, the actual
16 fields and locations probably changed, but they were
17 ongoing in the watershed.
18 DR. HEERINGA: Other questions or
19 clarifications?
20 DR. NOVAK: Yes. This is Jeff Novak
21 with the ARS. Are you practicing any buffer strips
22 along the stream channels?
23 MR. MARK WHITE: That practice is
24 ongoing on an individual basis. Our project has not
25 been directed towards buffer strips. However, I do

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1 know that some of those practices are installed through
2 the NRCS and other -- I guess, are you saying have we
3 installed those practices --
4 DR. NOVAK: Were there buffer strips in
5 the stream channels near this operator's facility?
6 MR. MARK WHITE: I guess I can't answer
7 that question.
8 DR. NOVAK: Okay. Thank you.
9 DR. HEERINGA: I don't see any more
10 questions. I'd like to thank you very much.
11 DR. LERCH: I've got one more. Sorry.
12 DR. HEERINGA: Oh, yes.
13 DR. LERCH: Bob Lerch. When
14 approximately is the corn harvested for silage?
15 MR. MARK WHITE: This was approximately
16 late July/August, I believe.
17 DR. EFFLAND: Bill Effland, USDA. After
18 the silage is harvested, is there a cover crop planted
19 on that?
20 MR. MARK WHITE: Not necessarily. And
21 sometimes, it can rotate into a week, which would
22 provide a cover crop in the fall. I can't speak
23 specifically to these fields.
24 DR. HEERINGA: Okay. Well, thank you
25 very much. Our next scheduled presenter was Scott

1 Slaughter -- but Scott, are you here? I don't
2 believe --
3 MR. SLAUGHTER: I'm here.
4 DR. HEERINGA: Oh, are you presenting?
5 MR. SLAUGHTER: Oh, no, I'm not.
6 DR. HEERINGA: You opted out?
7 MR. SLAUGHTER: I informed your, you
8 know, this morning, that I won't be filing anything.
9 DR. HEERINGA: Thanks. I -- he had told
10 me that, but I just wanted to check that -- thank you
11 very much. At this point then, I'd like to ask Jere
12 White from the Triazine Network and the Kansas Corn
13 Growers Association and, I guess, other colleagues if
14 they're going to be contributing too, but we'll begin
15 with Mr. White. Jere White has submitted written
16 comments for the panel, and those will be available on
17 the docket too. Oh, okay.
18 MR. JERE WHITE: The -- we do have a
19 DR. HEERINGA: We'll get you set up
20 here. Now, let's see. We'll work to get a computer
21 set up here that can be used for the public comment
22 presentations. While we're waiting to bring the
23 presentation up, I might mention too that for public
24 presenters who will be presenting after our break, I
25 think that would be predominantly the Syngenta

1 representatives, that we have presentations, let's
2 arrange to load those up during the break, if you
3 would, please? Jim and I can help with that. Okay.
4 Mr. White, welcome back.
5 MR. JERE WHITE: Thank you, Mr.
6 Chairman. Sorry about the delay.
7 DR. HEERINGA: No problem.
8 MR. JERE WHITE: My name is Jere White,
9 and I am the executive director of the Kansas Corn
10 Growers Association, Grains Sorghum Producers, and also
11 serve in kind of an ad hoc capacity as chairman of the
12 group known as the Triazine Network. I do have two
13 colleagues with me here today and an additional
14 colleague is attempting to get here from Iowa this
15 morning and hopefully, will be here before the end of
16 the comment period. But regardless, we would like to
17 start out this morning with DaNita Murray from National
18 Corn Growers Association, and DaNita is actually pinch
19 hitting for one of her colleagues, and I'll let her
20 explain that.
21 MS. MURRAY: Good morning. Thank you
22 for the opportunity
23 to comment here today. My colleague, Lisa Kelly, was
24 scheduled to be here but unfortunately, unforeseen
25 family circumstances have caused her to be out of town.

1 The National Corn Growers Association was
2 founded in 1957 and represents more than 32,000 members
3 in 48 states, 47 affiliated state organizations, and
4 more than 300,000 corn farmers who contribute to state
5 check off programs for the purpose of creating new
6 opportunities and markets for corn growers.
7 How well a producer controls weeds makes all
8 the difference in their yields and return on
9 investment. Corn growers depend on the safe, effective
10 use of atrazine and pre-packs containing atrazine to
11 control weeds on about two-thirds of the country's corn
12 acres. According to a review by this agency, by using
13 atrazine over other alternative herbicides, farmers
14 save an average of $28 per acre in herbicide costs and
15 yield advantages.
16 Atrazine is the most thoroughly tested
17 herbicide ever used in corn crop protection with the
18 weight of evidence of nearly 6,000 scientific studies
19 supporting its safety. In 2006, EPA re-registered
20 atrazine after more than a decade of intense scientific
21 review. However, as a condition of re-registration,
22 EPA required the registrant to develop a monitoring
23 program to determine whether atrazine concentrations in
24 streams associated with corn and sorghum production
25 were exceeding a designated and extremely conservative

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1 effects-based threshold based on aquatic plant
2 communities.
3 For over two years, Syngenta has conducted
4 this intensive monitoring program in the most
5 vulnerable watersheds involved in Midwest corn
6 production and determined that there are minimal to no
7 effects on these aquatic communities from atrazine use
8 when the modeling system is used appropriately.
9 NCGA believes that in some areas, EPA's
10 inputs to the model could be readily corrected. For
11 example, EPA pushes the simulation back to January 1 in
12 the model year, long before the first application of
13 atrazine, which is when the first detections of
14 atrazine in streams are possible or at about day 105 of
15 the year. EPA's assumptions and input to the model
16 artificially presume that concentrations of atrazine
17 are impacting a watershed when in fact atrazine
18 applications do not incur until it is time to plant
19 corn. The model incorrectly assumes that low levels of
20 atrazine have a biological impact. Additionally, NCGA
21 notes, the model assumes that common rooted vascular
22 plants called macrophytes are a large part of the
23 aquatic ecosystem early in the year. In the winter
24 months in the Midwest, this would be extremely
25 uncommon. In fact, these types of plants are not

1 typically found in the headwater streams monitored in
2 this program.
3 EPA has stated that it will return to another
4 statement of administrative position when it corrects
5 the way the model seems to overestimate the effects of
6 extended duration, low-level exposures, and the
7 apparent underestimate of the effects of short-term
8 high-level exposures. However, high-level exposures of
9 atrazine would likely not affect the aquatic community
10 since the mode of action of atrazine is reversible.
11 The streams and ecosystems on our growers' farms are
12 extremely resilient, and would easily recover from this
13 type of exposure.
14 Finally, no-till agriculture becomes
15 impossible without herbicide use. Resulting in
16 increased erosion estimated to be more than 300 billion
17 pounds of soil annually or a 15 percent increase.
18 According to the U.S. Department of Agriculture,
19 atrazine is the most widely used herbicide in
20 conservation tillage systems, which reduces soil
21 erosion by as much as 90 percent. Much of this soil
22 erosion would enter waterways and significantly reduce
23 the quality of the nation's surface water. Soil
24 erosion causes siltation, the most significant problem
25 facing waterways in agricultural regions. When rooted

1 plants as well as algae in streams are restricted in
2 growth, it is often by a lack of light from erosion-
3 borne sediment deposits.
4 In conclusion, our member corn growers are
5 committed to leaving our environment in better shape
6 than we found it. NCGA believes that atrazine is used
7 safely on farms in the U.S. without any detrimental
8 effects to aquatic communities. We believe that the
9 agency should complete the corrections to the model to
10 show that additional monitoring is indeed not
11 necessary. Again, I appreciate the opportunity to
12 provide comments today and hope you have a good rest of
13 the day. Thank you.
14 DR. HEERINGA: Thank you very much, Ms.
15 Murray. Mr. White, do you want to introduce Dr.
16 Fawcett?
17 MR. JERE WHITE: Yes. Looks like, we're
18 maybe still experiencing technical difficulties.
19 DR. FAWCETT: We may do it without
20 slides. I spent a lot of years in extension, I should
21 be able to do it without my crutch. I might -- if I
22 could get a copy of -- is there an extra copy of the --
23 at least the panel members could follow along on the,
24 on the copy you have, and hopefully, we can make the
25 same points here.

1 My name is Richard Fawcett, and I'm appearing
2 here today on behalf of the Triazine Network. I do
3 appreciate the opportunity to share some comments with
4 the panel today. I've spent about the last 35 years of
5 my career trying to work to reduce the adverse impacts
6 of agriculture on the environment, especially with
7 water quality issues. Working to try to develop
8 practices or BMPs to protect water; helping farmers
9 adopt those practices and working in some of the same
10 kinds of projects that you heard about already this
11 morning.
12 What I'd like to do is provide just a
13 little bit of background and perspective on the use of
14 atrazine, and some of the changes that have occurred on
15 how atrazine is used. And they'll hopefully be helpful
16 to the panel, but then, look a little more directly at
17 the question of: Is atrazine harming aquatic
18 ecosystems by reversibly inhibiting photosynthesis in
19 aquatic plants?
20 Atrazine does -- if you -- probably the
21 second slide here, atrazine does remain the most widely
22 used corn herbicide, and it remains the most widely
23 used herbicide for good reason. It provides farmers of
24 benefits. It effectively controls weeds at a lower
25 cost than the alternative products, and that effective

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1 weed control translates into higher yields. I've had
2 the opportunity to work on an analysis of a very big
3 database, about 237 weed-control studies conducted
4 across the north central region comparing herbicide
5 prospect and herbicide treatments that contained
6 atrazine versus comparable treatments that did not
7 contain atrazine. And in that 20 years of studies, the
8 average yield benefit due to atrazine was 5.7 bushels
9 per acre.
10 But what was interesting to me was, in recent
11 years, that yield benefit remained despite the
12 introduction of many new herbicide compounds, new
13 technologies like herbicide-resistant crops; the yield
14 benefit was still there. Atrazine is used with most of
15 these new compounds. Sometimes at relatively low
16 rates, but it improves weed control; it controls some
17 of the species that are missed by even the newer
18 chemistries.
19 Atrazine is rather unique in its suitability
20 to conservation tillage. Tell me if they start and
21 I'll watch the slides. It's uniquely suited to
22 conservation tillage and -- hey, there we are. Thank
23 you.
24 MALE SPEAKER: Which slide do you want
25 up?

1 DR. FAWCETT: Right there. We're in the
2 right place. I'll move over so I can change the
3 slides.
4 It's uniquely suited to conservation tillage.
5 Conservation tillage farmers are more likely to use
6 atrazine than conventional tillage farmers. About 84
7 percent of conservation tillage corn is treated with
8 atrazine; about 61 percent of conventional tillage
9 corn.
10 And that conservation tillage has produced
11 really great environmental benefits. The natural
12 resources inventory has shown that soil erosion
13 declined in the U.S. by 33 percent between 1982 and
14 2001 and largely due to adoption of conservation
15 tillage. And with conservation tillage, we just mean
16 systems that either perhaps have no tillage before
17 planting, or reduced tillage that leaves more crop
18 residue on the soil surface.
19 And that crop residue in turn protects the
20 soil from erosion, from the erosive impacts of
21 rainfall. It also has other environmental benefits,
22 wildlife habitat; a lot of other things.
23 So no till reduces not only erosion to keep
24 the sediment out of streams, we know it can affect our
25 aquatic ecosystems, but it reduces the runoff of

1 pesticides like atrazine or nutrients that I'll touch
2 on a little bit later. There's also been a -- well,
3 there's studies that have shown that no till reduces
4 herbicide runoff by about an average 70 percent. So it
5 is -- we're talking about significant reductions in
6 many settings, at least. Also, there has been a
7 reduction in fuel use.
8 I think agriculture's maybe one of the only
9 industries that can claim that we use less fuel today
10 than we did ten or 15 years ago. And that's largely
11 due to adoption of conservation tillage or making fewer
12 trips over the field. In fact, in corn production
13 alone, there has been a fuel savings of 89 million
14 gallons of fuel annually in corn production. If corn
15 farmers were to go back to conventional tillage, they'd
16 be using 89 million gallons more of fuel.
17 Farmers are protecting surface water.
18 Atrazine remains the most widely used corn herbicide
19 and yet atrazine concentrations in surface water have
20 declined over the last decade or two, and they continue
21 to decline. How can that happen when we still have the
22 widespread use of atrazine? Oh, the reason for that is
23 that the actions that growers have taken have
24 succeeded. Early on, there were label changes that
25 required reductions in maximum rates that were allowed.

1 There were setbacks, essentially buffers that were
2 required where surface water runoff enters streams.
3 So where atrazine is used, these practices
4 have changed. And there had -- have been recently some
5 label harmonization so that the many manufacturers of
6 atrazine now have to put those same water-protecting
7 practices on their labels. The same practice that
8 Syngenta previously had on their label. So some of the
9 reductions have come because of label -- of following
10 labels, but farmers have also adopted a number of
11 voluntary BMPs or best management practices. We've
12 already talked about conservation tillage, and that has
13 produced benefits.
14 One of the kind of the new trends we'd see is
15 a post-emergence application of herbicide to protect
16 the atrazine. When you apply the herbicide after the
17 corn and the weeds emerge or a post-emergence, there is
18 less risk of runoff than if you apply it to a bare soil
19 surface. We also often can use lower rates that reduce
20 the amount that potentially can runoff. The University
21 of Minnesota conducted a study where they either apply
22 the atrazine to a bare soil surface or pre-emergence
23 treatment or they applied it to the crops and weed
24 post-emergence. And they had 70 percent less runoff of
25 atrazine with post-emergence treatments. So this

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1 natural trend, and this again, is one of the BMPs we
2 recommend in many of these watersheds, has reduced the
3 risk of atrazine runoff.
4 Buffers were mentioned, conservation buffers,
5 and they're very important. They are effective
6 especially if you properly install and maintain them;
7 they're effective in trapping herbicides; often 50
8 percent or more of compounds like atrazine. And we
9 have seen a lot of buffers being installed with help
10 from the government's farm program, the Conservation
11 Reserve Program. On my own farm in Iowa, we have
12 seeded down several miles of buffers along all the
13 streams that go through our farm with payments to the
14 Conservation Reserve.
15 So all of these practices, I think, have
16 turned, teamed up to explain some of the reductions
17 that we do see in atrazine concentrations. These
18 monitoring studies do confirm that decline. U.S.
19 Geological Survey in their Midwest reconnaissance of
20 streams in the Midwest showed a 50 percent decline in
21 median atrazine concentrations from 1989 to 1995. More
22 recently, the NAQUA, a very large data source that has
23 been published to show significant reductions in stream
24 residues of atrazine between '92 and 2001. Some of the
25 states have analyzed their databases, the Iowa

1 Department of Natural Resources analyzed a very big
2 pesticide water database, and concluded there have been
3 statistically significant declines in atrazine
4 concentrations in really all the surface water stream
5 categories.
6 Also, there has been very intensive
7 monitoring of some of the reservoir watersheds that
8 serve as public drinking water sources, and I've been
9 involved personally in several projects in those
10 watersheds. And that monitoring does also, confirms a
11 consistent decline in atrazine concentrations.
12 Concentrations bounce up and down with the rainfall and
13 weather, but there has been that trend toward a
14 decline.
15 Well, to get a little more directly to
16 the charge of this panel in considering: Is atrazine
17 harming aquatic ecosystems by reversibly reducing
18 photosynthesis and algae in aquatic plants? Certainly,
19 we know it could. In a high enough concentration, the
20 mesocosm, microcosm studies will tell us it does. The
21 models would tell that, but I want to take -- take --
22 look back, a little more perspective on the real world
23 and some factors to consider.
24 If a reduction in algae and aquatic plant
25 growth due to atrazine were to adversely affect an

1 aquatic community, then that means that current levels
2 of aquatic plant growth in the presence of atrazine
3 would have to be deficient. However, the -- according
4 to EPA Office of Water, most rivers and lakes and
5 streams across the Corn Belt and the major atrazine
6 users have very excessive aquatic plant growth, not too
7 little. In the 2003-05-B national report, thought
8 excessive nutrients was the most common pollutant
9 affecting lakes, reservoirs, and ponds accounting for
10 50 percent of impaired waters. And again, it's that
11 high nutrient concentration that's leading to excessive
12 plant growth.
13 To address those concerns of excessive
14 aquatic plant growth and things like hypoxia that might
15 occur in local waters or certainly hypoxia in the Gulf
16 of Mexico when the nutrients go down -- go from Mexico,
17 EPA has published eco-regional nutrient criteria or
18 proposed standards. There's also regional technical
19 assistance groups that are developing proposed
20 criteria. The states must set enforceable nutrient and
21 chlorophyll-a standards, and right now, many states are
22 struggling with that in the process. And I'm sure some
23 of the panel members are very familiar with that
24 process of trying to set state standards to address
25 this problem of excessive aquatic plant growth. And

1 when you look at the monitoring data throughout the
2 Corn Belt, nitrogen, phosphorous, and chlorophyll-a
3 concentrations are routinely two to four times above
4 EPA's proposed criteria.
5 We look at Iowa, where I'm most familiar
6 with. In Iowa, all but one of 131 lakes exceeded the
7 proposed standards for nitrogen and phosphorous, with
8 some lakes 20 fold above the standard. All of the
9 rivers that were monitored exceeded the nitrogen and
10 phosphorous proposed standards. In Iowa, 98 of 131
11 lakes exceeded chlorophyll-a standards. And just to
12 illustrate, this is lake data and there's more -- I
13 realize we're dealing with the moving water in the
14 streams, but this is kind of our best data set, because
15 it was all taken at the same time. But you can see how
16 the proposed benchmark over on the left stacks up with
17 the existing chlorophyll-a concentrations in lakes.
18 Streams, the numbers are going to be different, but
19 really there's that same trend where the, it's much,
20 much above where the proposed standards are.
21 The 303(d) impaired waters list confirmed
22 this concern about nutrients and excessive plant
23 growth. In Illinois, 57 percent of the impaired waters
24 list excessive nutrients and/or algae as the cause;
25 they lump those together as a category. In Iowa, 50

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1 percent of the impaired lakes list excessive algae as
2 the cause. So we come back to the question then,
3 algae, algae and plant growth is excessive, not
4 suboptimal, in most rivers, lakes, and streams, at
5 least across the Corn Belt and where the major atrazine
6 use areas are. And farmers are concerned that they may
7 be regulated, and they're making changes to try to
8 address this.
9 When we get these enforceable standards,
10 there will be changes that take place. In fact, for
11 hypoxia in the Gulf of Mexico, the current goal is to
12 reduce nitrate losses by 40 percent. And in order to
13 cause that grave reduction in nitrate losses, it will
14 mean reductions in fertilizer applications, significant
15 reductions. It will mean reductions in yields, and
16 farmers are concerned about their livelihoods, and
17 these changes they may have to make. They realize they
18 have to be good stewards and they want to manage
19 nutrients. They want to manage pesticides, to do the
20 best they can to reduce impacts on the water, but
21 sometimes it kind of seems like they're being pulled in
22 two different directions.
23 In conclusion, atrazine remains a valuable
24 tool for farmers. It's used on more acres than any
25 other corn herbicide. And the reason is, because it

1 produces benefits, including increased yields and
2 facilitating adoption of conservation tillage.
3 Conservation tillage, in turn, produces many
4 environmental benefits including reducing erosion,
5 reducing runoff of pesticides and nutrients and savings
6 in fuel.
7 Farmers have abided by label changes that
8 have helped to protect surface water from atrazine.
9 They've also adopted a number of voluntary best
10 management practices to further protect water. And
11 atrazine concentrations in surface water have -- are
12 lower today, at least, by historical terms, and they
13 continue to decline. And lastly, algae and plant
14 growth at least across much of the Corn Belt is,
15 according to our aquatic biologist and EPA Office of
16 Water is actually excessive, not suboptimal, in most
17 rivers and streams and lakes. And for that reason,
18 especially, it appears that atrazine is unlikely to
19 have a detrimental effect on those aquatic communities.
20 I would be glad to answer any questions and I
21 appreciate this opportunity.
22 DR. HEERINGA: Mr. White --
23 MR. JERE WHITE: Yes?
24 DR. HEERINGA: -- do you want to
25 organize the totality of the presentation, or should we

1 share some questions?
2 MR. JERE WHITE: I have a few
3 observations --
4 DR. HEERINGA: Please.
5 MR. JERE WHITE: -- I'd like to add, and
6 we appreciate the committee's indulgence. I know we've
7 been talking a lot about the value to agriculture, and
8 that's not necessarily the charge of the committee, but
9 we do think it's important that we keep the value and
10 the importance to agriculture out there. Because, in
11 fact, it is certainly an issue to the people we
12 represent, and, we think, an issue to society in
13 general.
14 There are a few specific observations I'd
15 like to share with the committee today that might be a
16 little more targeted to your charge. First, the first
17 one deals with the state's need to have finalized
18 guidance documents that will allow them to implement a
19 science-based aquatic life criteria. I've been
20 involved in this issue in Kansas, well, longer than I'd
21 care to admit, and I know it is a challenge for states.
22 Certainly, the CASM model has provided EPA
23 with the tool, but a numeric trigger based on lessons
24 learned from recent monitoring using the conservative
25 and protective CASM model would be more acceptable to

1 states without the resources to implement their own
2 CASM approach.
3 You know, I can tell you I went through an
4 exercise in my home state several years ago where we
5 had, kind of by default, adopted a 1 ppb aquatic life
6 criteria for atrazine. At the time, it was probably
7 very similar to what the level of detection was and,
8 you know, obviously, depending on how you look for a 1
9 part-per-billion criteria and want to utilize that, it
10 could be very problematic given the nature of
11 agricultural runoff and just what we know about
12 atrazine and other, other, other products similar to
13 that, and what happens in the real world.
14 We attempted to, at a point in time when the
15 standards were coming up for review, interject some
16 other thought into the process and ended up actually
17 having to go to the state legislature and trying to get
18 them involved, because the scientific community and our
19 state regulatory system seem to be able to kind of --
20 unable to come to grips with it. Well, the non-
21 scientific legislature defaulted to the drinking water
22 standard. Well, that was, you know, three was better
23 than one, and we're not really sure that that was a
24 good approach, but we found it to be at least a little
25 more acceptable than, than what we had. With the

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1 default, the legislature created a blue ribbon
2 scientific panel made up of scholars and other
3 scientists from the region and universities to deal
4 with this issue.
5 And of course, after months of work, they
6 kept the standard recommendation at 3 parts per billion
7 until EPA completed their guidance document. That was,
8 you know, probably over a decade ago, and we're still
9 waiting for the finalization of the guidance document.
10 You know, the fact is, states might want to take a look
11 at something like the CASM model and think, well, this
12 really might be an ideal way to do it. But in reality,
13 most of them are suffering significant fiscal
14 restrictions in the current atmosphere that they
15 operate in and, you know, I think it's incumbent if we
16 want to see progress made in real science-based
17 standards adopted in the states that we provide them
18 with an adequate tool to do that.
19 'Cause in the absence of that, you have some
20 states like Kansas that will default to a drinking
21 water standard or maybe even the level of detection.
22 Some states have adopted some draft criteria in the
23 meantime. Many states don't have any standard, and
24 that is hardly protective of the things that I think
25 you guys are concerned about. So that certainly is a

1 strong recommendation and we think that it would be
2 good.
3 The other thing that ties into when you have
4 good science-based standards, it fits into other
5 programs that EPA and the states support, like the TMDL
6 programs. But absent those programs, you just don't
7 have much out there.
8 In addition, we do have concerns about the
9 real world application of monitoring solids from
10 intermittent streams that are not supportive of aquatic
11 life as well as artificially pushing numbers into a
12 model that show an effect but it's simply not logical.
13 DaNita talked about using the macrofied populations;
14 they were bumped up from a 105-day date to a January 1
15 date and that simply defies common sense with what we
16 see out there in the real world. These weed-like
17 plants would not be present in the Midwest small stream
18 ecosystems at any significant level during the time of
19 the first of the year, and certainly, atrazine levels
20 are not elevated at that time of year. But we know the
21 highest readings of atrazine in intermittent streams
22 occur simultaneously with high levels of runoff and
23 significant storm events. And the accompanying
24 turbidity and certainly photosynthesis at that time is
25 being inhibited regardless of the impact of any

1 herbicide activity or toxicity, including that from
2 atrazine.
3 The other thing that we see is streams dry
4 down, sometimes several times, between rainfall events
5 during the summer, and that effectively eliminates or
6 certainly challenges the ecosystem, the aquatic
7 ecosystem. And that's not to say that farmers should
8 ignore their ability to minimize the loss of atrazine
9 in any of these circumstances on their fields, because
10 it just seems -- makes good agronomic sense to do so.
11 The bottom line is atrazine helps farmers adopt
12 practices like conservation tillage that keeps more
13 soil on the field, minimizes nutrient loss and other
14 issues also of big importance. And that is a bigger
15 issue in every watershed that I have ever worked in
16 over the past two decades than the presence of
17 herbicides. Without exception, that has been a bigger
18 issue.
19 We do believe the agency has a good model in
20 place with CASM and the implementation of suggestive
21 correction should conclude that the additional
22 monitoring beyond that which is already being done at
23 the state and national level and we've -- Dr. Fawcett
24 talked about some of that. That is very significant.
25 We do not believe that there is a need to expand that

1 monitoring program. And on behalf of the network and
2 the growers in over 30 commodities that we represent,
3 we thank the committee for their time this morning.
4 DR. HEERINGA: Thank you very much, Mr.
5 White.
6 MR. JERE WHITE: I might also add, the
7 last page is just simply -- I threw this in. I know
8 you've seen slides from Missouri 01. These are
9 actually some, a copy of a photo that I had on my
10 laptop from some work we did looking at use
11 attainability analysis in southeast Kansas on streams.
12 This particular stream, obviously an intermittent
13 stream, southeast Kansas, was designated for contact
14 recreation. And also because of that, was subject to
15 the aquatic life standards and things like that and
16 obviously, the only recreation you do with this would
17 be rock hunting or four-wheeling, but it had nothing to
18 do with water. And that is not atypical of what we'd
19 see in the Corn Belt.
20 DR. HEERINGA: Panel members, any
21 questions for Dr. Fawcett, Ms. Murray, or Mr. White
22 about their presentations? Dr. Gay.
23 DR. GAY: In your, in your typical --
24 DR. HEERINGA: Dr. Gay, please use your
25 microphone, please?

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1 DR. GAY: In your typical intermittent
2 stream segments, have you measured any flows when you
3 had flashy hydrologic events for atrazine
4 concentrations?
5 DR. FAWCETT: Certainly, there are
6 monitoring programs in place and they will be, you
7 know, flows can be very high. Actually, this
8 particular segment that I copied in there, it will get
9 out of its banks for a short period of time and then,
10 you know, I would say, it would not be unusual at all
11 for, you know, within six weeks to return to the kind
12 of condition that you see in this photograph. And
13 obviously, when you have those significant events, you
14 will have more loading of compounds like atrazine, but
15 typically, there is quite a dilution effect because of
16 the massive water runoff as well.
17 DR. HEERINGA: Questions from other
18 panel members? Okay. Not seeing any at this point,
19 I'd like to thank Mr. White, Ms. Murray, Dr. Fawcett
20 for their presentations. And I gather if Rick Robinson
21 does show up, we'll certainly give his time, and the
22 public comment for him as well. At this point in time,
23 I think we're at a convenient breaking point.
24 Everybody deserves a break. I'd like to suggest that
25 we reconvene here at -- why don't we say at 10:40?

1 Take a little bit longer break. Actually, let's, yeah,
2 let's make it 10:40, and just a reminder to the
3 Syngenta folks, if we could set up your presentations
4 on the laptop during the break. And we'll see
5 everybody back here at 20 minutes of 11. Thank you
6 very much.
7 (WHEREUPON, a break was taken.)
8 DR. HEERINGA: Okay. Welcome back,
9 everybody, to the second half of our first morning of
10 our meeting with FIFRA Science Advisory Panel on the
11 topic of Interpretation of the Ecological Significance
12 of Atrazine Stream Water Concentrations Using a
13 Statistically Designed Monitoring Program.
14 At this point, we have been engaged in our
15 period of public comment, and we return to a sequence
16 of presentations by representatives of the primary
17 registrant, Syngenta. And I think I'd turn to -- Dr.
18 Soloman is going to sort of coordinate the
19 presentations. There are a sequence of them. I think
20 that Syngenta has offered to entertain questions from
21 the panel after each of the presentations to sort of
22 keep things current and so, Dr. Soloman.
23 DR. SOLOMAN: Mr. Chairman, thank you.
24 Members of the panel, and members of the public in the
25 audience, I am here at the request of Syngenta. And

1 I've been asked to act as a lightning rod and give a
2 brief introductory presentation with some biological
3 background, and then pass the torch onto several other
4 people who will present additional information, and
5 then I'll return to you for some summary comments at
6 the end of the presentation.
7 I have taught pesticide toxicology at the
8 University of Guelph for the last 30 years. And I've
9 been involved in a number of risk assessments and other
10 studies on pesticides over those years. And I started
11 working on atrazine in the early 1980s in some meso and
12 microcosms that we had, and I was involved in a number
13 of risk assessments after that. So I am here because
14 perhaps I've got lots of white hair, one of the effects
15 of atrazine, I suspect, on humans but anyway. The -- I
16 will give a brief introduction, and then you'll hear
17 some presentations from some other individuals. And on
18 my right is Chris Harbourt and further over is Steve
19 Hendley and Steve Bartel sorry, Steve -- Paul
20 Hendley, Steve Bartel, here, and Dave Volz on the other
21 side of him. And at the table, we also have Dr. Robert
22 Sielken, who's the statistical adviser to the group and
23 Dr. Jeffrey Giddings who's done a lot of work on
24 microcosms, and they're available for questions
25 although they won't be making any specific

1 presentations unless so requested.
2 I think the size of this project, the
3 enormity of this project, is perhaps illustrated in the
4 number of individuals making this presentation. It's
5 required a very wide range of expertise, and we intend
6 to bring the highlights of a very large amount of data
7 that is being supplied to the panel on CDs, and as an
8 environmental gesture and also as a handout of the
9 slides that you have in front of you. And we'll
10 obviously be willing to entertain questions at any
11 point. And also later on in the proceedings, should
12 that be appropriate, people will be here to answer
13 questions.
14 Dr. Jordan and Dr. Irene gave some
15 introductory comments, but what we will show in our
16 presentations will relate to two points. And that is,
17 how much and where and what can this -- be done to take
18 it forward into the future. We have, I think, a very
19 successful -- a high-quality study with a robust
20 sampling regimen of almost nine -- just over 9,000
21 samples. It's been an extensive study of 40 sites that
22 represent the distribution of environmental parameters.
23 35 of these sites were below the highly protective
24 level of concern and only two sites exceeded the level
25 of concern. These were associated with particular soil

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1 and hydrologic type that is unique to a major land
2 resource area, 113 in Missouri as was alluded to in
3 some earlier statements.
4 There are some sites that had intermittent
5 flow and these probably need some refined approaches to
6 assessing risks there. Where these exceedances
7 occurred wherein a specific site that had unusual
8 conditions that are not that widely spread and -- but
9 we can use this information to identify similar sites
10 where similar situations may occur. We can use this
11 knowledge from these observations and we'll make some
12 suggestions as to that to develop predictive tools, and
13 with the large amount of data that has been made
14 available through other groups such as the USGS. For
15 instance, 300 watersheds in the top 1172 have good data
16 from USGS, and we can use that in relation to the data
17 that is being generated for this study to further
18 validate and develop models.
19 There have been a number of -- over the
20 years, a number of aquatic regulatory guidelines and
21 standards have been set for atrazine and two of these,
22 I was physically involved with were comprehensive
23 probabilistic risk assessments of atrazine in the
24 ecosystem, this was the first one published in 1996,
25 and it was the first probabilistic risk assessment of

1 ecological risk from pesticides at that time. And this
2 was followed up later on by a much more detailed and a
3 longer book; it's actually a book here. The senior
4 author of this book, Jeff Giddings, is at the table,
5 and this updated the 1996 work and was published in
6 2005.
7 These two risk assessments were based on very
8 large amounts of data, and that's already been
9 discussed by some of the previous presenters. At that
10 time, we had about 32,000 samples of water -- surface
11 water analysis, that's increased to roughly 46,000 now,
12 and we had a large amount of laboratory toxicity data,
13 as well as a large number of micro and mesocosm
14 studies.
15 This illustrates from the 2005 book the
16 locations of the sampling in relation to areas that
17 have higher risk from runoff in relation to high use as
18 well as high rainfall in the pink and all of the
19 sampling locations indicated by the small letters on
20 the, on the slide. In the IRED from 2003 that resulted
21 in us being gathered here today, there was a proposal,
22 again, a guideline proposal to use rolling averages
23 over various periods from 14 to 90 days and to use
24 these to develop triggers that would either suggest
25 there was no concern, or that further information will

1 be required, such as the CASM model. And this is
2 illustrated here in this flowchart and then the numbers
3 on the bottom row of the table here. So for a 14-day
4 average of say 38 micrograms per liter, this would --
5 anything greater than that would trigger a more refined
6 risk assessment or 12 micrograms per liter for a 90-day
7 rolling average.
8 There -- a number of other risk assessments
9 that have been conducted by agencies. In Australia,
10 the ABPMA has done a risk assessment on atrazine, PSD
11 in the UK, as well as PMRA in my home country in Canada
12 that -- and they've -- all of these, including the two
13 probabilistic risk assessments, came to the conclusion
14 that at current environmental concentrations, atrazine
15 does not present a large risk to the environment.
16 I think it's very important to consider the
17 mode of action of atrazine in terms of its relation to
18 ecological risk and how the data are handled in these.
19 Photosynthesis is a very important process
20 and in primary producers it is -- mostly occurs other
21 than the blue green algae in the chloroplast and in the
22 thylakoid membrane of the chloroplast. And this is a
23 very well-understood, well-researched process and the
24 protein here, D1 protein, is a very important
25 intermediate in the photosynthetic process and

1 electrons and hydrogen are transferred through
2 plastoquinone from one part of the photosynthetic chain
3 to the other. And I've highlighted the plastoquinone
4 and the plastohydroquinone, accepts the two hydrogens.
5 But just to illustrate this in a little
6 cartoon, this is the normal process of transfer of
7 electrons where plastoquinone binds to the binding site
8 then accepts the two hydrogens, and at that point, it
9 moves out and carries those to another part of the
10 chain of photosynthesis. Now how this is interfered
11 with by atrazine is also well understood. In the -- if
12 atrazine is present in the plant or in the medium, if
13 you're thinking of an algae or something like that, it
14 will bind -- let me go back there, sorry. It will bind
15 to the same site, it binds, not covalently, but through
16 cornivalis interactions, and it basically blocks the
17 access of plastoquinone to the bonding site while it is
18 present. But if the atrazine is metabolized and
19 removed from the system, or if it's removed from the
20 matrix, it will diffuse out of the site, and at that
21 point, the plastoquinone can go in and do its normal
22 function. This binding is not covalent, so it is fully
23 reversible, and this is an important point in the mode
24 of action.
25 This is illustrated in the study that has

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1 been made available to the panel, which looks at the
2 aquatic macrophyte Lemna gibba, and these plants were
3 exposed to various concentrations of atrazine for a
4 period of 14 days, and then the atrazine was removed
5 and the plants, the plants were transferred to
6 uncontaminated medium. And at this point, at all
7 except the highest concentration, the growth rate
8 returned to control levels. So even after a 14-day
9 exposure period, the plants were able to recover from
10 relatively large exposures to atrazine.
11 This is a similar study done on another
12 macrophyte that has also been supplied to the panel.
13 This is a rooted macrophyte, Elodea Canadensis, and in
14 the presence of -- highlight the intensity, atrazine
15 inhibits growth in this, in this plant. However, at
16 lower intensities, this one is at 500 lux, which is not
17 showing up on the screen; I apologize for that. And
18 you can see less inhibition, in fact somewhat of a
19 stimulation of growth. And that's at zero lux, the
20 bottom line and of course, in the presence of no light,
21 there's no photosynthesis, so there's very little
22 growth. And this perhaps is useful in illustrating
23 that the effects of atrazine on macrophytes are light-
24 dependent, and that in the presence of other
25 confounding stresses, such as suspended sediments, you

1 may actually get some interaction there that would
2 protect plants from atrazine, and this happens in the
3 field.
4 So just a quick summary of this, non-
5 covalent, it's not bioaccumulated to a significant
6 extent. The response in the plants, and this is very
7 important, is proportional to exposure concentration
8 and duration. And atrazine, at certainly low
9 concentration merely causes stasis of growth, and this
10 resumes after removal of atrazine from the matrix. And
11 there are confounding effects under low-light
12 conditions, such as might occur in the real world in
13 the presence of sediments in the kinds of streams that
14 we have in the Midwest corn growing region.
15 I'd like to then just to spend a couple of
16 minutes on CASM, which is the model that was used to
17 bring together the stream monitoring data and the
18 ecotoxicological information. CASM makes use of
19 exposure monitoring data, and you'll hear more of this
20 later on from other presenters. And it integrates this
21 with ecotoxicological data based on, as you heard
22 earlier, on a very large number of studies that have
23 been conducted on atrazine. And then as required by
24 the 19 -- I'm sorry, the 2003 IRED, this allows you to
25 use the chemographs to look at the extent, and then

1 also the ecotoxicological data can be integrated with
2 that to look at the relevance of those exposures that
3 occur in the environment. And this is done, as you'll
4 hear later on, through the use of a refinement of the
5 CASM model, which has been refined to address the
6 atrazine issue specifically. And this develops
7 criteria that or measures relating to community
8 structure, so that's both structure and diversity, and
9 this gives you an index that you can measure the
10 potential effects of atrazine under the system.
11 So what CASM is basically doing is bringing
12 together and integrating toxicity data and monitoring
13 data. And this also, because it's over time series,
14 accounts for day-to-day dynamics in stream ecology and
15 exposures that occur on that day-to-day frequency. So
16 what I would like to do now is entertain any questions
17 if there are from the panel, and then I will pass on to
18 Dr. Chris Harbourt, first, who will talk to you about
19 the monitoring data.
20 DR. HEERINGA: Panel members, any
21 questions for Dr. Soloman? Yes, Dr. Gilliom.
22 MR. GILLIOM: I think that part -- is --
23 how variable is the reversibility with different
24 species, particularly thinking about some of the ones
25 that might be more sensitive in these ecosystems?

1 DR. SOLOMAN: What you saw there was a
2 study with Lemna gibba. There have been other studies
3 done on algae, and they also show rapid reversibility
4 even after a period of stasis of, I think, it was 21
5 days. This is work on by Steve Claney at Clemson
6 University. In terrestrial plants, there's also
7 reversibility that's been seen in Johnson grass and
8 some other weed species as well, if they're moved to a
9 clean environment. So this goes across most -- it's
10 related to a highly conserved nature of the
11 photosynthetic mechanism, which is very similar across
12 all plant species.
13 DR. HEERINGA: Dr. Lerch.
14 DR. LERCH: I'm just curious about the
15 reversibility in the presence of the sediment. I've
16 seen, say, shading for instance when you expose
17 atrazine to a plant at different concentrations of
18 shading. And as you increase the shading, the lower
19 concentration inhibits plant growth so, I guess, I
20 missed something on the reversibility with respect to
21 the sediment issue.
22 DR. SOLOMAN: Yes, we were -- our
23 contention is that sediment -- and we know this from
24 studies in microcosms, where we looked at dissolved
25 organic carbon which inhibits the penetration of light

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1 and absorbs light, and this will significantly reduce
2 photosynthesis in microcosms for macrophytes.
3 Sediment will do the same thing basically,
4 and that would inhibit the photosynthesis. And
5 basically, you have two things -- two stresses doing
6 the same thing, and they're not additive, because
7 they're not working through the same mechanism, and you
8 know, no light and atrazine operates through totally
9 different mechanisms. The interesting thing about that
10 -- the data that I saw and that's a recent study is
11 that it appeared to be slightly stimulatory at low-
12 light conditions, and that's actually not unusual.
13 Macrophytes, in our experience, grow in low-light
14 conditions or in conditions where photosynthesis has
15 been inhibited, will grow much longer to try and reach
16 the light. This is a natural response, so maybe that's
17 what's occurring in that situation.
18 DR. HEERINGA: Yes, Dr. Ellsworth.
19 DR. ELLSWORTH: Yeah, Tim Ellsworth,
20 University of Illinois. I've got a question on the
21 EC50 variability that was observed with respect to
22 atrazine for a given species. Could you comment
23 perhaps on why that type of uncertainty or variability
24 was encountered?
25 DR. SOLOMAN: I don't have a specific

1 information on, on exactly, but maybe in some of the
2 following presentations, that will be addressed. But
3 certainly, you do get variability in relation to the
4 strain of algae if you're doing an algal work, we've
5 seen differences between strains of the same species.
6 What the cause of that is, I'm not sure; it could be
7 metabolism.
8 Okay. With that, I'll play musical chairs
9 and pass on to the next speaker.
10 (WHEREUPON, a discussion was held off the record.)
11 DR. HEERINGA: Introduce yourself again
12 too, please, sir.
13 DR. HARBOURT: Yes. Mr. Chairman,
14 members of the panel, my name is Chris Harbourt. I'm
15 an engineer with Waterborne
16 Environmental, and I've been the principal investigator
17 on the field effort to collect all of this data for the
18 last four years. Waterborne Environmental is a
19 environmental engineering firm. We do science and
20 engineering and really focused here on field studies
21 and modeling in GIS support dose studies.
22 We operate under strict QA/QC called the
23 GLPs, good laboratory practices under FIFRA Guidance,
24 so all of our studies are of high quality, documented
25 extremely well.

1 In 2003, this process began with a
2 distribution across the US of atrazine use by county.
3 This is a five-year average of pounds per harvested
4 acre from survey data. This is from Dome's
5 Agricultural Survey Data of actual growers and
6 observations across the US to who was applying atrazine
7 where, and how much. And from that, we intersect, and
8 I'm going to start to introduce some jargon here, I
9 know, in the white paper, if you've been through the
10 EPA white paper, you may know some of these terms.
11 We began with a group of 9,513 HUC
12 watersheds. And a HUC is a hydrologic unit code and
13 it's just a numbering system to define watersheds of
14 different size. The HUC -- a HUC 6 or a HUC 8, you
15 need six or eight numbers to define an area, and as the
16 number gets larger, so HUC 10 or HUC 12, you need more
17 and more numbers to describe that smaller area, so
18 they're inversely related. And we began with this
19 area's 37 states with atrazine use on corn sorghum,
20 focused on those 37 states that have accounted for 99
21 percent of atrazine used on corn and sorghum.
22 From the 9,000 group, we narrowed that down
23 to 5,860 HUC watersheds, and these HUC watersheds are a
24 mix. We used the best available data in 2003. In some

1 and in southern states, that wasn't available
2 everywhere, so we had revert back to a HUC 8, a
3 slightly larger unit, but we mixed that together and we
4 kind of refer from that here on out as a HUC 10
5 coverage. And you'll see that terminology throughout
6 the white paper and other reports from Syngenta.
7 T`he 5860 group was really classified by
8 narrowing down to an area where we had greater than a
9 quarter-pound of atrazine per harvested acre applied.
10 And at this level we -- and EPA really applied
11 different models of potential vulnerability to these
12 watersheds, ultimately selecting the WARP model. And
13 another piece of jargon here, but WARP is the watershed
14 regression of pesticides model. It's a USGS model.
15 It's a regression-based model based on NAQUA and other
16 water quality sampling studies. It's specific to
17 atrazine, and it predicts atrazine annual average
18 concentrations.
19 EPA selected the upper 20th percentile of
20 that group, so we narrowed from 5,860 to 1172; that's
21 just the upper 20th percent of that distribution.
22 Focusing in on higher-use areas, the WARP model
23 accounts for -- the vast majority of its variability is
24 covered by use, atrazine use. There's also factors out
25 of the universal soil loss equation, K factor, and R

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1 factor there, for rainfall or acidity, and some soil's
2 parameters done over land flow, which is a predictor of
3 saturation excess moisture in an area. The area of the
4 watersheds also incorporated was related to that USGS
5 data.
6 From that group of 1172, 40 watersheds were
7 selected using another piece of jargon here, the GRTS,
8 which is the Generalized Random Tessellations
9 Stratified statistical sampling construct and, I think,
10 Dr. Tony Olsen may be speaking later in the week about
11 that in more depth. I just wanted to touch on it here
12 is that it, it focused on -- we identified 40
13 watersheds here in pink. But GRTS, the General Random
14 Tessellations Stratified tool selected two pools within
15 that 40; a group A and a group B site. Group A was a
16 WARP result of between two to four, and a group B
17 between four and 14. And that's an annual average
18 atrazine concentration. Within those two strata or
19 groups, sites were selected with a probability
20 weighting scheme weighting towards higher use again.
21 So it's a double accounting for use and a real focus on
22 where the use was largest.
23 Along with the 40 that were selected here
24 shown in purple and blue, there were five oversamples
25 per group, and that allowed us later, and I'll show you

1 a little more about this, if we encountered a problem
2 in the field in selection, finding an actual spot on
3 the ground to measure, we had those in reserve to use
4 in case, they were selected statistically using that
5 same GRTS approach.
6 In addition to the 40 sites, really honing in
7 on atrazine use and the parameters in the work model,
8 the 40 sites also represented a range of other
9 environmental parameters. And here, we're highlighting
10 group, hydrologic soil group, C and D soils. And
11 that's a classification for heavy soils, runoff-prone
12 soils perhaps if the slope is correct. And we're
13 comparing in blue, the 1172 that count across that
14 range of hydrologic soil group C and D percent in a
15 watershed to that in the group of 40 watersheds. And
16 we can see that in both cases, both in the 40 and the
17 1172, we have a decent coverage of the range of that
18 variable.
19 Along with C and D soils, EPA -- also here, I
20 have some nice little ways to show that, but I skipped
21 right through. Along with that one C and D soils,
22 which is included here, there were 34 others
23 considered, WARP model being one of them. But across
24 the group, somewhere between 91 percent and 99 percent
25 of these -- the range of these parameters were

1 represented in the group of 1172. And for more details
2 on this, I think, would -- it's best to refer to the
3 Silkien, et al. document that was submitted to the
4 docket. And there's a detailed discussion there of
5 more information on the different vulnerability and
6 disease that were reviewed in 2003/2004.
7 So we talked about these HUC 10 watersheds
8 before and 40 of them were selected. Well, we need to
9 get from that larger watershed scale to an actual
10 physical location on the ground to start our monitoring
11 and begin the program. And this is an example of one
12 in Ohio that ultimately became one of our monitored
13 sites. And I'm just going to walk you through the site
14 selection process that was approved by EPA in reports
15 after the final selection of the site.
16 We began with the HUC 10. We applied
17 criteria. We didn't want to be too far up the creek
18 where it was kind of an ephemeral stream. We didn't
19 want to be too far down where there was too much
20 influence from a broad area. We decided on nine square
21 miles where annual crop rotation was unlikely to
22 seriously skew results based on specific farmer
23 behavior. There was a decision made to restrict the
24 maximum size of the sampled watershed to somewhat
25 smaller than the HUC 10 watershed. And to do that, we

1 limited it to either half or in cases where that HUC 10
2 was actually less than 50 square miles, we limited it
3 to 50 square miles.
4 There was also a desire to stay away from
5 urban areas. And in GIS, we reviewed where urban areas
6 may have been and rejected possible areas that where --
7 effects from urban were more than ten percent of the
8 total flow at the proposed sampling place. And then
9 finally, we classified the area based on the crop that
10 was there so we looked at products from USDA, the
11 national land cover data set, looked for areas where
12 there was possibility for row crop, and then ranked all
13 of the possible locations in the watershed and chose
14 the upper half of that. So we're guaranteed to be in a
15 possibly more vulnerable situation than the HUC 10
16 originally. And this shows those reaches starting with
17 FA equals nine up in the, up in the corner here.
18 And what I'm going to do is kind of focus you
19 in this area here, the red reach here represents an
20 eligible reach based on our criteria for percent crop
21 accumulation. It also met the urban and other
22 criteria. In the office, we obtained the air photos
23 for these watersheds. And again, we're going to focus
24 in here. This is the zoom up of that small yellow area
25 there. We actually identified bridges, places where we

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1 can go and sample there, and then plans to go out and
2 visit. And the next slide I'm going to show you is
3 actually the picture from the person standing on the
4 bridge that's highlighted here. And the site
5 ultimately became one of our Ohio sampling sites. And
6 after we chose the site and that was selected then by
7 EPA and approved by them as an appropriate site, we
8 delineated the watershed and went about our sampling
9 program.
10 So I've mentioned earlier that we had these
11 oversamples in reserve. Going out to the field, we
12 ended up using of the 10 available to us, the five from
13 group A and B. We used four from the A strata and
14 three from the B strata. And these are highlighted in
15 the USEPA document as a separate group; these seven
16 sites that were rejected. I want to talk a little bit
17 about why -- why we rejected them. It really had
18 nothing to do with atrazine use or corn in the
19 watersheds. The dominant factor for us, there was
20 either -- there was no bridge. There wasn't an
21 eligible reach.
22 There simply was no length of stream that met
23 the criteria that we felt focused in on the appropriate
24 stream. And some of them had this very complex two-way
25 hydrology, particularly the site down in Louisiana and

1 those sites located near major rivers. An example of
2 that here is a picture from a rejected site between
3 Nebraska and Missouri right here. And we saw the sign,
4 and basically what it says is keep out, trespassers
5 will be prosecuted. And that part really didn't scare
6 us away.
7 We know we can get permission. What worried
8 us here was it's a flood-control project. And really
9 there was an Army Corps of Engineer structure that made
10 a flow condition that wasn't typical of the Midwest.
11 There were two of those type sites. But overall, the
12 rejected sites and the ones that we ended up
13 substituting, that reason for substitution had nothing
14 to do with atrazine runoff drivers or issues.
15 Here's an example of four different sites. I
16 think the one down on the lower left is from Kentucky.
17 The catty-corners upper left and lower right are from
18 Indiana. I believe the upper right one's an Illinois
19 site. The key here is to get a feel for these type of
20 streams where we're in close proximity to agriculture
21 fields right up to where we're monitoring. The streams
22 are typically one- to three-meters wide, half-a-meter
23 deep, at most, at kind of a base-flow condition, a
24 typical condition outside of a storm event.
25 So after we'd selected the sites and you've

1 seen some examples of the sites, let's talk a little
2 bit about the sampling strategy; about how we went
3 about getting to these 40 sites, when we get to them,
4 and all of the details there. The study timeline was
5 extremely condensed. We fixed the protocol in November
6 of 2003 and less than six months later, we were in the
7 field, sampling, instrumented, and everything, which is
8 a monumental effort; it happened over that winter of
9 2004.
10 April 1st of 2004, we began with 20 sites.
11 It was a mix of the group A and B strata from WARP and
12 GRTS. Those 20 sites continued through 2005. The
13 start of 2005, 20 additional sites came in. That was
14 the remainder of the mix of group A and group B. Those
15 sites continued through 2006 along with six sites from
16 2004 that carried all the way through to 2006 that EPA
17 identified were recommended that we have additional
18 monitoring, continue monitoring, at those sites.
19 Beyond 2006, 11 sites continued on into 2007. There've
20 been presentations before highlighting that some of the
21 things going on in Missouri, four, five of the sites
22 are in Missouri for 2007, and there were four
23 additional sites scattered throughout the Midwest that
24 possibly encountered a period in 2006 where there were
25 extremely low rainfall. And those were continued on to

1 make sure we capture the right types of, the right
2 types of data from our field study.
3 All right. So how we went about this? I've
4 mentioned before there's
5 four-day grab samples and how many of them. They
6 started approximately April 1st. We monitored the
7 regional corn planting information from USDA, and when
8 50 percent of the regional corn was planted around each
9 of our sites, we started a counter. That counter went
10 for 120 days. We drew a line in the sand that ended
11 sampling 120 days past that. That was typically the
12 last week in August to the first week in September.
13 And then we continued our four-day sampling, marching
14 on from that start date all the way to the end date.
15 So there was physically a person in the field taking a
16 grab sample every four days, weekends, holidays,
17 everything starting April 1st all the way through to
18 September 1st.
19 Here's an example of our four-day grab sample
20 visits. We collected them, as I said, every four days.
21 Here's a picture of a Lamont sampler. I actually
22 brought one with us. I wasn't sure how many of the
23 panel members may have seen one of these devices, but
24 there's physical limitations for what you can do with
25 these. We'll discuss a little more about that at low

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1 flow sites, but there's basically what's pictured in
2 the slide. Drop this in; dunk it a few times to make
3 sure it's rinsed properly. When you send this brass
4 weight down, so it takes a little bit of, all right,
5 you're going to hold this in one hand, you're dangling
6 this over the side of the bridge. That way it comes
7 down, slams into this catch. Closes that underwater,
8 you haul it up, and go about your sampling duties.
9 Oh, it's a pretty simple reliable technology;
10 easy to clean, easy to take care of. We collected
11 three bottles. One atrazine, one back-up, and one
12 total suspended solid sample. We performed equipment
13 checks to make sure that the equipment was working and
14 it hadn't been vandalized. Made site observations
15 about corn development as well as other, other things
16 of interest. We established a clean surface on the
17 back of our sampling vehicles; filled those bottles.
18 We recorded everything with pocket PCs, and created
19 then field forms that are all well-documented and
20 logged, filing cabinets of these things. And along with
21 chain of custodies to assure that the samples then move
22 through the process to the lab.
23 At ten of the 40 sites, we installed event-
24 driven auto-samplers. A picture of that. We located
25 them in stand or galvanized culvert pipes for security;

1 they survived bullet shots and everything else that you
2 find in the field. There's also a detail there of the
3 intake, it's stainless steel intake with Teflon tubing.
4 The auto-samplers were event triggered. They
5 were triggered by changes in flow, changes in depth of
6 the river. If the river changed in depth due to
7 runoff, they would trigger in. So here's just an
8 example of our four-day samples in red intermixed with
9 auto samplers. They could occur on the day we were
10 there; they could occur in between. They were
11 triggered by flow; they continued on until flow
12 subsided. They were representative, composite samples
13 collected over six or eight hours depending on the
14 year, and really, add value to those sites and were
15 designed to add value about what may be going on
16 between the four-day events to answer any questions
17 that might arise there.
18 It's the detail of our river system. Upper
19 left is a pressure transducer. We use those
20 extensively. They're very accurate. The upper right
21 is a picture of our rain gauge and data logger setup.
22 There was also a little switch on the side of these
23 boxes. The sampler was required to toggle that switch
24 when they were there. We have proof then that the
25 actual sampler was there on the location at the time

1 the sample was collected as a verification that they
2 truly were there and that sample is from at the site at
3 that time.
4 Lower left is just a picture of our
5 ultrasonic system when we had trouble obtaining
6 permissions on the banks. We hung all our equipment
7 directly off of a bridge. And down on the lower right,
8 that's actually me in the yellow shirt. We were out
9 there in the middle of, you know, from anytime from
10 when the snow disappeared and the creeks unfroze to
11 April 1st we were out there installing this equipment,
12 getting these fields prepped. Really under the gun
13 with a lot of pressure to get this stuff installed
14 before the growers were out in the fields making their
15 applications.
16 Overall, the study was a success. 9,513 grab
17 samples were collected. 99 percent of the targeted
18 samples were quantified with only a 0.7 percent failure
19 rate due to losses in shipping and other issues like
20 that. We collected over 35 samples per year. The only
21 exception were -- what we'll talk about later is three
22 dry down sites in southeastern Nebraska, where we had
23 prolonged periods where the stream was either low flow
24 or no flow; we couldn't use our sampling apparatus to
25 collect a representative sample of the water that was

1 there.
2 The auto-samplers performed exceptionally in
3 my experience. 807
4 samples collected over the study. Out of 178 flow
5 events that they attempted to
6 sample, 149 of those were captured. And our
7 understanding of the performance of these samplers
8 improved with time; the second year was always better
9 than the first. After we kind of understand the
10 difficult hydrology at each of these sites.
11 As I mentioned earlier, this is a GLPQA-
12 inspected study, FIFRA Good Laboratory Practices,
13 different aspects of the study had been quality checked
14 by our independent QA, Syngenta's Independent QA, and
15 then also U.S. EPA's independent QA. Our field
16 operations are all logged. Training files documenting
17 that the people on the field are trained to use the
18 type of equipment, and do the types of things that they
19 are on the study. Then the final report will
20 ultimately be inspected as well.
21 The goal of all that work is to generate
22 atrazine chemographs with corresponding data describing
23 flow, total suspended solids and rainfall data in
24 support of other activities that will follow. And in
25 summary, we have measured chemographs for the CASM

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1 Model with four-day sampling frequency at all sites.
2 This is a successful study; 99.9 percent of targeted
3 samples quantified. We added contextual data, inflow,
4 rainfall, and weather to surround the samples and add
5 value. And it's our belief that the 40 sites represent
6 a range of environmental parameters across multiple
7 years. With that, I'd like to go back to --
8 DR. HEERINGA: Thank you very much, Dr.
9 Harbourt. I'm sure this is going to generate a few
10 questions from the panel. Anybody have questions for
11 Dr. Harbourt on the presentation, methodology, at this
12 point? Yes, Dr. La Point.
13 DR. LA POINT: Yeah, I have a question.
14 Dr. Harbourt, you're the first to bring up the -- when
15 you're talking about the HUC watersheds and the upper
16 20th percentile of the watershed regression as those
17 being vulnerable. So vulnerable -- 'cause I kept
18 coming across the term in the various reports.
19 Vulnerable is taken to mean then, mass loading, really.
20 Is that correct?
21 DR. HARBOURT: Vulnerability, I think,
22 here, in terms of that's an -- the WARP model
23 specifically is an annual average concentration. I
24 don't really think of it in terms of a load. Perhaps,
25 it's more of an environmental sensitivity perhaps to

1 the types of conditions that would drive atrazine
2 runoff in -- or atrazine in runoff, not necessarily a
3 flow, or a loading.
4 DR. LA POINT: Okay. But it doesn't
5 have anything to do with vulnerability of the species
6 or the ecosystem subject to that? I mean, it is just a
7 potential for atrazine to get in to the system; right?
8 DR. HARBOURT: Yes.
9 DR. LA POINT: Okay. Yeah. It's
10 something we could talk about later, I think it might
11 be an unfortunate use of that term, vulnerability, but
12 thank you.
13 DR. HEERINGA: Dr. Grue.
14 DR. GRUE: You mentioned the maximum
15 drainage area as a selection criteria. Could you
16 explain that a little bit more? In other words, why,
17 why, why use the maximum, half the HUC 10 watershed?
18 DR. HARBOURT: Sure. That was a twofold
19 criteria. One of the issues with the Hydrologic Unit
20 Codes; they're not true watersheds. And an issue with
21 many of them, that they are linked to drainage areas
22 upstream of them. And the worry was that we would
23 select a site based on upstream drainage or some
24 characteristic that wasn't quantified by that
25 particular HUC that was selected. And for that reason,

1 we limited the upper size of them to something smaller.
2 And that was the decision that was brought to us by
3 USEPA.
4 DR. HEERINGA: Dr. Portier.
5 DR. PORTIER: On slide 31, could you
6 bring back slide 31? I just --
7 DR. HARBOURT: Sure. Let me.
8 DR. PORTIER: I wanted to kind of
9 clarify -- follow up on Dr. Grue's question. That's
10 the problem of animation; right? Another click.
11 DR. HARBOURT: We'll get there. 31?
12 DR. PORTIER: There you go.
13 DR. HARBOURT: Okay.
14 DR. PORTIER: So you have some, you have
15 some alterna -- alternates here you could have selected
16 and you selected the one that's kind of further up at
17 the top, right, of the watershed. Did that occur every
18 time? I mean, when you were looking at it, are you
19 always selecting something that's kind of a self-
20 contained top of the watershed kind of a reach rather
21 than something further down?
22 DR. HARBOURT: Well, I'm ,I'm glad you
23 asked that. I skimmed over that perhaps too fast here.
24 We went to these different reaches and here there's
25 actually two in this example. There's a long red one

1 and there's a very short red one there off to the lower
2 left. They were both -- they were first selected at
3 random.
4 So they were each assigned a code, one or
5 two. And we selected, used a random number generator
6 to select one, two; there were some that had ten or 15
7 of these individual reaches. And we started at the
8 most downstream point, and worked our way up until we
9 found a suitable bridge. So first in the office, they
10 started at the base. Identified bridges.
11 Then when they got to the field, they started
12 at the lowest portion, worked their way up until -- and
13 taking pictures all the way along working towards the
14 bridge that met the criteria for safety, and all the
15 other conditions that we had to get people on the
16 field. So --
17 DR. PORTIER: Just -- so you randomly
18 selected a reach and then you checked it for ability to
19 measure?
20 DR. HARBOURT: Yes.
21 DR. PORTIER: And then if you didn't
22 find anything, you went to the next selected one on the
23 -- or did you re-randomize?
24 DR. HARBOURT: The next random number.
25 DR. PORTIER: The next one in the random

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1 list?
2 DR. HARBOURT: Yeah. The next random
3 ordered list.
4 DR. PORTIER: Okay.
5 DR. HARBOURT: Yes.
6 DR. HEERINGA: Dr. Randolph and Dr.
7 Effland.
8 DR. RANDOLPH: Yes. Do you have a land
9 use or land covered data or coverages for the
10 watersheds?
11 DR. HARBOURT: Yes, we do. We have
12 different levels of
13 that. First of all, across all of the sites in the
14 selection, and that was one of the reasons initially
15 for selecting this level was the national land cover
16 data set from 1992. That's been updated in 2001 now.
17 And that product didn't come out 'til long after we
18 completed this portion of the study. That has a
19 classification for row crop and then we used a county-
20 level indicator for percent of row crop in an
21 individual county that was corn or soy beans or
22 something else, so we just looked at that corn/sorghum
23 fraction. We know that there are, today, better
24 products out there. At the time that was everywhere.
25 It was everywhere for the 1172; it allowed us the

1 greatest flexibility in selecting types of
2 vulnerability measures.
3 Today, there are better things. One product
4 is called the Crop Land Data Layer and that's crop-
5 specific; it's flown from many of the Midwest states.
6 I think in 2006, it's available for Nebraska, all the
7 way east, to Ohio, and that identifies individual crops
8 in that year. Corn specifically, for example.
9 DR. HEERINGA: Thank you.
10 DR. PORTIER: Back to the question about
11 the watershed. You only sample one stream reach per
12 watershed; there was no replication within a watershed
13 to see what the variability would be within a
14 watershed?
15 DR. HARBOURT: No. No. Just one, one
16 point was selected at random and that was the objective
17 of the study.
18 DR. PORTIER: One, one point within.
19 DR. HARBOURT: Yeah. Yeah.
20 DR. PORTIER: And then, you have some
21 criteria like the hydrologic soil group, how did you
22 deal with the dual -- you know there's dual hydrologic
23 soil groups that are related to -- primarily related to
24 tile drainage, which is where my question is leading.
25 So first: How did you deal with the dual; you just

1 leave those out?
2 DR. HARBOURT: You mean like linking
3 tile drainage to a C/D soil or --
4 DR. PORTIER: Well, let's say, with some
5 of the hydrologic soil groups, you have like an A/D,
6 meaning, that if you tile drain it, it changes it very
7 dramatically from a D to an A.
8 DR. HARBOURT: Sure. Sure. No, if it
9 wasn't -- if it was like example in Illinois, it's
10 heavily B/D soil, where it's a B if it's tile-drained,
11 it's a D if it's not. We assumed that if it's
12 agriculture, a B/D soil would be a B.
13 DR. PORTIER: Okay.
14 DR. HARBOURT: 'Cause the assumption is
15 that if a farmer is successful in monitoring a -- or
16 you know, in not monitoring, but in growing their crop,
17 they most likely have tile drained in that area where
18 it's a B/D soil.
19 DR. PORTIER: Okay. So then, how did
20 you -- did you include tile drainage in any of your
21 criteria as far as areas that you would select or not
22 select. Did you -- was that anywhere considered in
23 the --
24 DR. HARBOURT: That did not come in in
25 2003. And ultimately, I mentioned that we looked, and

1 EPA looked at 34 different indicators of potential
2 vulnerability. The ultimate one that was selected was
3 WARP and WARP does not account for tile drainage in any
4 of its factors. So -- and even if we had tried it,
5 really, that wouldn't be reflected in the study as it
6 was conducted.
7 DR. PORTIER: And you didn't -- did you
8 document that in your field notes, whether you thought
9 the area had tile drainage. You know, sometimes you'll
10 have a standpipe up or you'll see it was standing in a
11 creek, and you'll see where the tile line dumps
12 directly into the -- a lot of your streams look like
13 they've been altered right -- you know, considerably by
14 human activity, straightened and that sort of thing.
15 DR. HARBOURT: Yeah. Definitely it's an
16 agricultural area that's an occurrence. We did not
17 note tile drainage particularly, but we do have
18 pictures of all the sites, and it's possible from those
19 pictures if one was wanted.
20 DR. PORTIER: Okay. And one more
21 question: Did the EPA staff visit these sites? They
22 set up criteria for -- but did they -- was anybody from
23 the EPA office; did they go out with you folks and
24 visit any of the sites?
25 DR. HARBOURT: No. When we did the site

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1 selection component, EPA was not physically with us. I
2 don't know if they went out on their own. I can't
3 speak to that. We did have an independent QA come out
4 with us, but that was -- to my knowledge, no.
5 DR. HEERINGA: Chris, would you hit your
6 microphone by hand. Dr. Schlenk and then Doc -- over
7 to Dr. Gilliom?
8 DR. SCHLENK: Yeah, Dan Schlenk. Would
9 you be the person to deal with analytical chemistry
10 issues as well, or is that someone else?
11 DR. HARBOURT: I could talk to general
12 things. I was the principal investigator of the field
13 phase. There was a principal investigator for the
14 analytical side. I can get more information for you if
15 you need some --
16 DR. SCHLENK: Yeah. I just had
17 questions regarding -- 'cause if I read the
18 documentation right, there were three methods that were
19 used for analysis. One was immunoassay. One was the
20 GCMS, and another one was an LCMS method. And I'm
21 wondering -- I didn't see any documentation that
22 compared the three to see what sort of concentrations
23 you had as far as method detection limits and things of
24 that nature, but I'm just curious as to whether samples
25 were archived to be evaluated each of the three ways

1 just for continuity's sake --
2 DR. HARBOURT: Yeah.
3 DR. SCHLENK: -- across the sampling
4 things.
5 DR. HARBOURT: My colleague, Dr.
6 Hendley, here is able to answer that.
7 DR. SCHLENK: Oh, great.
8 DR. HARBOURT: Better than I would.
9 DR. HENDLEY: This is Paul Hendley. The
10 three methods, the immunoassay method had a LOD of 0.1
11 parts per billion, but the way Syngenta's used this
12 for a long time is any indication of over around five
13 to eight parts per billion, and those samples were
14 taken for GC mass spectrometry in 2004 and up 'til May
15 2005. After May 2005, the methodology moved to LCMS-
16 MS, and in the, through to about the middle of 2006,
17 the LOD was 0.1, and then it dropped to 0.05. So --
18 does that address the question?
19 DR. SCHLENK: Yes and no. More so, I'm
20 concerned with how -- if you did get a hit with the
21 immunoassay, was it confirmed with the GCMS, and
22 likewise, with the LC to MMS? Were those -- you know,
23 what was the variability in response between the three?
24 Does that make sense?

1 Hendley, again. All immunoassay detects greater than
2 five ppb were confirmed by GC mass spec. No
3 immunoassay was being done when the LCMS-MS came in,
4 because one of the advantages of LCMS-MS is you can run
5 every sample with the most sophisticated technology
6 available. And all methods are fully validated. The
7 validations were submitted to EPA, and the LCMS-MS is
8 the superior method as well as being easier and more
9 applicable to all samples. The comparison between the
10 immunoassay and the GC mass spec was done. I could
11 provide the information later, but generally, the GC
12 mass spec was giving higher values than the
13 immunoassay.
14 DR. HEERINGA: Mr. Gilliom. Dr. Novak.
15 MR. GILLIOM: Oh, Bob Gilliom, USGS.
16 Relative to the sub-watershed selection, that was one
17 of the parts that was a little hard to follow, exactly
18 how it worked in the background material. I think
19 that's probably why there was a few questions.
20 DR. HARBOURT: Sure.
21 MR. GILLIOM: It -- the way it came out
22 just a second ago made it sound like it was just a
23 random choice of eligible reaches within the larger
24 HUC. And I thought earlier, you said, that there were

1 amongst the most intensive atrazine use. So I have two
2 kind of related questions. What time scale have you
3 stayed on the crops and use intensity did you have to
4 make that decision relative to the monitoring year, and
5 how did that prioritize the selection of the sub-
6 watersheds? 'Cause it's not just random, I don't
7 think.
8 DR. HARBOURT: Yeah. That's a good
9 point. There's -- the atrazine use information that
10 was used at this level at this time was a five-year
11 average county-level use. We did not have specific use
12 records from any growers in any of these watersheds.
13 Slide 31 here shows a red eligible reach and what that
14 is, is it's eligible along its full length. Meaning
15 that, it met those criteria that I outlined in terms of
16 size, urban area, but also, here it's shown, you know,
17 highlighted in blue where -- would have been those
18 reaches that met the size and urban criteria but did
19 not meet that upper 50th percentile category of a crop
20 accumulation or an area of crop within that watershed.
21 So these are sequential watersheds. As you move up
22 these reaches, every 30 kilom -- every 30 meters is a
23 new watershed.
24 MR. GILLIOM: But according to what
25 you're going by

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1 DR. HEERINGA: Mr. Gilliom, use your
2 mic, please.
3 MR. GILLIOM: The corn acreages that
4 you're going by, that are defining upper 50th
5 percentile, it -- the problem is -- especially, when
6 you get to those smaller scales, the variation from
7 year to year gets more significant.
8 DR. HARBOURT: Sure.
9 MR. GILLIOM: So you could -- as you
10 guys know, you could -- if you get up to the HUC level,
11 everything kind of averages out and your five-year
12 average might be pretty good. And then you could go
13 into one of these smaller watersheds and that
14 particular year, corn could drop down to a fourth of
15 the area you thought it was going to be. So I was kind
16 of interested in this conjunctive problem: How do you
17 first factor that into the prioritization? I think
18 you're using the five-year average crop production in
19 that area?
20 DR. HARBOURT: Well, it's the NLCD row
21 crop is what we use.
22 MR. GILLIOM: So you're not -- this
23 isn't county corn acreages you're using?
24 DR. HARBOURT: No, it's not county corn
25 acreage. It's crop -- it's percent crop accumulation

1 of row crop. So it could be soybeans and corn. It's
2 in that rotation, but it's a potential for it to be a
3 corn or a crop where atrazine was used.
4 MR. GILLIOM: Okay. So the year that --
5 do we know after the fact, let's say, the year you
6 monitored, how many acres of corn was in each
7 watershed?
8 DR. HARBOURT: For the two sites in
9 Nebraska, we do. For all sites, we performed a -- a
10 drive-through ground-truthing of crop but looking for
11 and noting, driving every road; noting what was there.
12 We did a classification of that to a Landsat image for
13 Missouri 1 and Missouri 2, because they were of
14 interest. So we know some about -- some of the more --
15 MR. GILLIOM: Okay. But I guess, it
16 seems to boil down to -- it's hard to quantitatively
17 back-relate these small sub-watersheds in terms of
18 their actual crop and use extent during the monitored
19 years to the criteria that were used to select the big
20 HUCs. 'Cause I kept looking through the reports and
21 the tables looking for what was the percentage of corn
22 in the sub-watershed compared to the expected average
23 in the HUC. And I -- you know, I was never quite
24 finding it.
25 DR. HARBOURT: Yeah.

1 MR. GILLIOM: I don't think we have it.
2 DR. HARBOURT: Yeah. Oh, it's stated it
3 simply wasn't available at the time. In 2006, that
4 could be done with the USDA product of -- you know,
5 that CDL information is 30-meter corn; it's crop-
6 specific. So --
7 MR. GILLIOM: Okay.
8 DR. HEERINGA: Dr. Novak.
9 DR. NOVAK: Yes. Dr. Harbourt, first,
10 let me comment you on quite a large number of samples
11 here, 9500. I've done 3,000 in over two years, and I
12 know what that goes with, and that's a lot of work.
13 I'd like to ask though two questions that I
14 need some clarification on. You collected 9,500 grab
15 samples. At the time that the samples were collected,
16 do you know where you were on the stream hydrograph?
17 DR. HARBOURT: Yes. We have electronic
18 data. And we monitored stream depth and rainfall at
19 every monitoring site. Every spot that we took the
20 water samples every fourth day, we have that
21 information taken every 15 minutes, so we do have an
22 observation of stream flow or of stream depth,
23 rainfall, and all those different characteristics tied
24 to the time when that sampler was there.
25 DR. NOVAK: Okay. If I heard you

1 correctly, you have a Q value at the time for each grab
2 sample was collected?
3 DR. HARBOURT: We have an estimated flow
4 value. We have recorded a river stage, a depth, and
5 we've related that using Manning's equation and channel
6 geometry to obtain a flow.
7 DR. NOVAK: Okay. The reason I'm asking
8 that is because where you are in the hydrograph sort of
9 really affects the concentration of the analyte that
10 you're looking at. And if you were not to have that
11 knowledge, you may end up with some skewed data. But I
12 see that you've taken care of that. The next question,
13 I believe, maybe one of your other group members can
14 answer. I'm interested in the method of atrazine
15 extraction from the water samples. Did you use the
16 standard C18 solid phase cartridges? And the two
17 phases I'm concerned with looking at: Did you look at
18 atrazine in the liquid phase? And since this work is
19 also looking at sediments, did you do any sediment
20 extractions for atrazine?
21 DR. HEERINGA: Dr. Hendley.
22 DR. HENDLEY: Okay. Paul Hendley,
23 again. The immunoassay greater than five ppb, we moved
24 to the GC mass spectrometry. And I need to confirm
25 this for you tomorrow, but I believe we were using a

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1 reverse phase system for that. There was no sediment
2 extraction and checking atrazine levels on the sediment
3 given the KOC of atrazine. That's not judged necessary
4 within the protocol of this study. There's a great
5 deal known about atrazine KOC. There are more
6 measurements available than I can imagine, so I think
7 we've got a good handle on the fact that under these
8 conditions, 99 percent of the chemical will be in the
9 water phase.
10 The question of sediment levels though, the
11 sediment value is available for every time a grab
12 sample was there. A TSS value is available, so one can
13 do a back calculation if you wanted to, to work out,
14 given the KOC information, what the partition would
15 have been in the water column. Does that address the
16 question?
17 DR. NOVAK: Yeah. That also assumes the
18 carbon content is similar between sediment samples in
19 each stream which could be nefarious.
20 DR. HENDLEY: That's a good comment.
21 DR. NOVAK: Okay. Thank you.
22 DR. HEERINGA: Dr. Grue.
23 DR. GRUE: Chris Grue, University of
24 Washington. I just want to follow up again on my
25 comment -- on my question about the selection of the

1 sampling sites with respect to the individual stream
2 reaches. And it relates to the position of the bridge
3 from which you sampled relative to the potential for
4 differences in concentration of atrazine based on where
5 you are in the system relative to potential inputs.
6 And could you just describe that again in terms of how
7 did you select where that site, your sampling site, was
8 relative to position within the system that you had
9 selected?
10 DR. HARBOURT: All right. We began at
11 the downstream end of a reach.
12 DR. GRUE: Okay.
13 DR. HARBOURT: We identified bridges
14 working our way upstream and selected a bridge that was
15 safe for our sampler; that minimized any type of
16 complex hydrology right at the bridge. We steered away
17 from places where the channel changed shape rapidly;
18 that will really destroy any attempt to quantify flow.
19 Some of these areas, the bridges just weren't suitable,
20 you know, they were not necessarily the best place to
21 go and sample from our estimation. The thing to
22 realize here, and I guess -- the best way to show it
23 would be to show you physically a picture of all 40
24 sites. In all of them, you can see crop fields right
25 around, I mean, they're -- the proximity to agriculture

1 is absolute.
2 DR. GRUE: If -- maybe I can just follow
3 up.
4 DR. HARBOURT: Yeah. Sure.
5 DR. GRUE: If you were to take your --
6 the segments that you selected and you plotted actual
7 locations of samples, what would that distribution look
8 like relative to position on stream reach? In other
9 words, your -- what you've suggested is, it would be
10 biased, potentially biased, towards the low end, which
11 would be good in this -- if you're trying to
12 potentially identify maximum concentration, assuming
13 differential inputs along the, along the system.
14 If, in fact, they were biased towards the
15 high end, and potentially, they're not incorporating
16 inputs from sources lower in the system, then, you
17 know, that could potentially be a bias. So I don't
18 really get a feel for -- and maybe you can't address
19 this at this point, but, you know, if you were to look
20 at that distribution of sampling sites relative to
21 position on stream reach, what would that distribution
22 look like?
23 DR. HARBOURT: It's very difficult for
24 me to address that. I've always believed that the
25 water that we're pulling from the creeks in mid-depth,

1 mid-channel is representative of the upstream
2 watershed, not really representative of the particular
3 point on the stream reach.
4 DR. HEERINGA: Dr. Gay and then Dr. Chu.
5 DR. GAY: Paige Gay, University of
6 Georgia. I have one more question regarding this
7 matter and that is why you chose to start at the
8 downstream site. And then let's say that you had
9 identified, here you have two, but let's just say that
10 you had four stream sites selected, and then you
11 randomly numbered them, you began at the downstream
12 site, and then you went through your random numbers to
13 find a suitable site; is that correct?
14 DR. HARBOURT: Well, that was on a given
15 reach. Let's say we had four bridges on a particular
16 reach.
17 DR. GAY: Uh-huh.
18 DR. HARBOURT: We can start at that
19 downstream bridge, work our way up, and typically, it
20 was the first bridge. Yeah, there were very few that
21 we actually rejected. First or second bridge, there
22 were many of them that were very applicable and readily
23 sampled, but if perhaps all four of those bridges were
24 not on that first reach, we would then go back to the
25 random pool of five or seven reaches, however many

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1 there were, select that next random selected reach,
2 begin at the downstream end of that, and work our way
3 up until we find an appropriate sampling location.
4 DR. GAY: So if you had, well, let's say
5 four reaches that met your criteria, which one of those
6 did you start with? That was your random --
7 DR. HARBOURT: That was randomly
8 selected from those four, yeah.
9 DR. GAY: Random. Okay. Okay.
10 DR. HEERINGA: Dr. Chu and then Dr.
11 Ellsworth.
12 DR. CHU: Michael Chu. I have two
13 questions. And the first one: In your sampling, how
14 did you consider the atrazine application timing and
15 also the timing between presentation and applications?
16 This is the first one. And the second one: It seems
17 to me that you paid a lot of attention to surfaces
18 runoff, how did you consider the groundwater
19 contribution of diaza I'm sorry, of atrazine?
20 DR. HARBOURT: Well, first of all, the
21 sampling -- we began well in advance of planting of
22 atrazine, and that corresponds typically with atrazine
23 applications. April 1st is, you know, in many cases,
24 some of our equipment wasn't working properly, because
25 it was frozen out. There was snow on the grounds. So

1 we were well in advance of farmers doing any kind of
2 spring applications or spring planting. We continued
3 every four days well through the planting period, and
4 some of the reports will show there was rarely a
5 detection past July and August. So we feel that we
6 accurately covered both the response in terms of
7 atrazine runoff in runoff. And then also getting there
8 and in the field early enough to capture that, that
9 full range of potential application timings.
10 SPEAKER: Rainfall.
11 DR. HARBOURT: Yeah, rainfall. And the
12 second point had a groundwater component. That was
13 handled under a separate portion; the EPA is reviewing
14 that. And I really can't comment on the status of that
15 groundwater component.
16 DR. CHU: Did you compare one order of
17 concentrations of this, such runoff? And the -- the --
18 yeah.
19 DR. HARBOURT: The only chance for us to
20 have done that in a flowing water monitoring study
21 would have been contributions from base flow, and we
22 have no way of quantifying that difference.
23 DR. HEERINGA: Dr. Ellsworth.
24 DR. ELLSWORTH: Yes, I have several
25 questions. Number one, the original work regressions

1 were based on -- as I understand it, state level
2 atrazine use rates and county level crop data. And as
3 I understand what you did, you used that same
4 regression to identify these watersheds that would have
5 the potentially highest atrazine loads. But you used
6 different input variables in terms of the Doans data
7 for, you know, atrazine use per acre sort of corn
8 cropland in that watershed.
9 My question to you is: Since you're
10 using kind of different drivers here on the input
11 variables, how well do you think those regressions
12 would work? But you're using higher quality data, it
13 sounded to me like, as I understood that. So I didn't
14 see anywhere in the papers I saw where you actually saw
15 how well the work regressions did in predicting your
16 annual quantiles for these watersheds, you know, and it
17 would have been interesting to see how well WARP
18 actually did at predicting those 95th percentile
19 median. Maybe you have that, and I just haven't seen
20 it.
21 DR. HARBOURT: But just first, to
22 address the -- you stated you used from the beginning
23 was county level at the time. We've now revised that a
24 little bit and realized that survey data probably
25 should not be used at a county level; we backed off to

1 the crop reporting district level. Just eight or nine
2 values per state, so it's -- and that's been used
3 consistently. But to address the rest of your
4 question, I really think the follow-up presentation and
5 Dr. Hendley later on will address many of those
6 concerns.
7 DR. ELLSWORTH: Okay. Another question
8 I have then maybe which might tie in with this would
9 be: The paper that I read said that actually it was
10 the WARP regression for the 95th percentile, but when
11 you were talking, you said, it was the mean annual
12 regression that was used. Which was it?
13 DR. HARBOURT: For clarification, it's
14 the annual average atrazine concentration at the 95th
15 percentile model count.
16 DR. ELLSWORTH: All right. Okay. Which
17 I had a concern then in that regard, because it was
18 developed from like 112 watersheds with 25 validation
19 watersheds or whatever. But the point is, the 95th
20 percentile, they're almost all ones and a few zeros, 95
21 percent in the regression. The uncertainty in that
22 regression would be higher than, say, a median
23 regression. And, and maybe -- did you look at
24 classification at all? Why was that one chosen is what
25 I'm wondering.

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1 DR. HARBOURT: As -- within the work
2 model, why the 95th instead of perhaps the 50th or the
3 75th percentile model?
4 DR. ELLSWORTH: Yeah.
5 DR. HARBOURT: That was the choice of
6 EPA at the time.
7 DR. ELLSWORTH: Okay. Last question;
8 I'll quit. Was the composite sample, the six to eight-
9 hour composite that you mentioned, was that a time-
10 weighted average, flow-weighted average; how was that
11 composite created? I'm worried in terms of P
12 concentrations and things like that, so please explain.
13 DR. HARBOURT: It was a time -- this is
14 in reference to the auto samples. The auto samples
15 were collected. In year 1, we began with an eight-
16 hour composite sample. It was composited in equal
17 intervals. There was a one-liter bottle. I believe 80
18 milliliters were sipped equal time-weighted through an
19 eight-hour time period. Then we moved to a six-hour
20 time period in year two to capture a little more of the
21 variability. But they are time-weighted samples.
22 MR. FAIRCHILD: Were each of those --
23 DR. HEERINGA: Mr. Fairchild.
24 MR. FAIRCHILD: Jim Fairchild, USGS.
25 Were each of those separate samples taken with the auto

1 sampler analyzed separately, or were they, were they
2 pooled?
3 DR. HARBOURT: The composite samples
4 collected over either the six or eight hours, they were
5 composited into one bottle in the field. So they were
6 analyzed as just an average of that.
7 MR. FAIRCHILD: How many actual auto
8 samplers did you deploy in the study for the 40 sites?
9 DR. HARBOURT: There were ten, ten of
10 them. And in 2006, we actually supplemented a few more
11 in. As some of them came out of service, we brought
12 them back in into other sites. So in each year, there
13 were at least ten operating.
14 MR. FAIRCHILD: I noticed you said that
15 the utility improved with improving knowledge of the
16 hydrology data. Did you statistically analyze the
17 four-day grab compared to the composite sampler just to
18 see what degree of representation there was in terms of
19 the time duration between those two samples?
20 DR. HARBOURT: No. My comment there was
21 just our ability to capture that sample at a site we
22 knew nothing about. To go there and deploy an auto
23 sampler, and have it successfully collect the sample.
24 Once we were there for a year, we were able to review
25 and say, well, we didn't do such a good job here or

1 here. Let's tweak that flow calculation to either
2 trigger it. The stages were so variable at these sites
3 without knowledge of what was going on, and that
4 trigger value is really what we honed in on and
5 sharpened in the second or third year of the study.
6 DR. SOLOMAN: Mr. Chairman, I believe
7 also this will be addressed in a later presentation.
8 Keith Soloman.
9 DR. HEERINGA: There are a lot of
10 questions that have come up. What I'd like to do is to
11 move on to the next presenter. We'll have plenty of an
12 ample opportunity to revisit outstanding questions
13 before we end this. But Dr. Soloman, why don't you
14 introduce the next presenter and --
15 DR. SOLOMAN: Mr. Chairman, our next
16 presentation will be a duet by Steve Bartell and Dave
17 Volz.
18 DR. BARTELL: Good morning, Mr.
19 Chairman, panel members. Thank you for the opportunity
20 to present these comments. My name is Steve Bartell.
21 I'm a principal scientist with E2 Consulting Engineers.
22 I'm also an adjunct faculty member in the University of
23 Tennessee, Department of Ecology and Evolutionary
24 Biology. Prior to entering private consulting, I was a
25 senior research scientist in the Environmental Sciences

1 Division at Oak Ridge National Laboratory. My
2 professional background and training is in ecosystems
3 analysis, aquatic ecology, ecological, and
4 environmental modeling; more recently, in the past ten
5 or 15 years, in support of ecological risk assessment.
6 I am the developer of CASM, the Comprehensive
7 Aquatic Systems Model. More specifically, I'm the
8 developer of CASM Atrazine, which we'll be addressing
9 in this discussion. By way of conclusion, Dr. Volz and
10 I would like to offer this information in support of
11 the panel's deliberation in relationship to charge
12 questions that addressed CASM.
13 As Dr. Irene mentioned, a primarily technical
14 challenge in evaluating the potential ecological
15 effects of atrazine lie in relating complex watershed
16 monitoring data of the kind that Dr. Harbourt just
17 described to a diverse set of ecological effects
18 measured in various laboratory experimental systems. We
19 developed an aquatic ecosystem model as an operational
20 process level-based model to perform that particular
21 integration. That aquatic systems model allows us to
22 evaluate individual time bearing exposure scenarios,
23 chemographs, if you will, and tran , translate those
24 exposures into community level effects that can enter
25 into the development of decision criteria for

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1 evaluating potential impacts of atrazine.
2 Now, the desired features of that -- of a
3 model for performing that particular purpose include,
4 from an ecological perspective, the desire to be able
5 to model a complex producer and consumer community
6 structure, although the emphasis in this project was on
7 consumers. Be able to specify population specific
8 growth characteristics of those aquatic organisms
9 independent of atrazine exposure. In other words,
10 we're looking for a model that characterizes complex
11 community dynamics in a dynamic, physical environment
12 to provide a reference simulation that we can then use
13 to evaluate the potential impacts of atrazine.
14 From the perspective of environmental
15 toxicology and atrazine in specific, we'd like to be
16 able to examine population-specific sensitivities to
17 atrazine. We'd like to be able to address the time
18 varying exposure concentrations provided in the form of
19 these complex chemographs that result from the
20 comprehensive field sampling program. And finally and
21 very importantly, we want to be able to utilize this
22 combination of ecological and toxicological attributes
23 to relate exposure scenarios to effects reported in
24 micro and mesocosm studies.
25 Very briefly, because of the nature of the

1 time constraints, we would like to discuss or describe
2 the CASM in general, the CASM Atrazine in specific.
3 And Dr. Volz will detail how the CASM Atrazine was
4 actually used to relate environmental exposure
5 scenarios to the micro/mesocosm data. Some of these
6 issues will also be further elaborated in Dr.
7 Erickson's presentation this afternoon.
8 So what is the CASM? The Comprehensive
9 Aquatic Systems Model can be best thought of as a
10 dynamic modeling platform that allows you to specify in
11 either a site-specific sense or in a generic sense,
12 food webs, aquatic food webs, relevant to the
13 particular modeling objectives that you have. The
14 production dynamics of each of those model populations
15 is characterized by well-established, bioenergetic
16 equations that have been used for a number of years in
17 ecological modeling literature. It allows you to
18 specify trophic interactions. In this case, it also
19 allows you to specify population-specific sensitivities
20 to atrazine and evaluate time-varying exposures. The
21 model outputs daily values of each of the populations;
22 we can use this information to look at probable
23 effects, risks, if you will.
24 More importantly, the emphasis in this study
25 was summarizing those

1 effects in the community level descriptor, a similarity
2 index that Dr. Volz will describe in a few minutes. In
3 addition, the model also tracks some water quality
4 parameters in relationship to the production dynamics
5 described in the model.
6 Now, there are other potential tools that
7 could possibly fulfill this service. We looked at
8 several possible alternatives within the context of
9 both the ecological and toxicological design criteria
10 that I just discussed, and in most of the cases, models
11 simply did not provide a very -- the ability to specify
12 complex producer and consumer community structures,
13 which were essential to this particular analysis to
14 take advantage of the diverse array of atrazine
15 toxicity information that we had at our disposal.
16 Now, CASM itself, I developed the model
17 originally in about 1986. It was designed originally
18 to address problems in theoretical ecology. I had then
19 -- and subsequently adapted the model to look at the
20 potential impacts of a variety of chemical stressors
21 including applications to a variety of different kinds
22 of surface waters including lakes, rivers, estuarine
23 environments. It's also been adapted by EPA in the form
24 of the LERAM Model to look at the effects of
25 chlorpyrifos in little zone enclosures.

1 There are other current CASM projects that
2 are underway for several clients primarily in the -- in
3 the public sector at this moment, looking again at
4 other chemical contaminants as well as multiple
5 stressors. So the CASM has been well-established as a
6 model that is useful in assessing ecological risk
7 caused by a variety of different kinds of stressors in
8 a variety of different kinds of aquatic ecosystems.
9 Now, we certainly understand that when you're
10 attempting to use a model within the context of
11 informing a decision-making process in a regulatory
12 environment, we want to be very sure that we have
13 methodologies in place with regard to verifying,
14 evaluating a model performance, and providing a
15 transparent process in developing a tool for relating
16 these complex exposure scenarios to ecological effects.
17 With regard to CASM in general, we provide detailed
18 files that describe each of the daily terms and each of
19 the equations for each of the model populations that
20 can be inspected by hand or in spreadsheet
21 calculations. This is used primarily in the
22 development and debugging process.
23 With regard to model evaluation, previous
24 published studies have looked at the ability of the
25 model to predict, to act, or to usefully characterize

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1 production dynamics in a variety of different kinds of
2 aquatic systems. I'll say a little bit more about this
3 in the context of the Midwestern generic stream model
4 in a few minutes.
5 With regard to transparency, we want to make
6 sure that we're not offering a black box to be used
7 unknowingly by people to make decisions about the
8 potential ecological effects of atrazine in these
9 systems. We want to open the box, as it were, we do
10 this in the context of both peer reviewed publications,
11 in fact, you could go back to those publications, get
12 the equations and build your own version of CASM if you
13 wanted to. We've made previous presentations of CASM
14 and CASM Atrazine to the agency. As I mentioned
15 earlier, the model had been adapted with my assistance
16 by EPA in the development of the LERAM model to
17 evaluate chlorpyrifos.
18 In addition, we have developed a user-
19 friendly interface and have the CASM Atrazine developed
20 as a windows application; it runs on your laptop. You
21 can perform an evaluation of a chemograph by using that
22 technology in a matter of minutes with the proper
23 instruction. And finally, as you may have garnered
24 from reading the white paper, the development and
25 application of, of CASM within the context of atrazine

1 evaluation is an ongoing activity. There are some
2 issues that remain to be resolved. When they are, when
3 the tool is finalized, the code will be made publicly
4 available.
5 Let me speak briefly now in terms of
6 developing the generic Midwestern stream version of the
7 model. I want to emphasize as strong as I possibly
8 can, this is not a site-specific model. The model is
9 not developed to tell you atrazine is having this
10 effect in your stream. Rather, the generic model was
11 designed to capture what we think are important
12 controlling factors with regard to determining the
13 production dynamics in the second and third order
14 Midwestern streams and utilize those complex
15 descriptions and their interactions to translate
16 atrazine exposures and the potential effects.
17 So I think the fairest way to describe this
18 is that the community structure, sort of identified in
19 this cartoon representation, was guided by a
20 substantial amount of data; the defining relevant
21 populations for Upper Honey Creek. We used
22 environmental data that drive the model in terms of
23 inputs of light, water temperature, dissolved
24 phosphorus, nitrogen, silica, from that system as well.
25 The bioenergetics equations themselves have the

1 advantage that you can develop parameter estimates for
2 the populations of interest primarily from the
3 technical literature, there have been an awful lot of
4 studies of basic bioenergetics of a variety of aquatic
5 plants and animals that can be used to actually then
6 describe the production dynamics of each of the model
7 populations.
8 I want to point out in this particular
9 application that we've developed a complex producer
10 community structure consisting of ten functionally and
11 taxonomically defined populations of periphytic algae,
12 similarly, ten populations of phytoplankton, and six
13 populations of macrophytes. And I want to underscore
14 that the macrophytes were added to the system not
15 necessarily because they're typical of second, third-
16 order streams, I'd agree they're probably not that
17 typical, however, we have, as an advantage,
18 environmental toxicity data for these kinds of rooted
19 aquatic plants, and that was the primary motivation for
20 incorporating these plants into the overall model
21 construct. Again, taking in the advantage that this is
22 a generic stream model, it's not meant to provide site-
23 specific forecast of atrazine effects. What it does
24 do, however, is provide a complex and diverse plant
25 community to serve as a target if you will for time-

1 bearing atrazine exposure concentrations. And that's
2 -- I wanted to underscore that point, because I know
3 it's been an issue of concern.
4 Even though we're attempting just to develop
5 a generic descriptor of
6 the kinds of production dynamics that we've seen --
7 that we believe to be important to these kinds of
8 ecosystems, we would at least like to get some sort of
9 an understanding as to whether or not the predictions
10 of that model are consistent with observations that
11 have been reported for this particular -- these kinds
12 of systems, recognizing, not attempting to define a
13 site-specific set of numbers to validate the model.
14 However, we can at least look at the results of the
15 referent simulation and compare them to values that
16 have been reported for these kind of systems. And I
17 think you will agree, and this information is provided
18 in more detail in publications reports that Dr. Volz
19 and I have added to the docket.
20 But just briefly, the model appears to
21 provide both quantitative and qualitative features that
22 are consistent with what we observe in these particular
23 kinds of systems. And, in addition, even some of the
24 water quality characteristics that are influenced by
25 the production dynamics in these systems show patterns

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1 and values that appear to be consistent with what we
2 observed.
3 Well, given a useful reference simulation for
4 generalized second and third order of streams, how do
5 we impose the effects of atrazine? Well, first of all,
6 we start with the results of the monitoring studies,
7 such as Dr. Harbourt indicated, and have various
8 alternatives to interpolate and extrapolate those
9 values to provide the 365 daily values required by
10 CASM; the CASM runs at that time scale for a single
11 year. Those values are input to the model, and as Dr.
12 Irene and others have indicated, one of the advantages
13 of atrazine is we have a substantial toxicity database.
14 The panel on the lower right-hand corner shows species
15 sensitivity distributions constructed for consumer
16 populations and primary producers. You can see on this
17 order of this log scale, however, that the relative
18 sensitivity of atrazine to consumers and producers is
19 quite divergent. And as a result, even though the
20 model tracks the production dynamic scale of consumers,
21 that has not been the focus of its utilization in this
22 particular assessment. However, we focused on
23 evaluating the implications of population variability
24 and sensitivity to atrazine.
25 So the panel I'm pointing to right now, this

1 is the same species sensitivity, and sorry, Paul, this
2 is in a bad position, I'll try not to zap you here.
3 The various colored circles then show the species
4 sensitivity distribution developed from looking at the
5 EC50 values actually mapped on to the model
6 populations. And I think you'll agree that that's
7 remarkably similar. Not surprising, because we're
8 drawing from that database to make the assignment.
9 I do want to underscore that given the
10 taxonomic and ecological functional identity of each of
11 those model plant populations, we strove to do our best
12 to map the most appropriate and corresponding toxicity
13 data. In other words, for the diatoms in the model
14 population, we used toxicity for diatoms and similarly
15 for the other taxa; the assignments were not done
16 randomly.
17 Let me show you briefly then how we would,
18 for one just example population, how we would translate
19 an exposure to a toxic effect for a single model
20 population. Let's presume right now, we're looking at
21 one of the model populations that has an EC50 of 60
22 micrograms per liter. That and any information with
23 regard to a threshold response, if you will, would be
24 used to define the population specific exposure
25 response function. There are 26, one for each model

1 population in the system. Presume now, for this
2 particular population, that we have on a particular day
3 an exposure concentration of 35 micrograms per liter.
4 According to this exposure response function, we would
5 expect to see an approximate 20 percent decrease in the
6 production dynamics, the growth rate of that particular
7 population as it's exposed to that particular
8 concentration.
9 So how do we translate that into parameters
10 that the model recognizes? Well, we essentially
11 perform -- we simulate a toxicity assay. We start with
12 an initial biomass in it, and the results are really
13 independent of the initial biomass assumption, and run
14 the model under optimal conditions for that particular
15 populations for five days. If it was a four-day test,
16 we'd run it for four days, two days, so on and so
17 forth. And understand then what the biomass would be
18 in the absence of atrazine after five days, that value
19 is at B sub T.
20 Given the exposure concentration and the dose
21 response function, we said we would anticipate a 20
22 percent decrease over that same time period. So what
23 we then do is adjust the bioenergetics parameters to
24 determine this new growth rate, R sub X, which would
25 manifest as that particular magnitude of effect over

1 that day. That adjustment to the bioenergetic
2 parameters provides what we call the toxic effects
3 factor, results in this case from decreasing the rate
4 of photosynthesis consistent with the mode of atrazine
5 -- mode of action of atrazine as described by Dr.
6 Soloman.
7 We also adjust some of the catabolic
8 bioenergetic parameters, and that is one source of the
9 conservative nature of this particular calculation.
10 Each of the pop model -- the populations then would
11 have its own toxic effects factor determined by a
12 specific exposure response function for the exposure in
13 that particular day. The toxic effects factors are
14 then recalculated daily based upon changes in exposure
15 concentration. If the next day's exposure
16 concentration were zero, the parameters would -- in
17 other words, given the reversibility of atrazine, the
18 parameters would be returned to their base
19 configuration.
20 The TEFs are then calculated for each
21 population for each day of the year based upon the
22 dynamic atrazine exposure scenario and imposed on the
23 production dynamics. Again, these populations are also
24 changing in relationship to the model physical,
25 chemical parameters. We're overlaying the effects of

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1 atrazine in the context of adjusting these bioenergetic
2 parameters and get values of biomass for each of the
3 model populations, which we can then compare to the
4 reference simulation. And in the context of the CASM
5 Atrazine, the population level effects have been
6 aggregated into an index of community similarity to
7 evaluate community level effects. And Dr. Volz will
8 now tell you more about how we use that particular
9 methodology in estimating a level of concern for
10 atrazine.
11 DR. HEERINGA: Thank you very much, Dr.
12 Bartell. I want to check with Dr. Soloman and the team
13 here. We're going to need to break for lunch and it's
14 unfortunate -- I'm quite sure there is more content
15 particularly with Dr. Hendley's presentation. I'll
16 leave it to you. I want to give the panel adequate
17 time for questions too, so it's --
18 DR. SOLOMAN: Mr. Chairman, Keith
19 Soloman here. Dr. Volz's presentation will be 15
20 minutes, and it may be appropriate to break after that,
21 because that will deal with the entire CASM Atrazine.
22 DR. HEERINGA: Okay. That's a -- I
23 accept that suggestion and also then allow fairly brief
24 questions before lunch, but we'll return to questions
25 for Dr. Bartell and Dr. Volz after lunch, just for

1 continuity, but let's proceed then with the
2 presentation.
3 DR. SOLOMAN: Thank you, Mr. Chairman.
4 I think that'll be ideal. Although we do realize we're
5 between you and lunch, which is probably a really
6 dangerous position to be.
7 DR. HEERINGA: You can see I haven't
8 missed lunch too often in my life.
9 DR. VOLZ: Thank you, Mr. Chairman, and
10 thank you, members of the panel. My name is Dave Volz.
11 I'm an environmental toxicologist with Syngenta. I
12 have expertise and interest in aquatic toxicology and
13 molecular toxicology, and I've been primarily involved
14 within the context of this project -- primarily
15 involved on the application of CASM Atrazine as well as
16 addressing some uncertainties associated with the
17 model. And so what I'd like to do is address several
18 areas that are related to the first five charge
19 questions within EPA's white paper.
20 And so what I'm going to do is first start
21 out identifying and explaining
22 the index that's used to integrate all the daily
23 biomass estimates that Dr. Bartell discussed and then
24 move in to the response of this index to varying
25 degrees of atrazine concentration and exposure

1 duration. And then we're going to look at the
2 calibration of model results to effects data within the
3 mesocosm studies that the agency introduced. And then
4 lastly, we're going to touch on an issue identified
5 within charge question number 5, and this has to do
6 with an issue that the CASM Atrazine may potentially be
7 overestimating effects of long-term low concentrations
8 and underestimating effects of high short-term
9 concentrations.
10 And so as Steve -- as Dr. Bartell discussed,
11 within CASM Atrazine, daily biomass estimates are
12 calculated for each population on each day given the
13 atrazine concentration for that specific day. And so
14 within CASM Atrazine, it was decided to use an index or
15 a similarity index or diversity index called the
16 Steinhaus Similarity Index. This index was originally
17 developed in 1947. It's been widely used in the
18 ecological literature, and it really captures
19 structural change effectively, differences and
20 similarities between two communities, which is the
21 concern for this program.
22 And so what I'd like to do is just go through
23 a few hypothetical scenarios that illustrate how this
24 does -- how this index takes into account differences
25 in biomass estimates across the population, 'cause it's

1 not entirely intuitive just looking at the equation.
2 So let's assume that we have a hypothetical
3 community consisting of
4 three populations, A, B, and C. There's a control and
5 a treatment condition, in this case, the biomass
6 estimates for each population are the same. Therefore,
7 the SSI is equal to 1, which indicates that the
8 communities are completely identical; therefore,
9 there's a zero percent SSI deviation. If we move on to
10 the second scenario, we have population A under the
11 treatment condition, say, it's extremely sensitive to
12 this treatment, and the treatment actually results in
13 elimination of the species, the SSI picks up this
14 change and therefore is expressed in this case as a 14
15 percent SSI deviation. Alternatively, in scenario 3,
16 even though the total biomass abundance between the
17 control and the treatment population do not differ in
18 this case, the SSI picks this up as a change in the
19 community structure, in this case, it's expressed as a
20 25 percent SSI deviation.
21 So the important point here is that this
22 index is highly sensitive not only to decreases in
23 biomass abundance, but also partitioning of biomass
24 across these populations. And in this study, the SSI
25 is actually calculated on a daily basis based on how

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1 CASM Atrazine estimates the biomass for each of the
2 populations. It essentially integrates all this
3 information into one index on a daily basis, and it
4 does this for both the producer and the consumer
5 communities. In this study, the producer-based SSI
6 index was chosen given the increased sensitivity of
7 producers to atrazine.
8 So next what I'd like to discuss, now that
9 the endpoint has been identified, is the response of
10 this endpoint to varying degrees of atrazine
11 concentration as well as exposure duration. In this
12 study, in order to capture the reversibility of
13 atrazine as well as potential recovery of communities,
14 it was decided that the average percent SSI deviation
15 over the entire simulated 365-day simulation within
16 CASM Atrazine was used as the endpoint. And so as you
17 can see, as you increase the exposure duration as shown
18 in the X-axis and increase the atrazine concentration
19 as indicated by each of the lines, there's an increase
20 in the response of the average percent SSI deviation
21 within the model. And this is what you would expect
22 given that atrazine's toxicity is both dependent on
23 concentration and duration.
24 So the next step was to take a set of
25 exposure profiles, concentration duration profiles,

1 from the experimental ecosystems described by the
2 agency in their discussion, and simulate those exposure
3 profiles within CASM Atrazine in order to model the
4 effects as expressed by average percent SSI deviations.
5 And then calibrate those modeled calculations back to
6 the effects data observed within these experimental
7 ecosystems.
8 And so as indicated previously, there's a
9 robust database of micro
10 and mesocosm studies that have been reviewed by Brock
11 et al. in 2000 as well as EPA, and these studies
12 consist of 77 different concentration duration profiles
13 with varying observed effects. Now, the range of
14 atrazine concentration as you can see is pretty wide
15 from 0.5 to 10,000 ppb with a range of different study
16 durations, taxa evaluated, experimental systems, as
17 well as endpoints measured. And so it's important to
18 note that when evaluating these studies, there's a wide
19 degree of experimental variation as well as study
20 quality across these studies.
21 So given that atrazine's mode of action is
22 reversible, Brock et al. developed the scoring system
23 as indicated -- discussed previously for effects on
24 primary production within these studies. And as you
25 can see, an effect score of 1 equals no effect, and it

1 goes all the way up to an effect score of 5, which is a
2 clear effect with no recovery within a study that
3 lasted more than eight weeks.
4 If you plot these studies as a function of
5 atrazine concentration as well as exposure duration, as
6 indicated before, there's generally an increase in the
7 effect scores as you increase both concentration and
8 duration. And there's an approximate discrimination
9 between the 1s and 2s, the no and slight effects versus
10 the clear effects.
11 And so each of these exposure profiles was
12 simulated within CASM. An average percent SSI
13 deviation was calculated based on the CASM simulation,
14 and then correlated back to the effect scores that were
15 assigned by Brock and EPA. As you can see, there's
16 generally a positive correlation between the average
17 percent SSI deviation, granted this is on a log scale,
18 average percent SSI deviation as well as the effect
19 score. It's not a perfect correlation, and that's
20 likely due to the wide range or wide variation of
21 experimental design within these studies as indicated
22 previously, as well as the study quality.
23 Now, given that this wasn't a positive
24 correlate -- perfect positive correlation, the agency
25 selected a level of concern based on balancing the

1 false negatives, that is, the effect scores that were
2 ranked as a clear effect but CASM predicted below the
3 line or the false positives, those which were predicted
4 at a higher SSI deviation above the level of concern,
5 but were ranked as no or slight effects. Importantly,
6 within the reports submitted to the panel, Syngenta has
7 assessed the quality of the data within these studies,
8 and it's found that there's a fairly broad range of
9 quality as well. And so using three criteria related
10 to replication, the use of statistics, or not the use
11 of statistics, as well as whether recovery was actually
12 measured in these studies, all of these studies were
13 screened using these three criteria, and note that the
14 effect scores remained the same.
15 When you do that process or that exercise,
16 among some other studies, the studies that are circled
17 in red, the false negative studies actually do not meet
18 these criteria, and the remaining false negative study,
19 if you go back and look at the study itself, look at
20 the data, it actually reported a 50 percent increase in
21 primary production relative to controls.
22 Now, one other important point to note is
23 that when you look at the gap or the range between four
24 percent and roughly ten percent SSI deviation, you can
25 see that there's not a clear or distinct delineation

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1 between the no effects, no to slight effects, as well
2 as the clear effects. So the point here is really that
3 any exceedance of the level of concern but within the
4 range of four and ten percent really should be
5 interpreted with caution given that there's not a clear
6 delineation within this range.
7 My last issue I'd like to touch on is the, is
8 what was identified in the agency's white paper
9 relative to charge question number 5, and this has to
10 do with the potential underestimation of short-term
11 higher exposure effects and overestimation of chronic
12 low-exposure effects within CASM Atrazine.
13 Now, Steve indicated within the reference
14 simulation of CASM Atrazine, which is shown here in
15 this figure, on the X-axis, you have a day, year, and
16 then biomass estimates on the Y-axis and again, this is
17 the reference or control simulation within the model.
18 And as Steve indicated, even though macrophytes are not
19 generally representative of second and third order
20 streams, they were included within the model to utilize
21 the extensive atrazine specific toxicity database.
22 However, given the environmental input
23 derived from a second to third order stream within the
24 model, it was necessary to artificially set the initial
25 biomass on January 1st for the macrophytes at an

1 artificially high level in order to include these
2 populations within the model.
3 However, it should be emphasized that given
4 the original design criteria at the start of this
5 project, the exposures were focused on starting in
6 around day 1 of 5 or roughly, April 15th. So this
7 artifact in the earlier part of the year did not
8 present an issue given the original design criteria.
9 However, in EPA's analysis of the model, there were
10 exposures that were started prior to this April 15th
11 start date, and that's when these issues came up.
12 So it's important to note that to look at the
13 potential effects of this artifact or the exposure
14 start date on the model of the exposures at the level
15 of the end point or index of the interest, in this
16 case, the average percent SSI deviation.
17 So within CASM Atrazine, using the EPA --
18 using the base model formulation that EPA describes in
19 the white paper, there are a couple of different
20 simulations that were tested or assumptions that we're
21 testing. On the X-axis, you can see that there's a
22 wide range of atrazine concentrations from 0.5 to a
23 thousand ppb, and basically, using the base model
24 within EPA's white paper, the response of the model,
25 assuming a 260-day exposure, was assessed at either

1 starting the exposure date on day 1 or day 105. And as
2 you can see, the exposures that start on day 1 are
3 consistently higher -- predict consistently higher
4 percent SSI deviations than those that started on day
5 105. And we believe this is partially due to this
6 artifact of the macrophyte population in the earlier
7 part of the year.
8 However, another issue that may be resulting
9 in these potential underestimation of low or
10 underestimation of higher short-term concentrations and
11 underestimation -- and overestimation of lower long-
12 term concentrations has to do with the dose response
13 assumptions within CASM Atrazine. So what I'm going
to
14 do by way of illustration with one population in the
15 model is just to present two different approaches that
16 are currently within CASM Atrazine for calculating dose
17 responses and how these two approaches differ and what
18 the implications are.
19 And so if we look at population number 12, in
20 this case, which has a EC50 of 69 and look at the two
21 different approaches within CASM Atrazine to calculate
22 dose response assumptions, the first approach involves
23 taking an EC50, assuming a constant slope and
24 corresponding intercept and then calculating the
25 response of that population at the various atrazine

1 concentrations. Now, this is the approach that is
2 presented within EPA's white paper. However, an
3 additional approach or an alternative approach is by
4 taking the same EC50 and using a no-effect threshold
5 reported in the literature and then fitting the dose-
6 response curve based on those two estimates.
7 Now, as you can see, the two approaches do
8 differ in the steepness or flatness of the dose-
9 response curve and clearly, the two approaches differ
10 in terms of the response expected below the EC50 and
11 above the EC50. If we look at the first approach with
12 the black dotted -- or the black dots, which assumes an
13 EC50 in constant slope, below the EC50, this approach
14 is likely to be higher; it will be higher than the
15 alternative approach. However, if you go above the
16 EC50, the approach that uses the EC50 in slope tends to
17 be lower than the alternative approach, which uses the
18 EC50 in NOAC.
19 Now this, even though we're illustrating this
20 with one of the populations within the model, this is a
21 consistent trend that's been observed with all of the
22 populations. Now, the next important question is to
23 determine how this impacts -- what impacts this has at
24 the index or endpoint that we're interested in, again,
25 the average percent SSI deviation. And this figure

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1 simply shows that if you test from 0.5 all the way up
2 to a thousand ppb, comparing the two different methods,
3 that the method that uses the EC50 plus the NOAC tends
4 to generate higher SSI deviations within the range of
5 approximately 25 to 400 ppb and then -- and this is
6 again -- this is a three-day, a short-term, exposure
7 with the assumption that it started on day 105.
8 Alternatively, if we're looking at long-term
9 lower concentrations, there is another -- there are
10 differences between the two approaches. In this case,
11 we simulated between 0.5 and a thousand ppb, assuming a
12 365-day exposure. And what you can see is that
13 comparing the two, two different approaches, the
14 approach that relies on the EC50 plus the slope, the
15 approach presented within EPA's white paper tends to be
16 higher than the other approach which uses the EC50 plus
17 the NOAC within the range of approximately 150 ppb for
18 a 365-day exposure.
19 Now importantly, again, EPA addressed this
20 issue about these longer low concentration effects that
21 are being potentially overestimated within CASM
22 Atrazine. It's important to note that there are
23 numbers of meso and microcosm studies that did test the
24 atrazine below 10 ppb and generally found that there
25 was no to slight effects at concentrations less than 10

1 ppb. Now, granted there is a varying degree of
2 exposure durations, none of which are 365 days, but it
3 suggests that contrary to what the model is predicting,
4 we do not observe long-term low concentration effects
5 within the experimental studies, and this is consistent
6 with the conclusions by EPA in their 2003 IRED.
7 So in conclusion, CASM Atrazine is a
8 realistic model of a generic midwestern stream. It's
9 conservative by design. It can be calibrated to
10 ecological effects of atrazine measured in experimental
11 systems. It's an effective tool or model for
12 evaluating or integrating or interpreting time varying
13 exposure data from midwestern corn watershed
monitoring
14 programs. And lastly, more specific to charge question
15 5, the SSI deviations are sensitive to assumptions
16 about the initial day of exposure as well as population
17 specific dose response relationships. Thank you.
18 DR. HEERINGA: Thank you very much, Dr.
19 Volz. And again, I'd like to thank both Dr. Bartell
20 and Dr. Volz for their presentations. I think because
21 of -- this is important in terms of the panel's
22 understanding, we have background materials, but I
23 think it's good to hear it in this format. And I
24 apologize that the lunch break interrupts things, but
25 what I think we can do is I'd like to hold questions

1 until after the lunch break. We'll return to your
2 questions, and then Dr. Soloman to Dr. Hendley's
3 presentation will carry out. But before we do that,
4 there's one minor thing if you'd -- I beg your
5 permission -- is Dr. Dee Ann Staats, we have one short
6 public comment. Can we try to get this in for -- we
7 kind of indicated to Dr. Staats that it would occur
8 this morning. And if you wouldn't mind, Dr. Soloman,
9 just a --
10 DR. SOLOMAN: No, we can do it.
11 DR. HEERINGA: This is Dr. Dee Ann
12 Staats, who is the environmental science policy leader
13 with CropLife America, and she had registered for a
14 short comment.
15 DR. STAATS: Thank you so much for
16 letting me go ahead. I
17 just have a brief statement to read. I'm commenting
18 today on behalf of CropLife America, which is a non-
19 profit -- not-for-profit organization representing the
20 nation's developers, manufacturers, formulators, and
21 distributors of plant science solutions for agriculture
22 and pest management in the United States. Our member
23 companies produce, sell, and distribute virtually all
24 the crop protection technology products used by
25 American farmers. CropLife America comments on
issues

1 that have broad regulatory implications, which
2 sometimes occur in the context of chemical-specific or
3 product-specific regulatory reviews, decisions, and
4 actions.
5 In October of 2003 as you're aware, the
6 atrazine IRED -- in the atrazine IRED, EPA required the
7 registrant to conduct a watershed monitoring program to
8 confirm the agency's conclusion that use of atrazine is
9 not likely to result in unreasonable adverse effects to
10 freshwater aquatic ecosystems. CLA commends EPA for
11 achieving this goal and on the design of this
12 innovative extensive and intensive watershed-monitoring
13 program. Because this program may serve as a template
14 for future studies on other crop protection products,
15 CLA encourages the agency to carefully consider not
16 only triggers for monitoring, but milestones or
17 triggers to reduce, suspend, or end monitoring once the
18 conclusion is reached.
19 This extensive program shows that atrazine
20 had little to no effect on these watersheds, which were
21 chosen to represent those that are potentially most
22 vulnerable i.e., a worst case scenario. Therefore,
23 additional monitoring is unnecessary, and will set a
24 precedent of undue burden on the registrants for future
25 such studies. Furthermore, the data generated in this

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1 study has allowed for the magnitude and duration of
2 exposure to aquatic plants to be determined and used to
3 develop a level of concern. These monitoring data,
4 generated under good laboratory practice standards used
5 in conjunction with other extensive monitoring data and
6 surveys, should now be utilized by EPA's OPP and OW to
7 develop triggers for aquatic life criteria based on
8 rolling averages.
9 CLA encourages EPA to move forward with this
10 effort and to consider this methodology in the future
11 for the development of aquatic life criteria for other
12 crop protection products. Thank you for your patience
13 in allowing me to speak.
14 DR. HEERINGA: Thank you very much, Dr.
15 Staats. Any questions or comments for Dr. Staats from
16 panel members regarding her presentation? A copy of
17 Dr. Staats' comments is available to the panel, will be
18 in the docket, as well. Thank you very much.
19 DR. STAATS: Thank you.
20 DR. HEERINGA: And also again, thank you
21 to Dr. Soloman and the Syngenta team for allowing us to
22 accommodate Dr. Staats. The agenda, as we've always
23 said with the science advisory panel, is a floating
24 agenda. We have enough experience. I expect that we
25 will return after lunch for probably at least another

1 hour in terms of presentations and questions and
2 discussions 'cause we'll, I think we'll have a
3 substantial amount of questions on the last two
4 presentations.
5 We'll probably be about, at the conclusion of
6 the public comment period, about an hour and 15 minutes
7 delayed on our agenda. I'm not concerned about that.
8 We will, I think, easily make that up, and this is
9 important to get this in, but just for Dr. Erickson and
10 others who are preparing for this afternoon, I think,
11 we probably will be again about an hour-and-a-half slow
12 but catching up for the balance of the afternoon and
13 tomorrow afternoon. So at this point, I'd like to call
14 a lunch break, and my colleagues have informed me that
15 my watch is off relative to the satellite's signals or
16 the -- at least the transmissions on their telephones,
17 so I'm showing 12:25 right now, and let's plan to
18 reconvene here at 15 minutes of 2. So we'll have a
19 little over an hour and 10 minutes, 12:35, excuse me.
20 SPEAKER: By your order.
21 DR. HEERINGA: That was just a slip. My
22 watch isn't that bad. So we'll -- in any case, we'll
23 reconvene here at 15 minutes of 2.
24 Panel members, I think the room should be
25 secure over the lunch break, if you want to leave your

1 -- if you have laptops or other equipment set up, but
2 again, feel free to make your own choice.
3 (WHEREUPON, a lunch break was taken.)
4 DR. HEERINGA: We're still waiting on a
5 few panel members, so we'll give them a minute or two.
6 Good afternoon everyone, and welcome back
7 again to the afternoon session of our FIFRA Science
8 Advisory Panel meeting on the topic of the
9 Interpretation of the Ecological Significance of
10 Atrazine Streamwater Concentrations Using a
11 Statistically Designed Monitoring Program.
12 We are in the midst of our public comment
13 period, and with a slight deviation to allow Dr. Staats
14 to make her presentation prior to lunch. We are
15 hearing a series of presentations and discussions from
16 the team from Syngenta and we have, just prior to
17 lunch, finished up presentations -- a combined
18 presentation by Dr. David Volz and also Dr. Steve
19 Bartell. And at this point, what I'd like to do for
20 panel members with regard to either the CASM model for
21 Dr. Bartell, or the estimation procedures, calibration
22 procedures, for Dr. Volz or both; any questions from
23 panel members, questions of clarification?
24 Dr. Ellsworth and then Dr. Chu.
25 DR. ELLSWORTH: Yeah. A question for

1 Dr. Bartell. What I'm -- my question here, I guess,
2 suppose that I want to give a little analogy. Okay?
3 It's the skill issue in the model, so the model uses
4 daily time steps with daily DIN, Dissolved Inorganic
5 Nitrogen, you know, you developed it. So it has a
6 skill implicit in that assumption of a daily process,
7 and it uses nonlinear relationships to derive the
8 dependence on temperature, et cetera.
9 My question is: When you take something
10 like that to a highly variable system in terms of
11 nutrients like temperature fluctuating, how does the
12 aggregate process that results; how it is represented
13 in CASM using these lumped parameters, I guess, that's
14 essential to -- you know, I'm thinking in terms of
15 chemistry like an absorption experiment where you have
16 absorption of a pesticide onto clay. You use maybe a
17 Freundlich equation. Okay.
18 Let's say you have a hundred grams of soil
19 and each gram has a different Freundlich parameter.
20 The lumped system, if they're log normally distributed
21 is a Lamer equation. Okay. And in the same sense,
22 here, I'm struggling mentally, 'cause I'm not an expert
23 on this model, in terms of the skill issues related to
24 trying to model these streams with this approach, would
25 you address that a little bit?

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1 DR. BARTELL: Yes. With regard to the
2 first set of questions you asked about the nonlinear
3 responses of the model production dynamics to changes
4 in the physical chemical environment. It's a little
5 bit simpler in that each of the parameters, for
6 example, concentrations of DIN, DIP, silica, if it
7 happens to be a diatom are -- all define a growth
8 multiplier, which ranges between zero and one, one
9 being for optimal conditions defined by the Michaelis-
10 Menten parameter for the particular population based
11 upon literature and so on.
12 We define those growth modifiers for each of
13 the potentially limiting factors influencing
14 photosynthesis in this case, and then following a
15 Liebig approach, it's the minimum value of those that's
16 applied to the overall growth rate.
17 So it's -- while the relationships of the
18 environmental parameters are nonlinear, it's a fairly
19 simple mathematical formulation. And the second,
20 again, all CASM is attempting to do is to look
21 essentially at what's happening between a generic
22 square meter of water column in this second, third
23 order generalized midwestern stream with fluctuating
24 water levels and fluctuating dynamic physical, chemical
25 parameters to try and capture some of the basic

1 features, in terms of the production dynamics of these
2 kinds of system which I think I, you know, demonstrated
3 in results of model data comparison. So does that
4 answer your question?
5 DR. ELLSWORTH: Yeah. I'm just
6 concerned, I guess, a little bit about fluctuations in
7 the real world system. The mesocosm experiments are
8 all constant --
9 DR. BARTELL: Sure.
10 DR. ELLSWORTH: -- in nutrient
11 inputs --
12 DR. BARTELL: Sure.
13 DR. ELLSWORTH: -- fix concentration,
14 and yet in the real world, I've got all these
15 fluctuating dynamics, and I'm trying to use this kind
16 of lumped parameter that was estimated for this
17 constant system and extrapolated. I'm --
18 DR. BARTELL: Okay. Let me see --
19 DR. ELLSWORTH: -- struggling with that.
20 DR. BARTELL: Let me see if I can tackle
21 it from a slightly different direction. We developed
22 the CASM Atrazine as a complex ecological integrator
23 between atrazine exposure and a community-level
24 endpoint measured as a deviation in the Steinhaus
25 Similarity Index. So the bridge, if you will, between

1 the exposure concentrations and the microcosms is
2 taking a chemograph from the field, calculating its
3 associated average deviation in SSI, taking the
4 somewhat simpler exposure scenarios from all of the
5 CASM studies, calculating their corresponding SSIs and
6 then seeing how -- if this chemograph were a CASM
7 experiment, how would it plot on those Brock scores,
8 given that we've got a much more dynamic time-bearing
9 exposure than we did at the -- with the CASMs but -- so
10 it's essentially allowing us to interpret the field
11 measurements as another CASM experiment. That's all
12 we're doing.
13 DR. ELLSWORTH: Okay. One last question
14 and I'll quit. Do you have any CASM experiments where
15 you actually have fluctuations and then you try to --
16 DR. BARTELL: I'll let Dr. Volz
17 DR. ELLSWORTH: Okay.
18 DR. VOLZ: This is David Volz. No,
19 they're, not to my knowledge. They're not. It's
20 usually either a single pulse, or if it's an artificial
21 stream, for example, it would be a constant exposure as
22 well.
23 DR. ELLSWORTH: Okay.
24 DR. CHU: Actually, just to follow this
25 question. In addition to variations within time,

1 actually, in counting naturally, how did you consider
2 spatial variations; is that because we are looking at a
3 stream? Now, that means the, you simulate enough
4 dynamics. That means, in such a way, I'm not changing
5 time. In -- for input of data, for example, a
6 chemograph, some of the nutrient are kind of --
7 nutrient of concentrations, if we looked at a stream,
8 how did you consider the spatial variations, for
9 example, upstream, downstream?
10 DR. BARTELL: Yes. Steve Bartell again.
11 The model just addresses a small segment of the stream,
12 which is assumed to be homogenous. Okay. While it's
13 dynamic in time, it essentially represents -- it
14 doesn't consider upstream, downstream, spatial
15 variability.
16 DR. CHU: Okay. Another question about
17 the calibration, actually. CASM Atrazine is a process
18 based model, and that means that there are many, many
19 parameters in order to quantify these processes. I'm
20 wondering how these parameters were selected in the
21 modeling.
22 DR. BARTELL: Yeah. The parameter
23 estimates that define the basic bioenergetics for the
24 processes that determine growth both for the plant
25 populations and the consumer populations were taken

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1 from relevant studies from the technical literature. A
2 good example of some of the previous descriptions of
3 sources of those parameters would be in our publication
4 wherein we apply the model to various Canadian surface
5 waters. I can't remember the exact table number in
6 there which lists model parameters, but it gives a
7 whole list of references of where those values come
8 from. And the derivation of the CASM Atrazine was
9 essentially -- because it was a generic application,
10 we're sort of an amalgamation of parameter values that
11 I thought to be relevant from those different streams,
12 adjusted slightly to allow us to incorporate
13 macrophytes into the system.
14 DR. CHU: Actually, we have many
15 simulations for mesocosm studies and also from a rare
16 selected assistance, that means many parameters are
17 seen for -- in all simulations; right?
18 DR. BARTELL: Yes. It can be.
19 DR. CHU: Okay. Thank you.
20 DR. HEERINGA: Bob Gilliom.
21 MR. GILLIOM: Bob Gilliom, USGS. I
22 guess, since it's such an underpinning, the use of the
23 CASM model and then the similarity index and
24 deviations. The question I found myself keep coming
25 back to is, is not having a sense of field validation

1 at all. The whole structure is built up from fitting
2 to the mesocosm/microcosm studies, and both with the
3 model itself and with getting a benchmark in my own
4 mind of what deviation from the index means in terms of
5 actual impact on a real system, I got to say I have
6 like no sense of bearing on this. I see no field
7 validation of the model performance itself except to
8 lab studies, and then I don't have any sense at all of
9 how the SI deviation parameter matches with what I
10 expect impact to be on a real stream system. So --
11 DR. VOLZ: Dave Volz here. Actually, if
12 you look in the -- it's kind of interesting if you look
13 in the literature as to studies that have used the SSIs
14 as an endpoint. There's a lot of variability into
15 what's considered significant or what isn't. And that
16 really comes back to the variability within the two
17 populations of comparison and of course the sample
18 size, et cetera.
19 So it's really determined largely by the
20 experimental design undertaken within these studies.
21 But clearly, you know, in the case of this study the --
22 it should be emphasized that the LOC is really highly
23 dependent, critically dependent, on the calibration to
24 those mesocosm studies. And so it's not to -- it
25 really -- therefore, it really only has meaning within

1 the context of those studies. And you shouldn't
2 necessarily say that you would expect to find, let's
3 say, a four percent deviation or a five percent
4 deviation out in the field, because that LOC really
5 provides a reference value for assessing the different
6 exposure time series. But relative to a control, it is
7 a small deviation.
8 MR. GILLIOM: Okay. To follow up on
9 that. The reference condition for the deviation is the
10 dataset from that one site in Ohio; right?
11 DR. VOLZ: Uh-huh. (Indicating
12 affirmatively.)
13 MR. GILLIOM: So -- no? I mean, 'cause
14 wouldn't you get a, I mean, conceivably you could
15 have different reference conditions geographically, but
16 you have one. That's kind of one part of the question
17 is. And then just one little related thing, I think,
18 and then I'll -- in -- even in one of your examples
19 that you showed the calculations of the index, it was
20 one in which a minor species zeroed out caused less of
21 a change in the deviation index than kind of a major
22 flux in the mass differences in two major species. So
23 if the sense -- that's what I mean by the relation
24 between the deviations from the SI and what you really
25 are, are seeing in the effect on the system. So with

1 that, they're kind of related.
2 DR. VOLZ: Yeah. Yeah. No. It's a
3 very good question. This is Dave Volz, again. And
4 we've been, obviously, thinking about this quite a bit.
5 The unique thing, I think, about the study is that by
6 having just that one reference simulation that's fixed,
7 it allows you to evaluate these time-bearing
8 chemographs in relation to that simulation. However,
9 since you are using an SSI that is dependent on
10 comparing the similarity between two communities, you
11 essentially, inevitably have to develop separate LOCs
12 depending on which community you're looking at. Say
13 for example, if you're looking at a community that was
14 specific for another -- a different site, there would
15 be an LOC that would be calculated for that reference
16 simulation, for that reference condition.
17 DR. BARTELL: Steve Bartell, if I might
18 just follow up in that -- along that same line of
19 thought. It's been a very difficult conceptual hurdle
20 to overcome in the, you know, application and
21 explanation of this overall methodology because the --
22 your first inclination is to say okay, if you have a
23 level of concern of 4 percent average deviation that,
24 you know, gee, I expect to see a 4 percent deviation in
25 my stream if I had a particular kind of chemical

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1 exposure, and that's exactly not what we're saying. As
2 Dave mentioned, the 4 percent only has meaning in
3 context within the calibration to the CASM studies.
4 DR. VOLZ: Okay.
5 DR. BARTELL: Do a simple thought --
6 well, this is more than a thought experiment. We've
7 looked at the implications of variability associated
8 with the toxicity data for example, use the tenth
9 percentile estimates of the EC50 instead of the
10 geometric mean, you just shifted all the populations to
11 make them more sensitive. Now, you have a greater
12 average deviation that provides that discrimination
13 between the Brock 1 and 2s and the 3s and 5s, so the
14 LOC associated with that might be ten, 12 percent. But
15 it only has meaning within the context of that
16 calibration. It's not to say, we'd expect to see a
17 ten, 12 percent impact on the stream in the field.
18 DR. HEERINGA: Dr. Grue.
19 DR. GRUE: Chris Grue, University of
20 Washington. Following up on Robert's comment, I was
21 interested in seeing in the one slide, I think, it's
22 slide 64, that the change in the index was less when
23 the species dropped out versus an apparent shift in the
24 biomass among, say -- and I think it was only two
25 species. Does that make sense?

1 DR. VOLZ: This is Dave Volz. Those are
2 hypothetical scenarios -- those are all made-up values.
3 But actually, those are not real data, but were simply
4 to illustrate how the SSI could deviate under different
5 types of conditions.
6 DR. GRUE: Okay.
7 DR. VOLZ: I apologize for the
8 confusion.
9 DR. BARTELL: And again, Steve Bartell,
10 if I may follow up. It is somewhat the nature of these
11 kinds of similarity indices whether you look at
12 Steinhaus or some of the other ones that are utilized
13 that if you're trying to capture changes in species
14 richness as well as equitability and distribution in a
15 single number, all these indices have their strengths
16 and weaknesses associated with that. For example, if
17 you just keep upping the number of species, you lop one
18 out 100 percent, you're going to have less of an impact
19 on the overall SSI than if you had, say, two species,
20 and you lost one. So it's somewhat just an issue
21 associated with trying to capture those dynamics within
22 a single number; that's your risk assessment endpoint.
23 DR. HEERINGA: Other questions on this
24 parti -- yes, Jim Fairchild.
25 MR. FAIRCHILD: Jim Fairchild. One of

1 your examples, you showed, theoretically, a shift of a
2 4 percent SSI and, say, theoretical plant community. It
3 may not be the objective of this particular panel, but
4 have you modeled the effect at a next higher consumer
5 level of what that biomass or SSI change might mean?
6 DR. VOLZ: This is Dave Volz. As a
7 clarification, within the context of the mesocosm
8 studies?
9 MR. FAIRCHILD: Of the model?
10 DR. VOLZ: Yeah, there are daily SSIs
11 for the consumer community are calculated, and
12 actually, one of the outputs is an average percent SSI
13 deviation for the consumer community. But given the
14 higher sensitivity of the plant community, the agency
15 chose to use that as the endpoint, the producer-based
16 community.
17 DR. HEERINGA: Yes, Dr. Effland
18 DR. EFFLAND: Bill Effland, USDA-NRCS.
19 I'm sorry. I may have missed this 'cause I was a
20 little late coming back from lunch, but you mentioned
21 something about corrections, you're going, you're going
22 to make some additional changes to CASM Atrazine; is
23 that, is that correct?
24 DR. BARTELL: Steve Bartell. Yes, in
25 our interactions with the agency in developing and

1 evaluating the model, there are still some outstanding
2 issues to be addressed, namely, as Dr. Volz discussed
3 towards the end of the presentation, assumptions
4 concerning the specification of the exposure response
5 functions and a few other issues, which I believe Dr.
6 Erickson will address in -- not to pass the buck to
7 him, but, I think, he will address some of those
8 outstanding issues.
9 DR. EFFLAND: Is there anything else?
10 DR. BARTELL: There's -- there, there've
11 been some discussions about overestimating the way the
12 toxic effects factors might be calculated. I think
13 that's the -- well, the other issue then has to do with
14 the application of the model to exposure scenarios that
15 begin very earlier in the year. The original design
16 criteria for the model specified midwestern corn
17 applications with day of initial exposure to be around
18 April 15th.
19 DR. EFFLAND: Okay then. I know it says
20 in one of your slides that, at some point, this model
21 will become publicly available; is there a time frame
22 for that, or is that, I think, upon finalization or
23 whatever?
24 DR. BARTELL: Yes, Steve Bartell again.
25 It just depends when these remaining issues are worked

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1 out and addressing some other questions. I honestly
2 don't know what the ti -- final time frame for that is.
3 DR. EFFLAND: Okay. And then an
4 additional question somewhat related to that: This is
5 CASM Atrazine midwestern streams, second to third
6 order; is that correct? How about other, other areas,
7 let's say, if we were going to use it in -- I don't
8 know. Let's say we're going to use it in the southeast
9 United States; does it have to go through a whole
10 series of refinements and changes?
11 DR. BARTELL: Steve Bartell again. It
12 depends if you want the long or the short answer to
13 that question. That's one of the issues that remains
14 to be resolved if the agency would like to have a
15 single model that's generally applicable to other
16 surface waters for evaluating atrazine exposures, then
17 there may need to be some refinements to the model
18 because it was originally designed for that midwestern
19 corn application. Alternatively, there have been
20 discussions of developing companion CASMs, if you
were,
21 for exposures for Florida sugarcane, midwestern
22 reservoirs, other aquatic systems. That has not been
23 finalized.
24 DR. HEERINGA: Dr. Young. Oh, I'm
25 sorry.

1 DR. EFFLAND: Sorry. Just one more
2 question. And you may have answered this, and I just
3 missed it because I was a little late. Were your model
4 -- there's been a lot of discussion about turbidity in
5 streams, how does your model handle turbidity; is that
6 a part of the system?
7 DR. BARTELL: No, not directly. And
8 that's one of the reasons why we feel atrazine is a
9 conservative assessor of -- I mean, why the model's a
10 conservative assessment of atrazine effects. We didn't
11 want to have a situation where production dynamics were
12 overwhelmed by inputs of total suspended solids. So in
13 fact, we just look at the toxicological implications of
14 atrazine exposure directly.
15 DR. EFFLAND: Okay. Thank you.
16 DR. HEERINGA: Thanks, Dr. Effland.
17 Dr. Young. And we need a microphone for her. I think
18 we're one microphone short.
19 DR. YOUNG: Linda Young. I just --
20 following up on several questions, I just want to be
21 sure that I truly understand. The CASM has been
22 somewhat calibrated for Ohio, but no other part, ground
23 truthing, within the midwest; is that right? So
24 nothing in Nebraska or Missouri or Indiana or any of
25 the other states?

1 DR. BARTELL: As I mentioned this
2 morning, it's, you know, given that you're trying to
3 develop a generic stream model, we've made comparisons
4 and actually, the information I presented was from a
5 variety of different streams throughout the midwest.
6 In terms of comparing its production dynamics with
7 values that have been reported, in fact, has not been
8 calibrated to that Ohio stream. We just used
9 information reported for that stream to get an idea of
10 what would be relevant plant and consumer populations,
11 what are some reasonable seasonal inputs of some of the
12 environmental deriving variables just because it was a
13 convenient source to get them. But we've actually,
14 when we can -- when we -- as we're collecting
15 information, we're trying to sort of ground truth it
16 more generically within the context of midwestern
17 streams.
18 DR. YOUNG: So when you ground truth it
19 generically, you're trying to hit some kind of an
20 average?
21 DR. BARTELL: Well, you'd certainly want
22 to -- Steve Bartell again, I'm sorry. I keep
23 forgetting to do that. You certainly want to
24 understand whether or not the model structure, the
25 environmental inputs, the underlying bioenergetics

1 parameters, initial biomass values when you launch
2 that, does it provide you with some time-bearing
3 biomass estimates that are within the realm of values
4 that are measured for these systems? Are you ten
5 orders of magnitude high, ten orders low? Are you sort
6 of within the range? Given that, what we want to have
7 is a tool to make the integration from our exposure
8 scenarios' potential effects is a tool that has those
9 ecological features that we know to be important in
10 determining the production dynamics within the systems
11 but without trying to map onto an individual system.
12 CASM Atrazine does not map to a specific location on
13 the ground. We feel it maps reasonably well into the
14 Midwest.
15 DR. YOUNG: Okay. Now, I gathered that
16 it was not to a site specific, but it doesn't -- at the
17 same time, it doesn't capture any variation across the
18 Midwest; right? Or from the lower to the upper part of
19 the reaches?
20 DR. BARTELL: No. The --
21 DR. YOUNG: It's a completely
22 deterministic and you're trying to hit some average
23 thing that's okay overall?
24 DR. BARTELL: Yes. The current
25 reference simulation is deterministic.

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1 DR. HEERINGA: Dr. La Point.
2 DR. LA POINT: Steve, or Dr. Bartell,
3 excuse me, leads to a question that I have and it also
4 is off to one of them, general applicability of CASM,
5 excuse me. And what I was wondering about even as I
6 was reading this over the weekend too, if macrophytes
7 are included, given the response time and the
8 differences in generation time relative to periphyton
9 living on those macrophytes say, relative to the
10 exposure duration for atrazine in the area, how are the
11 different biotic components, periphyton versus
12 macrophytes, how are they weighted in this, or are they
13 weighted, are they treated equally in terms of the
14 percent carbon production?
15 DR. BARTELL: Yes. Steve Bartell.
16 Yeah, they're weighted equally. You're essentially
17 just looking at the difference in production dynamics,
18 recognizing that, you know, the photosynthetic rates
19 and growth rates of macrophytes are low compared to the
20 algae in the system. So depending upon the timing and
21 the duration of the exposure, there's a potential for
22 those different plant guilds to weigh in more or less.
23 Clearly, if you're looking at long-term
24 exposures, it gives the macrophytes a little bit more
25 chance to respond to the exposure if it's sufficiently

1 high. If you're looking at shorter-term exposures then
2 perhaps the deviations you're seeing in the similarity
3 index would derive more from changes in the periphyton.
4 DR. LA POINT: And if I may, this little
5 point again, does it -- I guess, not concerned, I just
6 question. Does having macrophytes in there kind of
7 average out and ameliorate the response of the
8 periphyton to a given exposure? I guess that's what
9 I'm saying. Is it sensitive to see the differences in
10 the two?
11 DR. BARTELL: Steve Bartell again. I
12 think having, you know, the macrophytes in the system
13 might -- I'm not sure what the correct word is to use
14 -- might result in impacts on the periphyton community
15 to be somewhat less apparent in the overall
16 characterization of the SSI. That's right. I think
17 that's probably a fair statement. It depends upon the
18 time of the year, because some times of the year,
19 periphyton dominate, other times macrophytes are more
20 abundant. And so that would flip flop, you know, so
21 it's kind of hard to answer that question.
22 DR. HEERINGA: Yes, Dr. Gay.
23 DR. GAY: Paige Gay, University of
24 Georgia. In looking through the CASM studies in the
25 paper that we were given, the low flow, I didn't really

1 see jumping out at me. There were some stagnant --
2 studies listed as stagnant. Can you talk about the
3 differences there relating to the low flow streams; do
4 you think it captured that?
5 DR. BARTELL: I'll defer to Dr. Volz.
6 DR. VOLZ: This is Dave Volz. No. I
7 don't think any of the mesocosm studies would
8 necessarily capture an intermittent stream if that's
9 what you're getting at. I mean, most of them are
10 either static pond enclosures, or if it's a microcosm
11 study, it will be obvious, you know, typically within a
12 land or continuous flowing artificial streams.
13 DR. GAY: Even the Missouri site that
14 had the really high concentrations with the low flow,
15 so in the laboratory studies with the -- some of them
16 had flowing studies or re-circulating versus stagnant.
17 So do you think that that was incorporated into there,
18 different like in the re-circulation, different flow
19 rates over circulation or anything to do with varying
20 flows?
21 DR. VOLZ: This is Dave Volz. Let me
22 make sure I'm clear with your question. Are you asking
23 that within the micro and mesocosm studies whether the
24 flow was varied to represent particularly, potentially
25 flashy-type streams? No, not, not from. No, the

1 answer is no. I mean, most of them are constant
2 exposure without necessarily varying flow if it is an
3 artificial stream.
4 DR. GAY: Thank you.
5 DR. VOLZ: To my knowledge.
6 DR. HEERINGA: At this point, I think I
7 would like to move on to the final presentation or the
8 next presentation. I guess, I don't want to say it's
9 final. Dr. Soloman?
10 DR. SOLOMAN: Mr. Chairman, thank you.
11 I would pass the podium to Dr. Paul Hendley.
12 DR. HENDLEY: Okay. Thank you, Dr.
13 Soloman. Thank you, Mr. Chairman and panel members. My
14 name is Paul Hendley. I started working on the
15 environmental fate of agri-chemicals about 32 years
16 ago. About 20 years ago, I actually did my first field
17 runoff study, and there were a few sites, and I
18 thought, wow, this is a big deal. I never realized I'd
19 be working on a study of the magnitude, the enormous
20 magnitude of the study we're working on now. And my
21 job is to keep everybody awake after lunch, but it's
22 also to tell you about some of the exciting science
23 we've been doing in this program. It will be
24 highlights of the enormous amount of work, but first, I
25 have to just make a clarification on the answer I gave

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1 to Dr. Schlenk earlier, if I may, Mr. Chairman?
2 DR. HEERINGA: You sure may. Yes.
3 DR. HENDLEY: Okay. You asked about the
4 number of -- or how we -- how many columns we used for
5 trapping the analytes in one of the methods, I believe.
6 DR. SCHLENK: Oh, actually no. I think
7 that was somebody else's question. I think it was --
8 DR. HENDLEY: Dr. Novak?
9 DR. SCHLENK: -- Dr. Novak's question.
10 DR. HENDLEY: Okay. I apologize. And
11 for atrazine alone, the reverse phase column is fine.
12 But in fact in the method, as published, that we're
13 using, there are two columns. The other one is a
14 cation exchange column for one of the degradates, and
15 the other piece of information, and it can be submitted
16 to the panel through the normal processes, is the LC
17 mass spec/mass spec methodology. It's actually
18 published, and that publication will be made available.
19 And we're also hoping to get some -- whether, it would
20 probably be later in the week, a comparison of some of
21 the analytical data from the GC mass spec and the
22 immunoassay.
23 DR. NOVAK: Dr. Hendley, generally in my
24 career, if I am using one method for an investigation,
25 if I change a detection or another instrument, a

1 reviewer will come up with a whole bunch of questions
2 as, can you marry the two data. So we will, and myself
3 included, I like the concept of screening your data
4 with immunoassay and then running GC/MS or LC/MS, but
5 what I was concerned about is why did you switch to the
6 last part of the study to be reliant on LC-MS/MS. And
7 if I may finish, do you feel that you can compare those
8 data?
9 DR. HENDLEY: Dr. Hendley again. The
10 first question is why did we switch, convenience and
11 quality. The quality of the results coming from the
12 LC-MS/MS method and the analytes included and the fact
13 we could do more samples faster, was a key reason, and
14 all of our methods have to go through validation and
15 then submitted to the agency.
16 So I'm absolutely confident that the results
17 from the LC-MS/MS are not only comparable, but also
18 actually better to the GC mass spec, because without an
19 extraction set, you've taken out a source of
20 uncertainty and variability in the process. The
21 recoveries are typically over 90 percent, and they're
22 much tighter than any procedure that involves a second
23 set of operations in the laboratory. Does that address
24 the question?
25 DR. NOVAK: It sounds like you're very

1 satisfied with LC/MS, but then you knew -- you said it
2 was better. Well, then, how do you comment on your
3 immunoassay results then?
4 DR. HENDLEY: I --
5 DR. NOVAK: I mean, are they good, but
6 the others better?
7 DR. HENDLEY: Thank you for giving me my
8 answer. That's quite correct. But the LC -- the
9 immunoassay results, as you said, was a screening tool.
10 The screening tool indicated, hey, this sample's got a
11 higher atrazine residue. Then we used the best
12 technology available, which was the GC mass spec/mass
13 spec method, and that gives us data with a confirmed
14 method that's fully validated to EPA requirements, and
15 we're very satisfied with that. The new technology
16 comes along and there's all-new technologies. It
17 improves incrementally over GC mass spec/mass spec.
18 And so we move to the best available technology today,
19 and that's the LC-MS/MS method.
20 DR. HEERINGA: Dr. Schlenk has one
21 question on this topic.
22 DR. SCHLENK: Yeah. Just to follow-up,
23 but I think I'd asked the original question comparing
24 the methods of detection. One of the things, concerns
25 that I had was, you had mentioned that the immunoassay

1 that you got better detection limits with GC/MS, which
2 is you would expect. So I wonder, are you concerned in
3 following up on Dr. Novak's question, the fact that
4 you, maybe you had false negatives with your
5 immunoassay in the earlier going; that maybe you missed
6 something with those evaluations. Whereas, now that
7 you have a much better system to evaluate, you're
8 seeing higher detection limits. And I think that's
9 what you said earlier that your GC/MS, you actually
10 tended to see higher -- or better detection with your
11 GC/MS compared to the immunoassay; is that, that;s
12 correct? Yeah.
13 DR. HENDLEY: Okay. Two questions
14 there. The second one of, did we see better/higher
15 detections? That's the data which I said we were in a
16 position to submit later this week, I hope. And the
17 answer is, I think, generally so. The reason why
18 immunoassay has been traditionally confirmed with GC
19 mass spec/mass spec is the issue of cross-reactivity.
20 And it's not the quality of the analysis of atrazine,
21 it's giving us confidence that the peak we are
22 measuring, it is a response due to the compound of
23 interest. I apologize.
24 DR. SCHLENK: Yeah. I'm just concerned.
25 So you're basically -- the detection limits, you're not

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1 concerned that the immunoassay is not picking up
2 concentrations. Your concern is just validating the
3 concentrations you did pick up with the immunoassay; is
4 that correct?
5 DR. HENDLEY: That is correct. Yeah.
6 DR. HEERINGA: Thank you very much, Dr.
7 Hendley. I think that clarified that.
8 DR. HENDLEY: Okay.
9 DR. HEERINGA: Please proceed with
10 the --
11 DR. HENDLEY: Yes. Let's start with
12 talking about the objectives of the study in 2003. And
13 they were summarized earlier. They were quite simple
14 really. How much or how many -- to what extent of the
15 waters exceeding a primary productivity-based effect
16 threshold focus on flowing water? The second one was,
17 if there are exceedances, where might they occur? And
18 one of the goals of the study was to generate data and
19 knowledge that could be used to improve the
20 methodologies for predicting watersheds with particular
21 behaviors given this endpoint.
22 So let's move to the chemograph that Dr.
23 Harbourt showed. And you can see here the elements of
24 what was being measured, flow, total suspended solids,
25 local rainfall, and the chemograph, the four-day grab

1 samples.
2 DR. HEERINGA: Paul, maybe you can go
3 get your
4 DR. HENDLEY: Okay. Is that working
5 better? Thank you. And the -- this is one example of
6 one year's chemograph. Obviously, at this stage, we
7 have 80 chemographs that we're talking about, and
8 chemographs differ from one another. You can see,
9 they differ in terms of magnitude. They differ in
10 terms of duration of peak.
11 They differ in terms of the numbers of peaks,
12 and when that peak occurs during the season. And the
13 reason why we've been talking about CASM is because
14 what CASM does is it integrates those chemographs. It
15 provides a common way of expressing the data, so we can
16 compare the data coming from different sites in
17 different years.
18 So what we do is we have our 80 chemographs,
19 and as has been explained, the CASM model has a
20 temporal element. And what we're doing here is we need
21 to feed it with 365 days of atrazine data. So how are
22 we going to do that when we have four-day grab samples?
23 And this is something that is important to the
24 interpretation of the study throughout. What we chose
25 to do was what we've given the slang name stair-step

1 fill-in. We continued the measured value until we get
2 a new measured value. That's a good start. And so we
3 have taken a grab sample; we've extended it for three
4 days 'til we got a new grab sample. So that gives us
5 365 days of record.
6 Now, I must mention here what do we do at the
7 beginning of the end of the season? And EPA's
8 recommendation at the moment is to take the first value
9 and extend it back to January, and to take the last
10 value and extend it through to the beginning of the
11 next season. So that's how you get a 365 days of
12 atrazine use. We combined that with our CASM model
and
13 the CASM Atrazine produces an SSI deviation.
14 So 80 chemographs produce a distribution of
15 SSI deviations. And here we see the CASM Atrazine SSI
16 values, and these are the number of occurrences of site
17 years falling each, into each of these bins. And the
18 -- first and foremost, 72 of the site years do not
19 reach this value of four percent, which is the LOC
20 trigger value that has been discussed. However, eight
21 do, two of those eight site years come from Missouri
22 01, you heard a bit about that earlier. Another two
23 from Missouri 02, one from Indiana 11 and three from
24 sites in Nebraska.
25 So we're going to talk some more about those

1 sites later but one of the fundamental questions that
2 EPA has asked about the study is how well did the grab
3 sampling regime work? And, and the simpler way of
4 asking that is, did we miss any peaks between the four-
5 day grabs that could actually impact the CASM Atrazine
6 endpoint? And I must say, I have this AEEMP up here;
7 EPA call it AEMP, I apologize for the difference. This
8 is the Atrazine Ecological Exposure Monitoring Program.
9 Okay. Because this is an important question,
10 we've used three threads that we're going to look at in
11 detail. And we'll see how they weave together into a
12 common answer at the end. The first one applies to the
13 ten sites for which we have auto samplers. And here
14 you can see the grab stair-step system we've talked
15 about; we add in auto sampler measurements that were
16 generated by runoff events. Those auto sampler points
17 can be treated as new samples using stair-step and so
18 you see, some of the auto samplers are stair-step; some
19 of them were sequences of measurements. When you use
20 this, you replace a couple of grab samples with auto
21 samples. So you come out with a refined record. That
22 can be compared with the old stair-step, and you could
23 see in some cases, the stair-step overestimated the
24 true exposure. And in other cases, it underestimated
25 it.

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1 Now, that's a graphic. CASM Atrazine is our
2 measure for this, and so when you look at the impact on
3 CASM Atrazine, these are the data on SSI of the Y-axis
4 this time, 4 percent LOC, generated using the grab
5 samples alone with stair-step. When we add in the data
6 from the auto sample, and here you see the blue
7 triangles, you can see that the variation between the
8 grab and its associated auto sample is quite low. And
9 what's more importantly, nothing changes its response
10 relative to the 4 percent value as a result of
11 introducing the auto sample data.
12 The second approach is to run what we've
13 called hybrid PRZM approach. And PRZM, another
14 acronym, the Pesticide Root Zone Model, is EPA's
15 preferred runoff model. And this, of course, applies
16 to all sites, not just those with auto samplers. And
17 to cut a long story short, what hybrid PRZM does is it
18 takes local spatial soils data. It takes the rainfall
19 information that we measured at the sites, and it takes
20 information observed by the site samplers on when
21 planting starts at the site. And it combines that with
22 other information to estimate edge-of-field
23 concentration events on days when runoff might have
24 occurred in the field. The details of this process are
25 in the supplied information and under the Schneider et

1 al. reference.
2 And so here you can see the measurements of
3 rainfall and the way the atrazine use was simulated.
4 And that through the modeling system generates these
5 events of predicted edge-of-field events that will be
6 impacting the stream. And that data is blended
7 following a series of working rules that are described
8 in the reference with the grab sample or grab and auto
9 sample to produce a 365-day record again. And you can
10 see, this time, they use linear interpolation between
11 points. And you can see the gray bars behind represent
12 the original stair-step mechanism.
13 Interestingly, some peaks, for instance, this
14 one, are predicted runoff events, but they did not
15 correspond to a significant flow event. So that's one
16 reason why the hybrid PRZM event method is pretty
17 conservative. But again, the measure of this is CASM
18 Atrazine. And here's the same diagram we've just
19 looked at, but what we've added here are the red
20 symbols showing the impact of adding the hybrid PRZM
21 information. And again, the key point is at this 4
22 percent level, there are no significant changes of
23 regulatory output as a result of introducing all these
24 additional conceptual exposure events.
25 I'd also like you to notice that where the

1 original SSI value was low, the percentage difference
2 in the SSI from adding all of these small runoff events
3 is actually quite significant from 0.1, let's say, SSI
4 to 1.3. If I express that as a percent, it would look
5 like several hundred percent. However, you do not see
6 variations of that nature when you get to higher SSI
7 values. So expressing the -- an average of all the
8 percentage changes, for all the site years as a percent
9 implies a high uncertainty to the significant
10 measurements that is not actually occurring. And I
11 point out that actually in a number of cases, the use
12 of a hybrid PRZM and the auto sample has reduced the
13 SSI value of these higher SSI values. So hybrid PRZM
14 and auto sample with grab, we've looked at.
15 We've got a third method. And this takes a
16 robust well-known dataset. The Heidelberg College Data
17 Set that Dr. Crawford from USGS used, and it's
18 discussed extensively in the white paper. Heidelberg
19 College is -- has been running, monitoring studies out
20 of Tiffin, Ohio for about 24-25 years. They have
21 created 365-day datasets for each of four watersheds
22 for each of 23 or 24 years of data. So it's a very
23 robust, very well-respected dataset.
24 And what we've done with that is we took the
25 two watersheds closest in size to the watersheds we're

1 examining in this study. And we did a hypothetical
2 sampling regime. For example, let's sample every other
3 day; there's two ways of doing that across all 23
4 years. Let's sample every three days; let's sample
5 every seven days, ten days, 14 days.
6 That's similar to what Dr. Crawford did. But
7 what we've then done is we've taken that data, applied
8 the stair-step approach and run CASM Atrazine. So this
9 is a way of seeing the impact of increasing sampling
10 frequency on the CASM Atrazine measurements. And
what
11 you can see here is that four -- one that represents
12 using every point from the Heidelberg dataset; the 365
13 points created by the Heidelberg guys. And the -- you
14 can see where it says two, that's the variation in the
15 CASM SSI values introduced by sampling every other
day.
16 And you can see, the variation increases slightly as
17 you go from three to four days. But a four-day
18 sampling regime is actually a very tight dataset, and
19 what we concluded is the four-day sampling regime in
20 the second dataset is being confirmed to be a very
21 suitable regime.
22 Now, you can also see, as you move to perhaps
23 ten days or 14 days intervals between sampling points
24 that the uncertainty in the CASM measurement is

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1 later.
2 So our three approaches seem to be weaving
3 together, and they suggest that the four-day sampling
4 intervals used in this study were an appropriate
5 measure given, and this is the important point, given
6 the stair-step extrapolation assumption, they were an
7 appropriate measure for the study. Does that make
8 sense given what Dr. Soloman described to you about the
9 mode of action, the reversible photosynthetic effect?
10 And the answer is yes. Because you need a moderate
11 duration, moderate exposure to exert this effect on the
12 community, introducing short sharp peaks between grabs
13 is not expected to have a major impact on the CASM
14 score. And so we believe that the sampling regime met
15 the study goals, and what's more, that no safety factor
16 is required because of that source of uncertainty.
17 Now, there's something else I'd like to
18 mention here. EPA in the white paper mentioned the
19 multiplication factor. And the multiplication factor
20 comes from a very elegant assessment of the CASM
21 Atrazine sensitivity. But when it comes to talking
22 about the exposure, it implies every peak in the
23 chemograph is doubled. Now, you might miss an event;
24 we actually have every fourth day measured with grab
25 samples. We've shown what happens if you put in a

1 conservative estimate of all the days when runoff might
2 occur. To assume every day, this value should double,
3 is not realistic at the field level from monitoring
4 people. So we do not believe that the concept of
5 doubling the chemograph is a realistic way of looking
6 at the exposure part of this argument.
7 Okay. Let's change emphasis and move to some
8 of the sites of interest. And starting again with the
9 comment that 72 of the site years didn't exceed the
10 LOC, what about the ones that did? And Dr. Harbourt
11 mentioned that three sites had a sampling record that
12 was lower sample frequency. He didn't just mean lower;
13 he meant exceptionally lower. 37 of the sites, we
14 basically managed 95 percent or better of the predicted
15 sampling. These three sites in southeastern Nebraska,
16 we actually managed only around 50 percent of the
17 expected sampling frequency.
18 What did they look like - well, this is
19 Nebraska 04 on a dry day, and you can see a sandy
20 bottom, a rather mobile streambed, and here is Nebraska
21 07, that's the puddle, and so these are the dry down
22 sites. Now, why might that be occurring? This graphic
23 shows that the green marks the row crop occurrence from
24 the National Land Cover Database. Over here, into
25 this, you've got rain-fed agriculture. This is getting

1 annoying. Yes. And -- I'm sorry about this. This is
2 representing rain-fed agriculture. The brown here is
3 where there's a high incidence of irrigation on
4 cropland. All three sites that are the dry down sites,
5 these two small ones and the larger ones fall in the
6 interface between where irrigation is becoming
7 necessary. So it's hardly surprising that the dry down
8 sites are in this location. It's also important to
9 note that it's a local phenomena, and you shouldn't be
10 expanding that to the entire pool of 1172 sites.
11 So our conclusion is the sites were clearly
12 different. And as the Heidelberg College result
13 showed, if you have a large interval between samples,
14 it's inappropriate to use CASM stair-step approach. So
15 evaluating the data with the CASM stair-step approach
16 doesn't make sense. So a different approach is needed.
17 Our recommendation would be to go back to the -- what
18 EPA proposed in 2003 in their document, which is of
19 rolling average triggers derived from the CASM Atrazine
20 model. And those could be used to deal effectively
21 both with this case within frequent sampling as well as
22 some of the cases where states have less frequent
23 monitoring. An alternative might be to use draft
24 aquatic life criteria.
25 So let's move on to the next site, Indiana

1 11. Indiana 11 is a small site we started monitoring
2 in 2005. Let's start on the first day of sampling of
3 the year. The first day was April the 4th. It so
4 happened the residue was 1.93 parts per billion.
5 Following the work the first day back to January the
6 1st rule, that 1.93 was applied to every day from
7 January the 1st to April the 3rd. What impact does
8 that have on CASM Atrazine? Well, if you take the 1.93
9 value for all of those days, the CASM Atrazine
10 prediction is around 5.2 SSI. If you replace that 1.93
11 with a 0.1 value, and the first measurements on the
12 other 2 years we have data for Indiana 11 were actually
13 less than 0.1; they were less than the LOD on both
14 occasions. So if you put in a value of 0.1 for those
15 days, the SSI drops considerably. This emphasizes what
16 Dr. Volz showed about the sensitivity of the model to
17 low residues at the beginning part of the year.
18 So our conclusion from this is the automatic
19 extrapolation back of the first residue of the year, it
20 is not appropriate without consideration. Let's go
21 forward about six weeks to the middle of May. This is
22 May the 14th, and this is the flow record, and you can
23 see a small flow event followed by a larger one. The
24 sampling that was going on, we had a grab sample here
25 and at noon on the 14th of May, as it happened, the

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1 sampler turned up to take a sample. Now, because it's
2 an auto sampler there, early in the morning when the
3 flow kicked in, the auto sampler started sampling. And
4 it took four samples over that period. It was 24 in
5 the morning, about the same time as this grab sample
6 was taken, the residue was 240 ppb. It dropped to 180.
7 By the end of the day, it was a 101. Now, the average
8 for those samples, and remember, it's six at intervals
9 throughout the day. We believe the best data for that
10 site for that day is the average of those four auto
11 samples, which actually is 136 parts per billion.
12 But the stair-step grab approach takes that
13 209 value and it extends it for four days essentially,
14 it applies it to four days in CASM Atrazine. And
15 that's what gives the value of around 4 SSI. However,
16 if you use the value that's the best available value
17 from the auto sampler of 136 ppb, the SSI is closer to
18 3 percent.
19 So our conclusions from this is that Indiana
20 11 using best available data in a sophisticated
21 fashion, not just like using it for grab and auto
22 analysis we've just looked at, Indiana 11 did not
23 exceed the triggers. Now, 209 ppb on May the 14th was
24 the only significant residue we ever had at that site,
25 but because it was a site that had exceeded the

1 threshold, we ran it for an extra year. And in the
2 third year, and the data is in the package that was
3 submitted in Hampton 2007, the SSI was also very low.
4 So where does that leave us with our
5 distribution? The dry down sites, we shouldn't be
6 using CASM Atrazine to examine those. Indiana 11 no
7 longer exceeds the threshold. But the Missouri sites
8 are still --need consideration. And that -- we're
9 going now to Missouri.
10 Missouri 01 and 02, about 50 miles apart, in
11 northeastern Missouri. And we did a detailed
12 evaluation, trying to understand what was making these
13 sites different? And quite rapidly, we found a linking
14 factor. And this boundary tells a story. It's the
15 major land resource area. That's a classification
16 designed by USDA, and it classifies this area as the
17 central clay pan area. And the features of a central
18 clay pan area particularly reflect the soils.
19 And there you can see that if you consider
20 runoff indices derived from soil data and the
21 percentage of the watershed is C and D soils, this
22 watershed falls in the region of the 99.7 and 100th
23 centile among corn cropping MLRAs. If you also look at
24 measures of clay pan, EPA pointed out very carefully
25 and very correctly that the term clay pan is perhaps a

1 simplification. We should use the term restricted soil
2 layer because there are many ways of expressing clay --
3 restricted soil layers, and it's not always referred to
4 as clay pan in the literature.
5 Here you see the term, argillic soils, which
6 in Missouri you can plot out. And you can see it --
7 within the boundaries of the MLRA, you have a very
8 continuous and extensive occurrence of argillic soils.
9 The key thing driving the phenomena we've seen at
10 Missouri 01 and 02 is this restrictive layer, the clay
11 pan, the impervious layer, not so much in the uplands
12 where there's still a lot of topsoil, but more on the
13 sloping areas where, historically, erosion has removed
14 an awful lot of the topsoil.
15 There's data going back on high erosion on
16 sloping soils in Missouri a long time. And on these
17 side slopes, we have the impact of shallow topsoil
18 making this very hydrologically responsive. The toe-
19 slope soils down at the bottom of the watershed will
20 tend to collect water coming from above, and they tend
21 to have perched water tables. And we will see water
22 tending to seep back out, lower down in the watershed
23 as a result of draining from the force of gravity.
24 And what this does, and this is the reason
25 why this has impacted the CASM Atrazine output rather

1 than just impacting residue levels, is it impacts the
2 duration of the exposures. What you can see here is
3 the comparison across the sites of the number of days
4 of the year exceeding a value.
5 This is an arbitrary value of 18 parts per
6 billion. Some of the reports also show the value of 12
7 parts per billion and the picture is the same. And you
8 can see that in terms of the number of days exceeding a
9 significant atrazine value, Missouri 01 and 02 are
10 alone.
11 And this is the phenomena that has driven
12 the -- particularly the duration part of the duration
13 and magnitude element. These areas though are very
14 prone to runoff, and USDA has done extensive work, and
15 the headwaters have been reported as having high peak
16 herbicide concentrations and can sustain concentrations
17 and durations in the tail of the hydrograph compared to
18 other areas. And USDA also commented that the region
19 reported in their study is overall one of the most
20 vulnerable to herbicide transport in the US or
21 worldwide.
22 We did a very detailed analysis and you saw
23 some photographs from Dr. White earlier. This is
24 another one of some activities going on in Missouri 01.
25 And as he pointed out, there were some activities from

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1 a landowner in Missouri 01 that are actually --
2 occurred across two or three of the years of the study,
3 and they involved continuous corn cropping and non-
4 ideal land management, 'cause it's just difficult when
5 you're doing stuff in a year. You can see also here
6 some of the gully erosion leading to a roadside ditch.
7 This isn't by the side of a stream; this leads to a
8 stream though from corn cropping.
9 So our conclusions on Missouri 01 and 02 are
10 that they have soils
11 that are very prone to runoff, and -- and the and is
12 important, and those soils occur where there's a
13 shallow topsoil above a restrictive layer. And that
14 condition occurs on slopes, and that condition tends to
15 be quite continuous on the watershed scale. And that's
16 why Syngenta would say that the HUC-10 scale watersheds
17 in MLRA 113 form a separate strata when analyzing the
18 results.
19 Now, having said there's a separate strata,
20 what would -- what does that mean? What was -- what
21 are we doing about it? And several activities are
22 underway. There's been discussions with the
23 stakeholders in the regions. Some of the sort of thing
24 you heard from Dr. White. We continue to collect data
25 from the area, and there's a rather exciting piece of

1 science that we don't have time to talk about today,
2 which is taking stats -- some of the available soils
3 layers in the SSURGO database and using that nationwide
4 to see whether restrictive layers are occurring close
5 to a topsoil, the surface, and whether that phenomena
6 is occurring on slopes. We'd be happy to provide
7 detail on that if the panel was interested, but that is
8 actually all theoretical. What's happening on a
9 practical level, and EPA asked us to look at the
10 variations within these watersheds that had indicated a
11 question. And so we identified other sub-watersheds
12 that met our criteria, and as it so happened, they were
13 both adjacent to their -- the original watersheds of
14 interest.
15 And you see here, Missouri 04 and 05, which
16 were sampled in 2007, and where they fit within their
17 parent HUC-10 watersheds. And the monitoring from 2007
18 actually showed none of those four sites exceeded the
19 threshold in 2007 and the -- we're also looking at the
20 bottom of that HUC-10 this year to see how the
21 variation in what we see happening in the sub
22 watersheds is reflected at the base of the HUC-10. So
23 where we are now then is Missouri 01 and 02 exceeded in
24 two seasons, actually they were extended to a third
25 season, and as EPA showed in their table, they exceeded

1 on those seasons as well. And then we have Indiana 11
2 and the dry-down sites that fall on the other side of
3 the LOC line. And so we have 35 sites that do not
4 exceed the LOC. Three sites that require a different
5 way of assessment, and the Missouri 01 and 02 condition
6 that remains exceeding the LOC.
7 What I'd like to turn to now are a couple --
8 very briefly, a couple of questions EPA raised
9 involving the national hydrography database, NHDPlus,
10 the enhanced version of this. This is actually -- we
11 used the NHDPlus in 2003 to develop our stream
12 segments. This is an enhancement that makes things a
13 lot easier. It allows you to do many things we
14 couldn't do before, but it's still, if it's using the
15 same data layers, doing the same job as what we did the
16 hard way in 2003.
17 EPA asked a couple of questions. The first
18 one was simply, can this
19 tool allow us to identify eligible watersheds? We had
20 a quick look at this, and in fact, you can see here,
21 running it quickly, we picked out as eligible the
22 Missouri 02 segment and the Missouri 01 segment. And
23 in fact, in a quick run through, the tool picks 75
24 percent of our 40 sampling segments. So the answer to
25 the panel and EPA is, this seems a good idea. It has

1 potential to do exactly as intended.
2 EPA also asked about variation within the
3 sub-watershed, and, I think, also Dr. Gilliom was
4 asking about this earlier. And again, we had a
5 preliminary look-see with the NHDPlus, and it is going
6 to give the potential to assess variability with it --
7 between sub-watersheds within a HUC-10. So last thing,
8 we've addressed the how many and how much question.
9 The second part of EPA's charge was if there are
10 issues, where are they occurring. And I've already
11 mentioned this work, to try and identify if shallow
12 soil -- restrictive soil layers are occurring similar
13 to Missouri 01 and 02. That work is underway. This is
14 looking at the more general picture of, can we predict
15 vulnerability to atrazine rather better?
16 And what we've done is we've divided this
17 into three steps. The first one is a re-evaluation of
18 the data. The second one is given that data, let's
19 take a couple of different approaches. A mechanistic
20 approach using a model-like PRZM where assumptions have
21 already been made about what drives runoff. And then
22 just throwing the variables into an assessment through
23 principal components, clustering approach, or
24 regression to see if something unexpected comes out of
25 that in terms of relationships we wouldn't have thought

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1 of. Those relationships can then be marked and
2 compared, and in an ideal world, we're looking for
3 congruence.
4 Now, I'll point out here, this is
5 exploratory. EPA and the study is in the stage of
6 evaluating approaches, and that's the questions being
7 asked of the panel. The key thing that we need to
8 remember is atrazine has something going for it. As
9 Dr. Jordan mentioned earlier, that other data and other
10 compounds don't have. And that's the magnitude of the
11 external data available. We've updated what EPA used
12 in 2003. There's now 46,000 atrazine data points from
13 the enormous range of sources, although I would have to
14 say NAQUA at the top of the list, not only due to the
15 magnitude, but the quality of and consistency of that
16 data.
17 The other thing I'd point out is the extent
18 of information available for the 1172 HUC watersheds
19 that EPA refers to. And through -- over 300 of those
20 has some atrazine monitoring data. So there's a lot of
21 data available for those watersheds in addition to what
22 Syngenta's been developing in this program. As you can
23 see from the mapping here, a lot of the data is
24 covering exactly the same regions that our 1172
25 watersheds and the 5860 are covering. Okay.

1 Just looking at some of the apparent trends,
2 and the question was asked earlier about the
3 correlation between the WARP value and the atrazine-
4 measured values. This is the 75th centile of the
5 atrazine values, and I must point out, this is a
6 refinement on what you see in the white paper. Due to
7 some issues with the NLCD data that we discovered very
8 recently in Missouri and some classification questions,
9 we have recently, very recently, submitted to EPA some
10 revisions in the use data. And what you see now is a
11 rather more satisfactory picture in terms of
12 correlation than was available in some of the documents
13 in the white paper.
14 When we look at the -- an index of severe
15 runoff, you see a strong correlation between Missouri
16 01 and 02 with their high-C/D soils and the runoff and
17 the atrazine-measured values. The same with the
18 percentage of rainfall running off, and again, in the
19 interest of time, the same picture for the erosion
20 greater than the threshold value recommended by NRCS,
21 the T-value, i.e., unsustainable erosion levels.
22 So from our examination of the data, we find
23 that there are apparent trends between the study-
24 measured atrazine values and environmental variables
25 known to be significant in defining runoff. And that

1 led us with some interest to use PRZM, and the piece of
2 work that's been done is PRZM has been conducted
3 nationally for every soil in the country with atrazine,
4 where relevant, and using local weather data to the
5 soils. And that national data has been analyzed for
6 the watersheds where we've been doing our
measurements.
7 And you can see here, when you have the estimated load
8 running off a treated area of atrazine in the 60 days
9 after application, and you look at the correlation
10 between that and the atrazine-measured values, and our
11 Missouri sites are different from the remainder with
12 high confidence.
13 When you map that out, you can see the dark
14 blue represents the greater than 95th centile of the
15 PRZM predictions. The lighter blue is this 90 to 95th.
16 And you can see that the selected sites represent a
17 very good distribution among these high runoff
18 potential sites. Moreover, when we look at the NAQUA
19 data that's available for these watersheds and the, I
20 think, 95th centile, for example, we find we're
21 selecting residue data that's in the high pool of that
22 that's available. And we're not going to go into that
23 in depth, but the approach is showing great promise.
24 So extrapolation, the method is under
25 development to identify soil settings similar to

1 Missouri 01 and 02. Existing data from the study sites
2 is being used to help develop predictive tools to help
3 us rank exposure potential across the sites. And
4 complementary modeling approaches are indicating a
5 strong potential for success.
6 And in addition, the fact that we have such a
7 large database of available monitoring data gives us
8 enormous capability for calibration and validation.
9 And of course, there's a lot of data available through
10 our watersheds of interest, so the to what extent
11 question has been addressed. We have a high quality
12 study with a robust sampling regime. The 40 sites, and
13 we haven't dwelt on this, but Dr. Harbourt gave you a
14 flavor, represent the distribution of environmental
15 parameters across the 1172 sites.
16 Those sites, in addition, be selected for
17 atrazine use in WARP score represent a great
18 representation of watersheds in the midwest. 35 of the
19 sites do not exceed the highly protective level of
20 concern. And only two sites did exceed that level of
21 concern and they -- that effect was caused by the
22 continuous shallow restrictive soils on the sloping
23 ground that extended the duration of the exposures and
24 the dry-down sites need a better way of assessment.
25 Exceedances occur where MLRA 113 conditions exist.
And

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1 the exploratory research using the data from the study
2 is underway to develop predictive tools and to take
3 best use of the available residue data. And I'd like
4 to pass you back now to Dr. Soloman or to address
5 questions. Thank you, Mr. Chairman.
6 DR. HEERINGA: Thank you very much, Dr.
7 Hendley.
8 DR. SOLOMAN: And I believe it's
9 appropriate for Dr. Hendley to receive questions at
10 this point.
11 DR. HEERINGA: Questions for Dr.
12 Hendley on this latest in the sequence of
13 presentations. Dr. Chu?
14 DR. CHU: Yeah, I'm Michael Chu. I'm
15 kind of curious about the application of a PRZM. As we
16 know, PRZM is a field scale model, but also and this
17 model cannot give you any concentration, atrazine
18 concentration, using streams -- result watershed scale
19 hydrological modeling and the stream routing and also
20 transport modeling. So I'm just curious as to how you
21 -- you got the atrazine concentration in streams?
22 DR. HENDLEY: Okay, Paul Hendley, again.
23 The hybrid PRZM approach used what is unusual compared
24 to EPA's standard approach on running PRZM. What we
25 did was we simulated the watershed use in cropping

1 within the treated field. So we adjusted the output
2 from PRZM based on the fraction of the watershed that
3 was cropped with corn and the fraction of that corn
4 that was treated. And then we assumed the estimated
5 edge-of-field concentration was what was going to be
6 found in the stream. We didn't apply a further
7 dilution factor. So you're absolutely correct that the
8 stream, the edge-of-field value is not a diluted water
9 body value. We were making a worst-case assessment
10 here.
11 DR. CHU: Okay. Second question about
12 the application. You showed some example -- it seems
13 in the application is kind of a hypothetical
14 application. I mean, quantity and also, especially in
15 the time distribution. Based on our application of a
16 PRZM, of course, of all pesticide to transport
17 modeling. It seems the timing of application is very,
18 very important. So is that really -- after simulation,
19 you compared in a simulated concentration with the
20 manner of the concentration. How did you consider this
21 effect of application?
22 DR. HENDLEY: Okay, Dr. Hendley, again.
23 In the PRZM hybrid approach, when we were getting the
24 technology working, you hit the nail on the head
25 absolutely. The key thing with PRZM is the coincidence

1 between rainfall --
2 DR. CHU: Yes.
3 DR. HENDLEY: -- timing, and the
4 application. And within the watershed, you have a
5 number of farmers who are applying on different days.
6 And there's a distribution of application dates that
7 the watersheds go and obviously, the timings for each
8 of those different farmers' fields, the interval
9 between application and rainfall will differ. So in
10 the PRZM hybrid method, and you may have noticed, we
11 actually simulated the load as multiple applications.
12 And the reason why we did that was to make it worst
13 case in the sense of making sure that there was always
14 fresh PRZM -- fresh, sorry, fresh atrazine out there on
15 the field, on the modeled field, when actual measured
16 rainfall occurred, because we are combining the
17 measured rainfall with our PRZM simulation. So we
18 simulated the application in order to make sure that we
19 -- there's always fresh atrazine around. Does that
20 help answer your question?
21 DR. CHU: Yes, thank you.
22 DR. HEERINGA: Dr. Ellsworth.
23 DR. ELLSWORTH: Yeah. Paul, I just had
24 a question for you on the analysis of the grab sample
25 and the uncertainty it would have on the CASM SSI

1 index. And you used the composite sample, which,
2 you've mentioned, does the sipping and provides a very,
3 you know, good average for an eight-hour or six-hour
4 period. And which is what CASM would want is some kind
5 of an average concentration for the day, but in terms
6 of evaluating the uncertainty in the grab sample, to
7 me, they seem like they're different creatures that
8 you're comparing there, this eight-day average that
9 isn't going to have the same statistical distribution
10 over a year.
11 That kind of a sample is going to have a much
12 narrower histogram, I would think. Is the max and the
13 manner going to be smaller, because it's an average,
14 and so how do you use -- I mean, I've got some concerns
15 about using something like that to assess the accuracy
16 of the grab sample. What do you -- I mean, how would
17 you address that?
18 DR. HENDLEY: I'd like to start off by
19 answering that, but I'd also like Dr. Harbourt to maybe
20 help me out on this one. I think the first answer to
21 your question, just to clarify, we were using the grab
22 samples for every site all the time. The auto sampler
23 data was the composite data, and the first graphic I
24 showed with the triangle, the blue triangles and the
25 black graphic, was comparing the grab and grab plus

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1 auto regimes. So in those cases, the auto -- if it was
2 higher, would have been used in the analysis, the auto
3 analysis, for those ten sites.
4 DR. ELLSWORTH: I'm fine with that. I
5 was just evaluating the uncertainty in the grab
6 sampling regime using the composite samples it seemed
7 -- had seemed inappropriate to me because the composite
8 samples would -- because they are composites have a
9 different distribution of properties than a grab sample
10 would.
11 DR. HENDLEY: The answer - I think the
12 answer to your question is yes. They will have a
13 different distribution. The grab sampling was common
14 to all sites and that was the sampling that's -- EPA
15 had asked us to do. Dr. Harbourt, would you?
16 DR. HARBOURT: 2007, did you mention
17 2007? That's the
18 DR. HENDLEY: Yes. Okay. Dr. Harbourt
19 has just pointed out correctly that the 2007 data
20 actually has followed a slightly different approach and
21 in 2007 -- and I have to say, we haven't had a chance
22 to evaluate the data at all yet, but I'm sure at a
23 later SAP, this can be discussed. We have auto
24 samplers operating every day and so we will have grab
25 sample data that we can compare with auto sampler data,

1 but we can't make a comment on that at the moment.
2 DR. HEERINGA: Dr. Lerch.
3 DR. LERCH: I've got several questions.
4 First off, I was just curious why the stair-step
5 interpolation instead of something more common like a
6 linear interpolation. And in your various scenarios,
7 have you compared a linear interpolation to stair-step
8 to see how that would affect the outcome?
9 DR. HENDLEY: Paul Hendley. Why stair-
10 step? EPA asked us to use that as a default. It
11 looked like, you know, imagining what was going to
12 happen in 2003, like it would be more conservative, and
13 as it happens, it proves to be, and I think that was
14 probably the rationale. Second question on have we
15 looked at that. In fact, Dr. Bartell very kindly, when
16 -- when the model was being put together in an older
17 version of the model, and it may not be in the latest
18 version, allowed the option to take four-day grab
19 samples and use either a linear interpolation or a
20 stair-step. And they do give different results, but we
21 have been working with the stair-step approach now as
22 the standard.
23 DR. LERCH: Okay, thank you. I was
24 curious about -- given the result, I think it was the
25 Indiana 11 example, I'm not sure when you realized that

1 result, but it would have seemed that the simple
2 solution there would just to be to get a couple of
3 samples over the winter, and then that way when you
4 interpolate backwards, you'd have better data and you
5 don't get stuck with the 1.9 or whatever. Was that
6 considered at some point, during this, since it's small
7 to your study?
8 DR. HENDLEY: Okay. Paul Hendley. The
9 answer to that question is -- it needs a little bit of
10 history. As we'll hear from Dr. Erickson and we heard
11 from Drs. Volz and Bartell, the model has undergone
12 some changes. In the early days, the model was much
13 less sensitive to lower residues, and so the assumption
14 that Syngenta made, in fact, was just to use zeroes
15 because if you use zeroes or even 2s or 3s or 4s or 5s,
16 it made no difference to the model output. So when we
17 first learned about the Indiana 11 number -- whether it
18 was a 1.93 or a 3 or a 0.1 was not going to affect the
19 outcome, so it has only been with the latest
20 implementation of the model that this suddenly became
21 an issue. So had I known now what I -- known then what
22 I know now, your suggestion is a good one.
23 DR. LERCH: Okay. One last question and
24 maybe this is more of a comment. This also dealt with
25 the Indiana 11 example. We have multiple samples in a

1 day, and I think, the example had four auto samples and
2 a fifth grab sample, and you indicated that the best
3 number would be the average of those. I guess I would
4 beg to differ though, since you had flow information.
5 Could you have not computed a flow weighted
6 concentration knowing what interval in time, and
7 therefore, how much water was represented by each of
8 those samples. And then therefore in that case, you'd
9 have a better number instead of just an arithmetic mean
10 of the five samples.
11 DR. HENDLEY: I'll take a shot at --
12 they spent a -- Dr. Harbourt, I think, may wish to add
13 to it. I think the issue that drives the CASM Atrazine
14 model is concentration rather than load. So my feeling
15 is that we are looking for an estimate of the
16 concentration across the day and the continuous sipping
17 and the averaging of the concentration for daily time
18 step model seemed appropriate to me. Dr. Harbourt,
19 would you like to --
20 DR. HARBOURT: No, that's
21 DR. HENDLEY: Okay.
22 DR. VOLZ: This is Dave Volz. I would
23 add also that within CASM Atrazine, it's on a daily
24 time step, so it -- you wouldn't be able to assess
25 within the model sub-daily exposures.

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1 DR. LERCH: I guess I was -- Bob Lerch
2 again. I was just suggesting that within that day,
3 you'd know the amount of flow that each one of those
4 samples represented, and you could come up with a flow-
5 weighted average for that specific day. That's what I
6 was suggesting.
7 DR. HEERINGA: Dr. Gilliom.
8 MR. GILLIOM: I'm Bob Gilliom. Could
9 you go to slide 15 once, Paul? Sorry.
10 DR. HENDLEY: Speaking my way through
11 several hundred slides, it's --
12 MR. GILLIOM: I think I got the right
13 one.
14 DR. HENDLEY: This one?
15 MR. GILLIOM: Yeah. The main question,
16 point I want to make is that I understand that within
17 this limited sample of 40, the change in picking up the
18 peaks did not increase how many went over the line, but
19 it did apparently raise the distribution of everything.
20 And if you look at the sample as a representation for
21 other sites and kind of more a frequency distribution
22 view of the world, it would certainly indicate an
23 increased percentage of sites likely to go over
24 whatever LOC you pick, I think. So I'm looking for a
25 feedback on whether you're disagreeing or not to that.

1 DR. HENDLEY: I'm afraid I'm
2 disagreeing, Dr. Gilliom. What we actually see is
3 we're introducing a number of -- actually quite a lot
4 of simulated edge-of-field events that are
5 conservative, both in terms of the prediction that what
6 leaves the field is -- represents what's happening in
7 the stream without further dilution and also in the
8 fact that it doesn't take account for the atrazine
9 label requirements of buffers and the things that stop
10 edge-of-field water getting into streams and the design
11 to do so.
12 So there's a lot of extra events added, and I
13 am absolutely certain this makes sense. There's
14 perhaps a thousand fold change, a thousand percent
15 change from this point one value going up to one
16 percent and that's a high percentage change. But if
17 you look at the percent difference, when you come to
18 the higher SSI values, because you've already got a
19 more substantial score there, I don't think the
20 uncertainty reflected by the percentage difference
21 where the starting SSI value is low should be
22 extrapolated to those where the starting SSI value is
23 high.
24 MR. GILLIOM: So I think in a way,
25 you're saying that as long as the S -- LOC stays at 4

1 and doesn't go to 1 or something, you're saying it's
2 not that sensitive to an increase?
3 DR. HENDLEY: Correct.
4 MR. GILLIOM: If you went down into a
5 lower range, it would change the distributional answer?
6 DR. HENDLEY: That's correct.
7 MR. GILLIOM: Okay. The second question
8 I had was on the issue of the sensitivity of the SSI to
9 the duration of high concentration conditions, and this
10 has to do with a combination of scale factors in how
11 the results of concentration at these size watersheds
12 get translated into the SSI or the deviation. And also
13 it has to do with sites like Missouri where part of the
14 reason that you get the higher deviation is because of
15 the spread-out peak; right?
16 When you go up in basin scale, you're in
17 bigger basins, like the parent HUCS, you would expect
18 to generally get that spread-out peak more than these
19 little basins we monitored. So I'm curious in a sense
20 -- what, what type of comment does the team that's
21 worked on this have regarding the -- how much the -- I
22 mean the general question is: What's the sensitivity
23 of the deviations to this scale of duration, and is the
24 -- and the implication to me is that maybe some of the
25 conditions that have longer duration might have the

1 greatest deviation.
2 DR. SOLOMAN: Mr. Chairman, I think Dave
3 Volz will answer that.
4 DR. VOLZ: That's a very good question.
5 This is Dave Volz. I think the key issue here is
6 really to ensure that what the model is predicting
7 represent, is reflective of what is observed in these
8 meso and microcosm studies. That's why this -- those
9 studies are so critical in the analysis of up -- or in
10 interpretation of the model results. I'll leave it at
11 that.
12 MR. GILLIOM: But I think I, I
13 understand that. I think the point I'm trying to make
14 is that if you take the same -- if you take a very
15 short term high spiky exposure in one stream that's all
16 -- doesn't have any drains, hard pan or anything, and
17 then you take the same mass of atrazine and spread it
18 out over a longer peak, what I've seen is showing that
19 the deviation's going to be higher mostly, 'cause the
20 sustained exposure is what's causing the greatest
21 deviations.
22 DR. VOLZ: Well, yeah, this is Dave
23 Volz. I'd just like to mention something before Steve
24 adds in. I think, again, it largely has to do again
25 with the dose/response relationships or the assumptions

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1 about the dose/response relationships within the model.
2 In fact, in the previous version, that was a little bit
3 different than what EPA described in their white paper.
4 It involved using the -- that second approach, which
5 involved using the no-effect threshold relative to the
6 EC50 and using that model, in fact Indiana 11, as Paul
7 was discussing, triggered within that model. If you
8 don't assume the extrapolation within the model that
9 EPA describes in their white paper, if you don't assume
10 the extrapolation of the 1.9 back to the January 1st as
11 Paul showed, the SSI doesn't trigger in the model that
12 EPA presented. And we think that's largely driven by
13 the change in the dose/response relationships between
14 the two models, but that's not to say that either one
15 is correct. It just suggests that there needs to be
16 refinement of the model such that it reflects the
17 observed effects.
18 DR. SOLOMAN: Mr. Chairman, I think, Dr.
19 Bartell maybe could add something and then Dr. Hendley.
20 DR. BARTELL: Yes. And just as a brief
21 follow up. It depends upon the exact nature of the
22 spreading out of that peak in relationship to timing
23 and magnitude of those concentrations compared to the
24 EC50s. So it's fairly difficult to answer generally
25 without just running that kind of chemograph through

1 the model.
2 DR. HEERINGA: I'd like to move on to
3 wrap up.
4 DR. HENDLEY: I think the important
5 statement -- EPA has recommended that, that further
6 improvements to the model need to be examined and, I
7 think, Dr. Gilliom's question ought to be asked when we
8 have a model that we finally agreed with that deals --
9 that has addressed some of the questions that Dr. Volz
10 and Dr. Bartell have raised in terms of responses to
11 low concentrations of atrazine.
12 DR. HEERINGA: Dr. Grue, certainly, get
13 one last question here.
14 DR. GRUE: Chris Grue. I understand the
15 rationale to look at the points in which the SSI has
16 exceeded the LOC. Do the characteristics of those
17 sites show up anywhere else in that dataset? In other
18 words, if in fact EPA in this -- my -- I may be
19 mistaken in my understanding, but if using a
20 multiplication factor based on the relative position of
21 the SSI to the LOC as potentially a margin of safety,
22 then are we selectively altering that distribution? Or
23 are those sites that you've described, the
24 characteristics of those sites that exceeded the LOC,
25 truly unique in that dataset, or are there others that

1 would show up, where they're also hard pan, but they
2 ended up with a low score?
3 DR. HENDLEY: Paul Hendley. I do not
4 believe that any of the remaining 38 sites have shallow
5 clay pans on slopes under the conditions that would be
6 similar to Missouri 01 or 02.
7 DR. GRUE: What about the other factors
8 too? I mean, that was one example of a factor that
9 would result in an exclusion but --
10 DR. HENDLEY: Well, that's the only
11 factor that's been identified that's led to an
12 exceedance. So I don't think those -- that combination
13 of factors occurs among the other 38, but Dr. Sielken
14 has a comment.
15 DR. SIELKEN: Bob Sielken, statistician
16 consultant. I just wanted to add, and this addressed a
17 question that Dr. Effland made earlier, that we do have
18 34 different site characteristics, 40 to the sites.
19 The Missouri 01 and 02 are unique among the 40, and as
20 Dr. Hendley mentioned, they need to be treated as a
21 separate stratum for predicting what's going on in the
22 world, but we do have 34 other characteristics that can
23 be used with the 35 sites for which we really have data
24 to potentially predict which specific sites in the 1172
25 or the 5860 might be of concern. Thank you.

1 DR. HEERINGA: Dr. Effland, and then
2 we'll have to wrap it up to move on.
3 DR. EFFLAND: I'd just like to make an
4 additional comment to that, and while as a soil
5 scientist, it's very near and dear to my heart to see
6 the word argillic soils used, because only but a few
7 people besides my children know that term. The concept
8 of an argillic horizon is very widespread in the
9 central to eastern United States and actually globally,
10 because all they're talking about is a clay enriched --
11 now, what is an argillic horizon? There are various
12 flavors, let's say, of argillic horizons.
13 So I think if you're going to use that and I
14 think it's an interesting approach, I think it's
15 something that certainly warrants some additional
16 investigation, just be aware, and I know that my
17 colleagues in EPA that are soil scientists are also
18 aware, that not all argillics are created the same.
19 And if we did a map of the distribution of soils with
20 argillic horizons in the U.S. and you consider those to
21 be a unique stratum, we'd be looking at an awful lot of
22 the U.S. That's all.
23 DR. HARBOURT: This is Chris Harbourt.
24 If I could add, we're -- have ongoing work into the
25 SSURGO database, which is essentially for those who

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1 aren't familiar with that term, the SSURGO data is the
2 county level soils booklet, you know, and you've seen
3 these packets of soil mapped. It's the highest level
4 soil information. There is an argillic horizon
5 classification within that dataset and it's hit or
6 miss, you know, a county or any -- each county is run
7 by a person, you know, who may figure it right. An
8 argillic is different here, different there. It's
9 somewhat subjective.
10 What we've decided to do is go back to more
11 properties of the soils looking for a restrictive
12 layer. A layer where we see hydraulic conductivity, a
13 rapid change in hydraulic conductivity with depth.
14 We're combining that with a 30-meter DEM slope to try
15 and predict at an individual spot everywhere, is it
16 this combination of the shallow confining layer that's
17 indicative of these clay pan areas in the Midwest with
18 a slope, is it continuous across large portions of the
19 field. That, that type of information, we're really
20 digging into, and that's a monumental undertaking in
21 terms of SSURGO. I mean the processing has been
months
22 of running and chugging this stuff. It's really quite
23 impressive, and we hope to show that here in the next
24 -- before the next SAP would be the
25 DR. EFFLAND: I think that the SSURGO

1 dataset's an ideal way to go. I would disagree with
2 you though as far as each county sets up what they call
3 an argillic horizon. There's a national cooperative
4 soil survey system. There's a national system of soil
5 classification. All those soils are rated and ranked
6 and classified under that system. The idea of using
7 saturated hydraulic conductivity or an actual physical
8 property measurement, I think that's an excellent way
9 to go especially if you're going to look at specific
10 sites.
11 DR. HEERINGA: We'll be certain that
12 those recommendations get into the report. Dr.
13 Soloman, I think, what I'd like to do -- I know you
14 have a few wrap up comments. If you could do those at
15 this point in time and just we're clearly off the
16 agenda, so let me just give you a picture of -- take a
17 moment here.
18 DR. SOLOMAN: That's okay.
19 DR. HEERINGA: It's a -- how is this --
20 just sort of -- we're sort of extrapolating here, the
21 -- what I'd like to do is wrap up with this
22 presentation. We do have one additional public
23 speaker. Rick Robinson has arrived, and we'll give him
24 a little time, but I think what we'll actually do is to
25 wrap up your presentation, take a break, come back,

1 have Rick Robinson do his public comment and wrap up.
2 And then, I think, over the break, I'll discuss with
3 the EPA staff, Dr. Erickson, whether they want to go
4 ahead with their presentations this afternoon. I'd
5 hoped that they would be able to do that, and we'd
6 return to it tomorrow morning. So let's wrap up, and
7 then we'll take a break, come back for the final public
8 comment and then turn to the first of the EPA
9 presentations.
10 DR. SOLOMAN: Mr. Chairman, thank you
11 very much. Keith Soloman here again. I just had a few
12 concluding remarks that I can go through fairly
13 quickly, so I think we can fit into your schedule here.
14 The -- and there's really reminders of some
15 of the conclusions. I didn't know where exactly lunch
16 and breaks would interpolate in the presentation, but
17 as this was before lunch, you may have forgotten it. I
18 think what we have here in response to charge questions
19 1 to 5, we have a realistic ecological model. It's
20 been calibrated to ecological effects in meso and
21 microcosms. It's conservative in design, therefore, it
22 overestimates some of the effects. It's an effective
23 model for Midwestern corn watershed data and, but we do
24 know that it is sensitive in terms of the SSI output to
25 assumptions about initial date of exposure and also the

1 dose/response relationships.
2 In terms of questions 6 to 8, WARP and GRTS
3 were appropriate methodologies to initially identify
4 the 40 selected sites. They are from a high exposure
5 pool and a representative range of environmental
6 parameters. The other approaches, such as the newly
7 available NHDPlus, now allow estimation within a high
8 degree of variability. The intermittent flow sites
9 that dry down, this is an issue that needs to be
10 addressed in perhaps other ways.
11 A running day average may be one way; they
12 certainly don't have an adequate time series for use in
13 CASM Atrazine, which requires daily times. And I think
14 we also need to consider the biological difference in
15 terms of the primary producer community in these kinds
16 of systems. And just to remind you what they look
17 like, you saw this slide earlier on.
18 The other issue is we are dealing with
19 streams in temperate regions and they vary seasonally
20 as well. This is pictures, a series of pictures taken
21 from the same site in the spring runoff later towards
22 the end of the summer and in the wintertime. So these
23 sites experience big changes in physical parameters,
24 temperature and other things. And these act --
25 seasonal effects act as resets for many of the

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1 organisms that live in these systems. And they've
2 evolved and been selected for traits that allow them to
3 repopulate and recover from these types of resets.
4 Terrestrial stages that invade propagules, seeds, eggs,
5 tubers, and cones, and these strategies allow recovery
6 from natural stresses and maybe also from stresses that
7 are more anthropogenic.
8 In terms of sampling regimen, the four-day
9 sampling period with stair-step approach, we feel is
10 sufficient to characterize exposure. It's biologically
11 relevant to the mode of action of atrazine, which is
12 this area under the curve, reversible mechanism, and
13 that the sampling regimens met the study goal criteria.
14 And we believe because of inherent conservatism in the
15 approach, no safety factor is required, and the
16 doubling of the chemographs as discussed by Dr. Hendley
17 is probably not new. I turned the wrong thing here.
18 Just some general conclusions -- I beg your
19 pardon is -- to Charge Questions 10 and 11, we, again,
20 believe that NHDPlus should allow for identification of
21 stream segments that are eligible. Syngenta has
22 submitted some datasets, and recommends, in particular,
23 that this be used along with the CDL and the national
24 PRZM modeling coverage. And that we can use these
25 additional datasets to develop models based on this

1 data produced in this particular study. This was the
2 conclusion that Dr. Hendley put at the end of his
3 slides, and it is so recent that I'm sure it's not
4 necessary to go over it again, so I will just step to
5 some overall conclusions.
6 We believe this was a robust and extensive
7 study, large number of samples, a lot of the people
8 involved in it, et cetera. It's biologically based and
9 it links exposure to responses that is conservative --
10 in a -- conservatism in the model as you had earlier.
11 But in addition, some confounding stresses that may be
12 quite important have not been included yet in the
13 model. And the model, although it looks at a
14 replacement to function, it's not able to assess
15 resiliency, because that kind of data is not available.
16 And despite the selection of worst case
17 sites, we had a low frequency of incidences of
18 exceedance of the LOC and there's, generally, a very
19 low risk of adverse effects across all sites. The
20 characterization was for responses in the producer
21 community which, by the mechanism of action, is the
22 most sensitive and consumers are -- above that level
23 are therefore protected. I think this was a conclusion
24 that was arrived at in the 2003 RED as well.
25 These kinds of differences would be

1 statistically undetectable in the field. Anybody who's
2 done field research would find it very difficult with
3 biological variability to show more than a 50 percent
4 difference in species numbers and other factors like
5 that. And I - but we do believe that the better
6 knowledge that we now have allows us to move forward
7 with best management plans and to scientifically
8 identify sites for these to be exercised. And then
9 with that, I'd like to thank you for attention. I
10 think there have been many questions. I wish you were
11 in my class back at the university, because you've been
12 the most interested group of people listening to this
13 that I've ever seen, and that's absolutely great. I'm
14 sure there may be further questions. I will try to
15 deflect those to people with better knowledge than I do
16 -- than I have, but also to reassure you again that
17 we're available here for the rest of this SAP meeting
18 should additional data be needed by the panel. Thank
19 you.
20 DR. HEERINGA: Thank you very much, Dr.
21 Soloman, and the entire team who's here to present.
22 It's been a thorough presentation, I think that's one
23 very beneficial to these proceedings. And as we get in
24 to presentations by the EPA scientific staff on their
25 white paper and their conclusions if there are points

1 where they feel your expertise would be needed, we'll
2 ask if you could come back to the microphone to
3 present, but thank you very much again to all of you.
4 At this point, maybe before we take our
5 break, why don't I ask Rick Robinson of the Iowa Farm
6 Bureau, if you would be willing to make your
7 presentation. Mr. Robinson was going to be here this
8 morning, but, I think, due to travel difficulties,
9 arrived a little later so -- Rick Robinson.
10 MR. ROBINSON: Good afternoon. My name
11 is Rick Robinson. I'm an environmental policy advisor
12 for the Iowa Farm Bureau in West Des Moines, Iowa.
And
13 I appreciate the opportunity to visit with you today.
14 The Farm Bureau's Iowa's largest general farm
15 organization, about 157,000 member families in the
16 state of Iowa, and actually, across the nation too. I
17 submitted some written comments yesterday
18 electronically. I noticed a couple of typos in there,
19 so when I get done here today, I'm going to work on
20 maybe cleaning up a couple of those and resubmitting.
21 But I don't want to just read those comments to you.
22 What I want to do is share with you some other ideas,
23 some other points of view, and some, add some context
24 to the discussion from the standpoint of some of the
25 water quality issues that we're dealing with in Iowa.

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1 Our written comments deal a lot more
2 specifically with some of the use and benefits of
3 atrazine, but I want to focus in a little bit more on
4 some of the water quality aspects in Iowa. I've been
5 in agriculture all my life. I was born on an Iowa
6 farm. I've been working for farmers all my life, now
7 about 47 years, so I've been around as long as atrazine
8 has been used, primarily. I've seen a lot of changes
9 in my life. Agriculture is going through many changes.
10 Right now, we're discussing a new farm bill, and a new
11 energy title or a new energy bill as well. And so
12 agriculture is going to be going through some more
13 changes, hopefully, very soon.
14 And what the federal government does is very
15 important to Iowa agriculture. About 95 percent of our
16 voluntary conservation dollars come from the federal
17 government. And so that combined with the decisions it
18 makes on re-registration of herbicides, for example,
19 such as atrazine, is a very important function of the
20 federal government along with the energy bill and the
21 farm bill. As we think about the opportunities for
22 Iowa farmers with respect to the farm bill and the
23 energy bill, we think about renewable fuels that will
24 come from the cornfields of Iowa in the Midwest.
25 There's -- it's a very exciting time in agriculture,

1 and a lot of people, I think, farmers and consumers and
2 the environment are going to benefit from that. But it
3 also places more importance on a very critical tillage
4 and cropping system in Iowa called conservation tillage
5 or no till. And as we move into more corn production
6 conservation tillage and the use of atrazine, in
7 particular, will become or at least remain as important
8 in the future as it is today.
9 And when you think about what Iowa's water
10 quality problems are, if you look at our 2006 impaired
11 waters list and, it's obvious -- it's sediment in Iowa
12 is probably our biggest issue, our biggest challenge.
13 Numerically, it's number 4 for the cause of stream
14 impairment in Iowa. It's behind only unknown causes,
15 habitat alterations, and low dissolved oxygen. So
16 sediment delivery to our streams is a critical issue.
17 Pesticides actually rank last in terms of impairments.
18 If you look at our lakes data, sediment and turbidity
19 issues are number 1 in terms of impairments for our
20 lakes in Iowa.
21 So you can combine that also with other
22 challenges that we have. The gulf hypoxia task force
23 is looking at new -- a new action plan. Not only are
24 they going to increase the percentage reduction goal
25 for total nitrogen, they're going to increase or add a

1 new reduction goal for total phosphorus of 45 percent
2 delivered to the Gulf of Mexico. So we have a little
3 bit of additional pressure there in addition to just
4 the sediment from our farm fields and impacts on
5 streams in Iowa.
6 And also, you look at regional nutrient
7 criteria that the EPA has
8 suggested for our eco-region in Iowa. And if you look
9 at what they're suggesting, a target of 76 parts per
10 billion, if you look at Iowa's water quality data, in
11 2006, total phosphorus, for example, in streams was 4.3
12 -- you know, our highest readings were around just over
13 four parts per million. But again, EPA is suggesting
14 total phosphorus criteria of 76 parts per billion, with
15 a B. So we've got some real challenges when we start
16 to think about what our issues are in Iowa.
17 Well, recently, Iowa State University Center
18 for Agricultural and Rural Development did a study to
19 take a look at a couple of different issues. But one
20 of the issues they looked at in this study, which I'll
21 provide some information in my electronic comments,
was
22 to look at what would it take Iowa to get to these
23 regional nutrient criteria numbers that the EPA is
24 suggesting for total phosphorus, for example. And one
25 of the things that the study found is that we've made a

1 lot of good progress in our conservation practices in
2 the state of Iowa. We do have -- we can document --
3 for the dollars that we spend, we have documented
4 reductions in total phosphorus, total nitrogen, and
5 nitrates. But when it comes to looking at these future
6 goals, such as the regional nutrient criteria numbers,
7 we see that, well, it took 91 days of computer CPU time
8 and over 116,000 runs of the soil water assessment
9 tool. And the computer couldn't answer the question,
10 what would it take to get to those EPA regional
11 nutrient criteria numbers.
12 So we kind of had to look at what were the
13 average maximum reductions we were getting in total
14 phosphorus, and we came up with about a 40 percent
15 reduction. The computer told us, in other words, that
16 we could get to a 40 percent reduction, which would get
17 us closer to what EPA is talking about, but it's not
18 going to get us to what -- to the 76 part per billion
19 type of figure that EPA is suggesting to the states.
20 If we look at the cost of achieving that 40 percent
21 additional reduction in total phosphorus in Iowa, we're
22 estimating or actually Iowa State University's
23 estimating a cost of an additional $613 million a year;
24 that's on top of the -- depending on what dataset you
25 look at, 300 to 400 million that we're currently

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1 spending.
2 So it's important, I think, for you to
3 understand that we are looking at these issues. First
4 of all, what our real water quality challenge issues
5 are and that's really total phosphorus or phosphorus
6 and nutrients and what it's going to cost us to get
7 there, and to remind you that another part of EPA is
8 telling us to seriously look at those issues as well.
9 And now, how does atrazine fit into that?
10 Well, if you haven't heard by now, I hope you
11 understand that atrazine is very important in these no
12 till and conservation tillage systems that we use,
13 especially in the hillier ground of Iowa. They help us
14 achieve and address some of these sediment delivery
15 concerns that I've talked about. Atrazine works very
16 well on a high residue, high crop residue environment.
17 It's very effective in broad leaf weed control, and
18 very cost effective in our conservation tillage systems
19 in Iowa. So I wanted to remind you of those things and
20 how important that is, and for my estimation, how
21 important the loss of atrazine if it's not
22 reregistered. How important that would be in terms of
23 having a negative water quality impact in the state of
24 Iowa, given our sediment issues that we have to deal
25 with.

1 And I would argue that, really, atrazine's
2 use is not likely to present an unreasonable relative
3 risk to freshwater aquatic systems in the state of
4 Iowa, from my estimation. So thank you for your time,
5 your attention, and can I answer any questions?
6 DR. HEERINGA: Thank you, Mr. Robinson.
7 Any questions for Mr. Robinson?
8 MR. ROBINSON: Thank you.
9 DR. HEERINGA: Thank you very much for
10 your comments. Okay. At this point in time, unless
11 there's anyone else in the public attendance who would
12 like to make a comment, I'd like to draw then the
13 period of public comment to a close. It's been
14 extensive, but I think very, very, helpful. I'd like
15 to call a break for 15 minutes, and we'll reconvene at
16 4 p.m. here. A little more than 15 minutes, I guess,
17 and my watch is fast. And during that period of time,
18 I'd like to speak to the EPA's scientific team to see
19 how they would like to approach the session so. Would
20 you join me, Ken?
21 DR. PORTIER: Yeah.
22 (WHEREUPON, a discussion was held off the record.)
23 DR. PORTIER: Okay. We're going to get
24 started with this last session. My name is Ken
25 Portier. I'm going to assess -- I'm going to chair

1 this last discussion. Dr. Heeringa normally teaches a
2 class on sampling out at the University of Maryland on
3 a -- this is Tuesday night, so he asked me to step in.
4 He'll be back tomorrow morning, so rest assured that my
5 only job here is to introduce the EPA, who's going to
6 be -- we're now at 1:15 on our schedule so it gives you
7 an idea of what's going to happen.
8 I want to assure the panel that we're not
9 going to get into charge questions this afternoon.
10 We'll probably start with charge question 1 tomorrow
11 morning, so you can kind of take a breath and say, all
12 right, I have this evening to prepare. This also gives
13 EPA a little bit more opportunity this afternoon to
14 kind of fully explain the topic and incorporate some of
15 the things that we've seen from the public commentors.
16 So with that said, I'm going to turn the --
17 turn the mic over to Dr. Erickson, who's going to be
18 talking on the Use of a Community Simulation Model for
19 Extrapolation of Atrazine Levels of Concern Among
20 Exposure Time Series.
21 DR. ERICKSON: Thank you, Mr. Chairman.
22 And I'd also like to thank the organizers and Syngenta
23 for their -- for having the public presentations
24 earlier because it -- it relieves me of going into a
25 lot of details that I wouldn't be -- have been able to

1 very well. And it's also appropriate because this
2 whole effort was structured under the IRED for Syngenta
3 to do the monitoring program under -- with EPA feedback
4 and to develop CASM Atrazine as a tool that we then
5 take over to do the analyses, the risk assessments.
6 And what I'd like to do in this talk is to
7 start with the problem definition for this risk
8 assessment as I see it. And starting with a slide that
9 Dr. Irene presented earlier today as, again, the basic
10 starting point of what is intended here. And that is
11 that the ecological level of concern and the level of
12 protection that we're providing under this risk
13 assessment is based on plant community effects in the
14 set of microcosm and mesocosm tests that have already
15 been talked about, ranked according to their Brock
16 scores, which also have been defined.
17 And I'm going to try to emphasize this
18 throughout my talk, because I think it gets into some
19 potential for misconceptions about exactly what role
20 CASM is filling -- fulfilling in this assessment. And
21 it's rather limited, and I'll try to emphasize that as
22 we go along; although the point has been made earlier.
23 Anyway, this is -- these are the score -- the
24 concentration versus duration curve.
25 You already saw for the 77 microcosm/mesocosm

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1 results, which show a rather substantial effect of
2 concentration in a more limited but still suggestion of
3 an effect of duration that would be expected. The
4 emphasis on this evaluation was on the plant community
5 because, again, as Dr. Bartell already presented, the
6 -- based on individual lab toxicity tests, plants,
7 generally, are rather more sensitive. And by the time
8 you have effects in these microcosm and mesocosms, the
9 plant community is being affected at the levels we --
10 you would want to regulate before you get to direct
11 animal toxicity.
12 For this slide, I'd like to emphasize a
13 couple of things that relate to later in my talk.
14 First of all, there is an overlap of the scores. That
15 can be due to a variety of sources, the diversity of
16 systems and also the diversity of methodology in the
17 state dataset. And the risk assessment has to address
18 that overlap in some ways, which I'll come to later.
19 Another thing is, although this might seem
20 contradictory to earlier speakers, I label -- this is
21 not labeled right, I say, little indication of time
22 dependence. It would have been better to state that
23 there's little definitive way to using the
24 microcosm/mesocosm to quantify the time dependence.
25 And because of the uncertainties in comparing the

1 scores, in particular, the scores at early times are
2 always done within the context of the duration of the
3 experiment. And so the three-day experiment is done of
4 effects just within those three days. Likewise, a 60-
5 day test is within -- over a much longer duration, and
6 we would like our risk assessment to be more -- to look
7 at a more consistent level of effects that, that --
8 over, over time. And again, I'll get to that, and
9 just wanted this note here to set that issue up.
10 Okay. The other big aspect of the problem
11 definition which has already been talked about is that
12 the microcosm/mesocosm test, although not absolutely
13 constant concentration are relatively constant compared
14 to the types of exposures that occur on the field. And
15 this is just several examples of a larger set that I'll
16 be dealing with later which have been pulled from the
17 Heidelberg College set and the monitoring program of
18 sort of to represent the diversity. This is several of
19 a set of 16, which I'll talk to later, which were
20 selected by OPP staff and also to some degree
21 manipulated to look at different issues of how
22 chemographs might differ across the universe we want to
23 be assessing. And the complete set is in the white
24 paper.
25 So problem definition statements on the next

1 slide, first of all, we need a method given the
2 extrapolation between why the varying exposures -- we
3 need a method for a consistent quantitative index of
4 effect that can be specified for any exposure time
5 series, whether it be in the microcosm/mesocosm dataset
6 or at the field sites. And by consistent, I mean, that
7 it has much the same meaning as far as risk. And so
8 something within -- that's just within a one-day period
9 or three-day period is not consistent with something
10 that's measured over several months.
11 I can't emphasize more that this method does
12 not need to provide absolute predictions of effects in
13 any system. That's not the intent of this model. Dr.
14 Bartell emphasized earlier that this was a generic
15 model. I'll go even further in saying that, even
16 within the generic concept of this model, we're not
17 interested in the absolute predictions. We're
18 interested in this model simply to look at the relative
19 severity of effects across exposure time series.
20 And then, therefore, the basic assumption
21 here is that -- for our model, is that the
22 extrapolation within the model from exposure time
23 series A to exposure time series B, the relative
24 severity of those has some relevance to the field
25 systems and to the mesocosm/microcosm dataset. It's

1 the linkage there, but again, it's just a matter of
2 extrapolating between two different time series. We're
3 not going to be interested in any absolute predictions.
4 The -- and an aquatic community simulation
5 model was selected as a general approach to address
6 this problem because more so than just looking at, for
7 example, species sensitivity distribution of individual
8 toxicity test, it includes processes that might be
9 important for this extrapolation as far as how the
10 model community recovers. How there is perhaps some
11 redundancy between species taken over from -- in the
12 primary producer community.
13 The general strategy then for this
14 methodology is to, first of all, formulate a generic
15 aquatic community model that has processes and
16 components considered necessary to -- for this
17 extrapolation that has a diversity of different plant
18 species and, as Dr. Bartell talked about earlier, that
19 some models are lacking and that it has the -- at least
20 realistic processes, and that even if it's not going to
21 make these absolute predictions. And again, that was a
22 task that was done by Syngenta and under EPA feedback
23 as far as suggestions as far as how the -- as we tested
24 the models, suggestions as far as how there might be
25 some changes to it, which is still an ongoing process.

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1 The second step in this general strategy is
2 to conduct model simulations for the exposure duration,
3 concentration, combinations in the micro/mesocosm
4 experiments. And that these -- the effects in these
5 simulations then would be summarized by what we call a
6 model effect index, which is the Steinhaus Similarity
7 Index that Dr. Volz referred to earlier and which I
8 will repeat in a little while.
9 The third step in the general strategy was to
10 correlate the model effects index with the
11 microcosm/mesocosm effects score to determine the model
12 LOC that thus discriminates the low, the 1 and 2 scores
13 from the high, the 3 through 5 scores. And again, I
14 have to emphasize that it's the microcosm/mesocosm,
15 therefore, that is defining the level of protection.
16 It's the effects in the microcosm/mesocosm which are
17 the basis for the level of protection and the level of
18 concern. The model is just acting as a vehicle to do
19 the time extrapolations of -- for which we need to have
20 a model LOC, and I emphasize model LOC and a model
21 effect index to conduct those extrapolations. But the
22 real level of protection and level of concern is
23 defined by the microcosm/mesocosms.
24 And then finally, the application of the
25 method, the fourth step, is to conduct the model

1 simulations for the -- any field exposure time series
2 of interest and simply to determine if the model LOC is
3 exceeded. And one thing that's already been mentioned
4 by Dr. Hendley is that, and I'll maybe say more exactly
5 how I feel it's useful is to -- we could stop there,
6 but then another useful aspect of the procedure might
7 be to compute a multiplication factor which is the
8 factor that the exposure has to increase or decrease to
9 equal the LOC; that might have some utility as far as
10 quantifying the level of mitigation that's needed. And
11 while a simple multiplication factor is admittedly
12 simple, the -- it still has some uses, I think.
13 Okay. Model formulation and
14 parameterization. I'll try to go through this quickly
15 because Dr. Bartell gave a very good summary of the --
16 and a much more detailed summary of what it was. The
17 selected model was the Comprehensive Aquatic Systems
18 Model, CASM. The state variables of CASM are the
19 biomasses of the various component aquatic species and
20 also concentrations of certain physical chemical
21 parameters.
22 Oh, brother. That always happens. The state
23 equation for each aquatic species population is a
24 bioenergetics equation that defines biomass gains and
25 losses. And we were joking earlier about how the

1 printout came out good and how some printouts are
2 fouled up by as far as the equations, but now I see
3 that the on-screen driver here is doing the same thing.
4 Basically, this equation at the bottom is the
5 change in biomass of a species I with time, and it
6 increases due to photosynthesis, the P term in green.
7 And then decreases due to various loss terms, R being
8 respiration or catabolic losses, S being a sinking
9 rate, in this case, because we're talking about a
10 phytoplankton species; M for mortality and G for
11 grazing by various consumer species.
12 Simple mass balance model, the -- probably
13 run into some problems here too, each on the
14 presentation -- each component of the bioenergetics
15 equations is in turn a function of various other state
16 variables and various input variables. And again for
17 photosynthesis, it consists of a maximum photosynthesis
18 rate, a factor related to temperature that has things
19 like optimal temperature, maximum temperature. So the
20 input variable is temperature, but there's some model
21 parameters relating to the optimal and maximum
22 temperatures. A function of the light with input light
23 concentration, some shading calculations, and some
24 parameters that relate to the light saturation curve.
25 And a factor related to the nutrient status of the

1 water which has as input variables the nutrient
2 concentrations, and then for this case, some half
3 saturation constants for each nutrient.
4 The -- for the atrazine assessment purposes,
5 a version of the general model, CASM, was developed by
6 Dr. Bartell and his associates, CASM Atrazine, and was
7 formulated to emulate a second to third order
8 Midwestern U.S. stream now -- this is a generic model
9 it -- the -- because we were concentrating on the Corn
10 Belt issues, it -- that's why the Midwestern stream was
11 selected as sort of the archetype. It consists of a
12 variety of species listed here. As Dr. Bartell
13 explained, the bioenergetics parameters and other model
14 parameters were gleaned from the peer-reviewed
15 literature and the physical, chemical input variables
16 were obtained from a specific Ohio stream. But again,
17 I want to emphasize that, again, this is not a specific
18 system. It's -- it was selected as a matter of
19 convenience for as far as having a generic model that
20 would embody the processes that would support the time
21 extrapolation. Anything beyond that, as far as what
22 the specific nature of the system is is unimportant.
23 And we would hope that this might have even broader
24 applicability, or we might have to develop a limited
25 set of models to support different areas of the

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1 country.
2 One of the most difficult aspects and one
3 which we're still struggling with, which I will spend
4 some time on here, was applying toxicity data to the
5 model. It's -- for CASM Atrazine, applying toxicity
6 data to CASM in general is somewhat problematic,
7 because toxicity tests are not conducted to determine
8 bioenergetics equation parameters. In some cases, like
9 maybe a mortality rate, it can be done, but a lot of
10 the bioenergetics parameters aren't explicitly
11 addressed in toxicity experiments. In -- for plants
12 with atrazine, it's somewhat of an easier task, because
13 there is a direct effect on -- the growth rate is the
14 measure made and that fits in well more with the
15 bioenergetics equation, but it still requires -- as Dr.
16 Bartell already went over some calculations, which I'm
17 going to go through here as far as translating a
18 toxicity dataset into CASM parameters.
19 We start with an EC50 with a slope for the
20 response curve that specifies the net effect of --
21 might be various toxicity processes on bioenergetics.
22 And like I said, for plants, this is relatively
23 straightforward.
24 For each daily exposure concentration, CASM
25 then runs a mini-simulation of the toxicity curve,

1 which represents a toxicity test to computer toxic
2 effects factor, which is used to modify selected
3 parameters in the bioenergetics equations, such that
4 the model equation then reproduces the toxicity test
5 result. And it's basically what I -- just a little
6 cartoon here, if we start out with an observed toxicity
7 relationship where we have a relative growth rate at a
8 certain concentration, we're asking the question as
9 that if we go up to the -- this is at the median effect
10 level, if we go up at a concen --we have to have the
11 concentration of concern and go up to that curve, we go
12 over and model that curve, but not modeling it against
13 concentration, but modeling it against a toxic effects
14 factor that's put into the bioenergetics equation.
15 So you determine exactly how the
16 bioenergetics equation is to be modified and again,
17 Steve did discuss this.
18 And the next equation. There's a couple of
19 options in CASM for how the TEF is put into the
20 bioenergetics equations for plants. And one is simply
21 multiplying one minus the TEF, the TEF being a
22 percentage reduction or percentage increase. But one
23 minus the TEF times the photosynthetic photosynthesis
24 term and the -- or more precisely, the maximum
25 photosynthesis parameter, but it's equivalent to doing

1 this. A more complicated approach, which Steve alluded
2 to, was the general stress syndrome where the TEF
3 increases or decreases multiple parameters in the
4 bioenergetics equations. For example, one might, you
5 know, increase respiration as a toxic effect and
6 decrease photosynthesis for plants. We've done some
7 comparisons, and doing it by either approach doesn't
8 have much effect.
9 The -- so anyway, that's the procedure that
10 -- how this toxicity data is put into CASM. EC50s for
11 the model plant species were selected from a compendium
12 of observed plant growth EC50s, and Dr. Bartell
13 mentioned that and we include this as a table in the
14 white paper. And all our calculations assumed a slope
15 of 3.3, a log, for the log Gaussian toxicity
16 relationship. And that was, again, based on a
17 compendium of actual observed slopes. I think it's
18 preferable to directly use the empirical slopes here
19 rather than the approach Dr. Volz took -- mentioned of
20 assigning an NOEC, which is of uncertain magnitude as
21 far as what effect it represents, because CASM is
22 assuming an NOEC, represents a certain number of
23 standard deviations from the median. And if we have
24 the data that actually has an empirical slope, that's
25 -- we feel that's preferable.

1 The one thing about the plant toxicity data,
2 which was a subject of an earlier question, was that it
3 shows tremendously large within-species variability,
4 which causes uncertainty. And in the species
5 sensitivity selections, in fact, I took the data from
6 that -- the table on the white paper and ran an
7 analysis of variants testing for an actual between
8 species effect and it came out to be non-significant.
9 And the -- and this graphics illustrates why, I mean,
10 the -- between different studies, there are some
11 species where the EC50s vary by two orders of
12 magnitude. And actually, a lot of the variability that
13 might look like they're, it's species sensitivity
14 might, in fact, just be within-species variability.
15 And as was suggested earlier, this might be the strain
16 of the organism or -- but we really don't know what it
17 is. But I present this here, because it's going to be
18 a major factor in the sensitivity analysis I'll present
19 later. But it may well be that a sensitive species, I
20 mean, if you -- if we just randomly selected one of the
21 test results from one of these species, it can appear
22 to be either highly sensitive or rather tolerant. And
23 again, it's an issue that we have to address in how the
24 model is parameterized.
25 Animal toxicity values were also specified

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1 based on the available data, but they really have
2 negligible consequences in the results, because by the
3 time we get to an effect level, we're already at an
4 effect level for the plant community before we would
5 get to significant effects on the animal community,
6 either by direct toxicity or by indirect effects from
7 the plant community. And so we're sticking with
8 indices that relate to the plant community and the
9 model.
10 So anyway, the model implementation step then
11 is that we have a what is referred to here as a base
12 model definition. And it's the midwestern stream
13 community structure as already discussed, although the
14 development of other community structures is part of,
15 part of the plan. The -- and the Ohio River -- well,
16 not the Ohio River, but it's an Ohio stream physical,
17 chemical parameters. The EC50 selections from the
18 white paper, we used the general stress syndrome,
19 though, as I indicated the -- it doesn't have the
20 photosynthetic stress syndrome produces very similar
21 results, and it's a 365-day simulation with CASM. And
22 again, the time course for the reference simulation was
23 already presented earlier -- in earlier talks. Again,
24 the Steinhaus Similarity Index was already discussed.
25 I have the equation here, but Dr. Volz already

1 presented it. That was -- what was selected as the
2 model effect index, again, for the base model
3 definition, but I'm going to look at alternatives later
4 in this talk as part of our sensitivity analysis.
5 The next step of the process was to conduct
6 the model simulations for each microcosm/mesocosm
7 concentration duration. This had a Julian day 105
8 start as our base start date. Everything was zero
9 before that. So any of the issues that were raised
10 earlier, which I'll get to later, about early exposures
11 and at low concentrations don't affect this. Again,
12 Dr. Volz presented a similar graph about how the LOC
13 became to be assigned before point zero based on
14 equalizing false negatives and false positive scores.
15 And then this shows a plot of the model LOC
16 on a different, on the different graph of concentration
17 versus duration to illustrate where it falls within
18 that graph of the microcosm/mesocosm data. Again, it
19 splits through that uncertainty region, that overlap
20 region right around 30 days, but it's the model that
21 defines the time dependence.
22 Processes inherent to the model will define
23 as time dependence, and it does exert a time dependence
24 that is not necessarily, you know, clearly evident in
25 the data. And, in fact, the false negatives tend to be

1 more at the lower concentrations than the positives
2 there. And it somewhat fit in because of what I said
3 before, because these kind of short duration
4 experiments that just look at effects within limited
5 duration aren't really consistently comparable to the
6 longer ones, and it's the model that puts on the time
7 dependence to this. And the -- anyway, the -- and so
8 once the model is calibrated to the microcosm/mesocosm
9 data, the last step is simply to apply it. And this is
10 a graph of the 16 example chemographs.
11 This is not our actual implementation
12 analysis; that will be presented in subsequent days.
13 But just to illustrate how the model is applied, the
14 model is run for each of those 16 chemographs I
15 mentioned. A model effects index is calculated for
16 each simulation. The red line is the LOC at a value of
17 4. And here are two points that exceed the value, and
18 the rest are -- some are near it, some are far below.
19 I wouldn't put any stock in the ones that are really
20 near it because, again, some of these chemographs are
21 artificial manipulations of other chemographs. But
22 it's just an example of how the model is applied. You
23 run the model, compare it to the LOC, and if the LOC is
24 either exceeded or not.
25 And the alternate -- another part of the

1 application, as I mentioned before, would be to
2 calculate the multiplication factor that is needed to
3 increase or decrease the chemograph, by a constant
4 amount admittedly, so that it exactly equals the LOC.
5 And if that multiplication factor is over 1, it means
6 the LOC wasn't exceeded. And in this case, the LOC is
7 a factor of 5 would indicate that approximately the
8 exposure could be about five-fold higher and -- before
9 it reaches the LOC, and -- which would give at least an
10 indication on the exposure concentration axis rather
11 than on the model effects index axis, how close or far
12 away you are from the level of concern. With the model
13 effects index, does a model effects index down around 2
14 mean that you can maybe increase exposure by ten-fold
15 to get up to that level, a hundred-fold or just two-
16 fold or 50 percent. You don't know from the model
17 effects index. This at least gives you the idea of
18 what you have to -- what the magnitude on the exposure
19 axis, which the multiplication factor is on, how much
20 -- how close to the LOC you are or either below it.
21 And here, it would indicate you would need to reduce
22 the exposure by about two-fold for those sites to get
23 down to the LOC. Okay.
24 The rest of my talk is going to be devoted to
25 a sensitivity analysis we thought was necessary to, to

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1 evaluate this methodology and to determine if it was
2 appropriate. And the sensitivity analysis is needed
3 because the base model configuration I gave involves
4 several decisions with unknown effects on the end
5 results; the end results being whether the LOC is
6 exceeded or whether -- what those multiplication
7 factors are. And not all those decisions are, you know
8 -- while they all had rationales, there were
9 alternative decisions that could have been made, and
10 still had -- and still been as justified. For example,
11 an Ohio stream was picked for its nutrient parameters
12 and temperature and such, flows, depths; why not
13 another stream to do that? But there were several
14 points where decisions were made and the toxicity
15 values in the -- perhaps in the bioenergetics
16 parameters in the model structure itself; a variety of
17 decisions which were reasonable decisions but were not
18 definitive decisions.
19 And what we wanted to know is that, well,
20 what would happen if alternative decisions were made?
21 And an analysis of the sensitivity results to these
22 decisions can do a couple of things. First of all,
23 hopefully, it can help justify the model, because if
24 the results aren't sensitive to these decisions, then
25 the decisions are giving similar results, so you could

1 apply one model configuration to a broader set of
2 sites. And also a sensitivity analysis can help, you
3 know, define uncertainty -- the magnitude of
4 uncertainty from those decisions, so you can
5 concentrate on refining those decisions perhaps or
6 else, at least, have some quantification of part of the
7 uncertainty of this process.
8 But the important thing about the sensitivity
9 analysis is that each model variation we have has to go
10 through the whole process. It's not, well, we're
11 going to change nutrients and then see if the LOC of 4
12 is exceeded or not. We've changed the model. We have
13 to redo the LOC compared to microcosm/mesocosms
because
14 that LOC, model LOC value, has no independent meaning
15 as far as level of protection, and so that any
16 variation of the model must go through the whole
17 process I outlined earlier. And that's what'll be done
18 here. The sensitivity analyses to date have addressed
19 the effects of selections for the model effects index,
20 that I'll present, the exposure start date, that Julian
21 day 105, the environmental variable inputs, nutrients,
22 temperature, light, the EC50 selection, and others I
23 will not present, like the P of the photosynthetic
24 stress syndrome versus the general stress syndrome,
25 which had negligible effects on the results. There

1 were a few other aspects of CASM that also we -- that
2 also did not really significantly affect the results
3 that I won't be presenting here.
4 This is still an ongoing process. I talked
5 about alternative community structure and bioenergetics
6 under development for future sensitivity analysis.
7 There's other possibilities; we didn't do the slope
8 selection. Dr. Volz referred earlier to the different
9 ways of doing the slope. Like I said, we did not like
10 the NOEC approach with available data, but the slope I
11 assigned does vary among different datasets. And that
12 might be a subject for this, and there are others that
13 might be under consideration.
14 I'm going to -- for the model effect index,
15 I'm going to step through the steps of our sensitivity
16 analysis. For other ones, I'll just present the end
17 result.
18 This repeats the slide I've already showed.
19 This is the base model, which uses the average percent
20 SSI reduction. So it has an LOC of 4. An alternative
21 model effects index we looked at was the maximum
22 Steinhaus similarity deviation from the reference of
23 the exposed from the reference simulation at any day
24 during the simulation, not the average, the maximum.
25 And that produced a higher LOC because the maximum

1 would be higher than the average. But it still means
2 roughly the same thing, because as you flip between
3 these slides, I shifted the scales so that the vertical
4 lines superimposed. And by doing that, the dots almost
5 superimposed. And all that's saying is that doing a
6 different model effect index is really not affecting
7 where the relative risks are perceived to be in the
8 different points. And it'll be more clearly
9 illustrated later.
10 Another effects index, which we've looked at
11 and we've looked at others beyond this is getting away
12 from a similarity index and just looking at the plant
13 biomass in the regime. And that produces a lower LOC
14 of 2.7, and it produces somewhat more shifts in the
15 points, but it generally sorts out to the same pattern
16 of correlation. That is, the effects in the
17 microcosm/mesocosms have about the same correlation to
18 the model index for these three different model
19 indices. And this is even more clear on this spot
20 where we look at the concentration duration plot and
21 look at the lines for these different alternatives.
22 The black one being the base model, and the red and
23 green being these alternatives. And except at very
24 short times, they're very close and often superimposed
25 on each other. This is basically saying that the model

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1 is telling us that the concentration -- the effects
2 time relationships are about the same regardless of
3 what index we use.
4 And the next slide looks at the
5 multiplication factors for these variations, which
6 again shows the similarity that even the previous slide
7 was for the constant exposures in microcosms and
8 mesocosms, these are for the highly time variable
9 exposures in those example chemographs as represented
10 by the multiplication factors for those chemographs to
11 reach the respective LOCs for the different indices.
12 And again, they're very, very close. The pattern is
13 almost identical. The absolute magnitudes are almost
14 identical. And it becomes even clearer what the
15 deviations are in the next plot, where I'd plot a
16 relative multiplication factor, which is the
17 multiplication factor divided by the multiplication
18 factor for the base case. So the base case plots out
19 exactly at 1 here. The dotted lines represent a factor
20 of 1.2 deviation. The dash lines, a factor of 1.5, and
21 the dash dotted lines a factor of 2. And you see that
22 all the plots are within those narrow ones, so that the
23 deviation is generally 20 percent or less as far as
24 what on our exposure axis, which the multiplication
25 factor has, and how much the exposure would shift as

1 far from these alternatives.
2 Okay. Well, the rest of the sensitivity
3 analysis I'll show just this plot for each of the
4 factors we've looked at. One is the exposure start
5 date, now on our chemographs, we're not changing the
6 exposure start date on our chemographs. Those are the
7 actual field exposures, but when we calibrate to the
8 mesocosm and microcosm, we have to assume some date
9 that we start the exposure in the model. And that the
10 base case is Julian day 105 if we shift it 15 days
11 earlier or later, again, it stays usually within ten
12 percent of the result.
13 We have looked on a limited case of even some
14 bigger shifts, and again, it generally does not deviate
15 much though. If we went all the way unrealistically
16 down into starting in January where you can accumulate
17 the effects. And this is basically -- it will start
18 affecting things, but this is basically a reflection of
19 -- that the fact that if you start exposures earlier,
20 and they have some residual effects during the season,
21 the earlier you start them, the more -- the greater
22 your average Steinhaus Similarity Index is going to be.
23 But it's somewhat compensating in the fact that the
24 greater Steinhaus Similarity Index is then calibrated
25 to the mesocosm/microcosm data. And so that shift is

1 at least somewhat compensated for and resulting in this
2 residual difference.
3 We've looked at, individual nutrients have
4 been looked at, but this is sort of a combined increase
5 of -- either increasing or the nutrients, increasing or
6 decreasing the nutrients by a factor of 2, again, very
7 little effect on model results. Increasing or
8 decreasing temperature by 20 percent defining zero
9 Celsius as, you know, no change, and so that the change
10 at 10 degrees is a plus or minus 2 degrees. Change at
11 20 degrees Celsius is a 4-degree change over the annual
12 temperature cycle. Again, virtually no effect and even
13 less effect changing light intensity either up or down
14 by a fair degree of -- by 50 percent.
15 The exception comes when we start looking at
16 the EC50 selection and there you start seeing more
17 sensitivity of the, of the, the end results of the
18 model, the whole end results of the procedure based on
19 this. Now, as Dr. Bartell emphasized, he selected
20 toxicity values based on their fit to the bioenergetics
21 and nature of the different model species. He tried to
22 come up with the closest matches for the base case.
23 What we did was somewhat simple minded, or
24 what I did was simple minded, in that given the
25 variability I showed earlier, I basically said, well,

1 an extreme -- the worst case on the variation would
2 just be to randomly assign toxicity values based on the
3 distribution of toxicity values we observed. Assumed
4 -- don't assume any species' sensitivity or
5 relationships, just assign them randomly.
6 So we assigned ten random sets to the 26
7 plant species, and the relative multiplication factors
8 are plotted here in the sensitivity results.
9 They're almost all still within the factor of
10 1.5 lines. The majority is still within a factor of
11 1.2 lines, the plus or minus 20 percent, and except for
12 the -- like I said, except for the chemograph number 1,
13 which is most extreme, which is the sharpest shortest
14 peak in the chemograph set, and would be most sensitive
15 to if a certain species is thought to be sensitive or
16 tolerant randomly.
17 Like I said, the variation is almost always
18 within the factor of 1.5. And if we look at the -- the
19 orange lines here are the mean and plus or minus one
20 standard deviation of the -- within this random
21 toxicity dataset. And our base case that was selected
22 by Dr. Bartell is always within, except for that first
23 chemograph, is always within 20 percent of the random
24 selection.
25 And if we take the mean and variability of

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1 the random selection as the comparison, the base case
2 is always within 20 percent. And it's also within --
3 almost always within plus or minus one standard
4 deviation of these random sets, which argues for the
5 base case at least being a reasonable depiction of the
6 range of possibilities. Again, given that this random
7 selection is kind of extreme for as far as the range
8 over which these can vary.
9 And then one other thing I should note here
10 is that, this does start representing a significant
11 amount of uncertainty that should maybe be factored in
12 to the implementation. And what you'll see in later
13 talks is that if we go out to two standard deviations,
14 it does vary with chemograph a lot. But with two
15 standard deviations, what we're concerned about is that
16 if we have a case where perhaps the multiplication
17 factor is over two -- over one, so you think the LOC
18 hasn't been exceeded, but is there a possibility that
19 the LOC might be exceeded based on this uncertainty in
20 the multiplication factor.
21 And to assess that issue, we actually look at
22 the lower half of this graph and ask about the
23 variability here. And generally it -- once you get out
24 to two standard deviations on several of the
25 chemographs, you're out about a factor of two. And so

1 you'll see later, a factor of two used in some of the
2 screening and that's where that came from.
3 Not rigorous, because to be rigorous, we
4 would really have to start matching the sub to the
5 attributes of the chemographs, which we don't really
6 understand yet.
7 Okay. Finally, the next steps on this
8 process -- we're going to be dealing with further
9 quality assurance and finalization of CASM code that
10 Steve Bartell and his associates will be doing, but
11 within EPA, we'll be doing some code inspection. And
12 also some code ourselves, which will be testing part of
13 the CASM kernel code. There is an issue with the
14 toxicity algorithm revision.
15 Earlier, the issue of EPA and some of the --
16 our more recent use of CASM, we're the ones who noted
17 that when there were chemographs that had some early
18 exposures at low concentrations, there were more
19 effects than we would expect from the dose response
20 curves or the toxic dose response curves that were put
21 in to the model. And so there were some discussions
22 regarding why that was the case.
23 It's not just -- in addition to what Dr. Volz
24 presented earlier, some of the issues that he brought
25 up, there were also some issues with the toxicity

1 algorithm programming that need examination and
2 revision. And the entire issue will lead to a revision
3 of CASM Atrazine that will require us to re-run and
4 refine the analyses that I've already discussed.
5 And we want to expand the sensitivity
6 analysis once those revisions are done to -- as I said
7 before, to include some additional alternative model
8 structures and other factors. And then finally, the
9 end result might be that as we look at the variations
10 of CASM Atrazine that we are looking at in the
11 sensitivity analysis, we will have to ask the question:
12 Is there one variation of the model that would be a
13 better base model that would more fit within the mid-
14 range of the variations among the models?
15 And so that consideration will have to be
16 given -- some consideration will have to be given to
17 that. And that's it, Mr. Chairman.
18 MR. PORTIER: Okay. We'll open it up to
19 the panel for any questions. Dr. Isom.
20 DR. ISOM: I thought it was interesting
21 where you went through and looked at the various
22 environmental inputs on the sensitivity analysis,
23 specifically temperature, but being from the Midwest,
24 we live on the extremes weather-wise. Particularly
25 from April 15th to June 15th, specifically rainfall,

1 moisture, and stream flows have a great variability in
2 that time frame. Have you considered or is that
3 considered in any of the modeling; that rainfall and
4 the effects it would have on the sensitivity analysis?
5 DR. ERICKSON: Well, that is -- CASM
6 does include aspects of stream flow and depth as part
7 of it. And again, those are input parameters from the,
8 that one Ohio stream. That certainly is a candidate
9 for looking at variation of that; of those things that
10 I mentioned for additional sensitivity analysis. And
11 yeah, I would agree that that would be one factor that
12 we should include in the next stage of the sensitivity
13 analysis. But I think if you need more information
14 about how CASM factors that in, you'd have to ask Dr.
15 Bartell.
16 DR. PORTIER: Dr. La Point.
17 DR. LA POINT: Dr. Erickson, when I look
18 at slide 42 and then compare it to the sensitivity
19 analyses beginning with slide 44 and then 49 where you
20 look at the sensitivity analysis on EC50 selection, I'm
21 reminded again of a question I asked Dr. Bartell
22 earlier, that with the relative robustness, I mean, you
23 know, the fact that the sensitivity analysis shows that
24 there's not much of a change depending on the nature of
25 the chemograph and all, it still seems to me that -- or

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1 the question is -- no, it's a question. Do these
2 outcomes result from the selection of the initial type
3 of species groups, in other words, the macrophytes,
4 particularly, the number of periphytes and species and
5 so forth?
6 And -- because when I look at this and think
7 about kind of the inertia that must be overcome for
8 things that would be kind of dominated by the
9 macrophytes. In other words, is this a macrophyte-
10 dominated system that would show this? Do you see what
11 I'm saying?
12 DR. ERICKSON: I would agree. I think
13 we've -- I'm thinking, the macrophyte issue has been an
14 issue all along and, I think, as I said, we want to be
15 pursuing this expanded sensitivity analysis. One of
16 those things is alternative model structures and while
17 that -- just modifying the macrophyte importance within
18 this base model wasn't part of the discussion so far,
19 it certainly could be.
20 And -- but we've also discussed whether, you
21 know, to not necessarily eliminate them but to look at
22 whether the bioenergetics aspects of them could be made
23 to include them but as a, you know, with a more
24 realistic time series and lesser importance. Again,
25 that's, we're certainly looking for suggestions about

1 what factors are considered to be most important in
2 looking at the sensitivity, and I'm glad you used the
3 word robustness.
4 I meant to use it myself. That's the whole
5 point of this. If the model is adequately robust, then
6 at least through the Corn Belt, if we have the
7 sensitivity analysis structured adequately, we could
8 apply, you know, one model for a range of systems. And
9 that was the hope - and even perhaps going beyond that
10 if by doing models that, you know, emulate systems in
11 other parts of the country, again, not necessarily have
12 the same extrapolation relationships between these time
13 series. And again, can't emphasize that enough, that's
14 all that's important here.
15 I mean, we're not dealing with the absolute
16 predictions. If they have the same extrapolation
17 properties between time series, then it might be
18 possible to have just a single globally model that --
19 and whether it was -- whether it's called a second or
20 third order Midwestern stream or not, or whether it is
21 that one model, to have one globally applicable model
22 would be ideal because it would be problematic to start
23 then talking about even a few models and say, well,
24 which model applies to what situation. That gets into
25 -- that jumps the order of difficulty; that's a quantum

1 jump in the difficulty of applying the procedure. I
2 mean, it could be done but it would be -- my hope would
3 be that we could keep it simple like this.
4 DR. PORTIER: I've got a comment. One
5 thing that bothers me about the sensitivity analysis
6 that you present here is that each time you manipulate
7 the parameter, you recalibrate to the data, so the fact
8 in Figure 42 that all three lines are the same are not
9 surprising because you're recalibrating. It would
10 almost be like I'm doing a simple regression, and I
11 want to know how sensitive the line is to an outlier
12 and every time I move the outlier, I redo the
13 regression. I'm going to show it's not sensitive;
14 right?
15 DR. ERICKSON: Yeah, but remember again,
16 our goal is to look at the time dependence, and our
17 recalibration is tantamount to changing the intercept
18 of the line but not the slope. And it is the slope
19 that is the time dependence and it is the slope that
20 the model specifies. And that's how I would justify
21 that; I think this is appropriate. And so if I go back
22 to that - because the whole point is that we start with
23 the mesocosm/microcosm data and we want it to go -- we
24 want whatever LOC we get from the model, whatever model
25 LOC value we have, we want to have the same

1 discrimination of the microcosm/mesocosm data.
2 And that's tantamount to lifting these lines
3 up and down, but it has nothing to do with the slope of
4 the line. And so it would have been possible for that
5 green line -- well, see the slopes are different at the
6 very early times and it would have been possible if the
7 slope was different for those methods to have the green
8 line be here and just go flat across here, if in fact,
9 it made a difference. But we're really - since most of
10 the data here, we are forcing agreement right here, but
11 we aren't forcing agreement out here or here or between
12 the lines. And I'm glad you asked the question,
13 because I mean, I've been dealing with this.
14 Even within our group, development group, a
15 few years ago, we lost track of that. We would ask --
16 and if I may remark, there were some comments earlier
17 today about -- well, CASM is conservative. Well, CASM,
18 as it's implemented here, is neither conservative nor
19 liberal, because it's adjusted to the
20 microcosm/mesocosm data to set the level of protection.
21 And we could make -- and what the sensitivity analysis
22 says is if we make, you know, CASM more -- as -- if we
23 raise --
24 I've done some sensitivity analysis where
25 I've increased the EC50 for every plant species by two-

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1 fold or decreased it by two-fold and you still come up
2 with fairly good agreement. And because of the nature
3 of this, and that's why I said it's important to
4 emphasize that the use of CASM here is very limited,
5 it's an arbiter of the time dependence of toxicity and
6 how that time dependence is -- including highly time
7 variable exposure concentrations. And so if the
8 absolute -- if, if we have a model that has greater
9 absolute levels of effect, but then we get it to --
10 calibrate it to the mesocosm/microcosm data, which was
11 decided to be the basis for the level of protection and
12 level of concern, you end up with very similar results.
13 DR. PORTIER: Dr. Young?
14 DR. YOUNG: Given the nonlinear nature
15 of CASM, it would seem that -- well, let me back up.
16 When you looked at, did your sensitivity analysis, you
17 started appropriately in that you looked at a variable
18 at a time, but CASM is nonlinear and so the real issues
19 may come when you have multiple departures, multiple
20 fluctuations from the base. Have you considered that
21 at all?
22 DR. ERICKSON: Some of the simulations
23 that -- Syngenta didn't present this work; they did
24 some similar examinations of CASM, and they did look at
25 multiple combinations there, and we certainly could do

1 that. I mean, it wouldn't be hard to do that. I think
2 that that's a good suggestion for our future work. I
3 guess, I -- my memory is not such that I can speak to
4 what they found regarding that as far as the -- and
5 whether how far they got relative to how the
6 sensitivity analysis procedure, but it has been -- the
7 combinations of certain parameters has been looked at.
8 In fact, there was an effort to look at temperature,
9 light, and nutrients as -- maybe a southern Corn Belt
10 stream versus a northern Corn Belt stream to that
11 extent, but -- yeah, it's a -- I would like that as a
12 suggestion. I think it's something I had really
13 forgotten about and it should be done.
14 DR. PORTIER: Doctor --
15 DR. ELLSWORTH: Ellsworth -- Tim
16 Ellsworth.
17 DR. PORTIER: Tim Ellsworth.
18 DR. ELLSWORTH: Yeah. I just had --
19 first, one comment that I really think that is
20 important to look at, maybe the interaction between
21 nutrients and light, et cetera and that model effect
22 index as well. But the other thing and the question I
23 have: On these micro/mesocosm experiments, did they
24 give, I mean, what is the endpoint, do they actually
25 have an SSI at the endpoint on these things or -- I

1 know you're only after relative effects.
2 DR. ERICKSON: Yeah.
3 DR. ELLSWORTH: I understand that, but
4 I'm just trying to look at validating this model even
5 with respect to micro/mesocosm atrazine data.
6 DR. ERICKSON: Okay. I think the
7 endpoints are included in some of your material, but it
8 was -- no, there was not a consistent -- I don't know.
9 Well, first of all, I should preface this with that the
10 microcosm/mesocosm dataset was the starting point for
11 my involvement in this process.
12 So I was not one of the ones dealing with the
13 review and assignment of the scores and the nature of
14 the topic, so I can't speak very well to that. But I
15 do know enough to know that there was a diversity of
16 methodologies that were used and what was a Brock
17 score; what the endpoint for a Brock score was varied
18 between the different studies as far as the actual
19 endpoint reported by the study.
20 And I don't think the reports of those
21 studies would have supported going back to doing a
22 consistent -- the available data wouldn't have been
23 sufficient to go back and do a sort of a consistent
24 measure of effect even ignoring the time issue, but
25 even in terms of the actual effect of actually doing

1 like an SSI or doing anything else.
2 There was a diversity of endpoints, and that
3 is one of the limitations, if you will, of the set that
4 the endpoints that are related to these scores are
5 diverse. And basically, the decision was that the
6 endpoints that were classified 3 and above were -- and
7 it wasn't just the nature of the endpoints, it was like
8 the duration of the endpoints.
9 There was a lot of factors in the scores, but
10 whatever was ranked as 3 above could be different
11 things, but were still all considered unacceptable.
12 And those ranked 1 and 2 or those ranked like 2 even if
13 there were slight effects, those slight effects might
14 have been different things, but they were all ranked as
15 being acceptable as far as saying that the method
16 needed to discriminate those two group scores. Thank
17 you, sir.
18 DR. ELLSWORTH: Yeah. Okay. I guess,
19 where I was going and hoping was like in some of these
20 microcosm experiments, if they had a control versus
21 atrazine over a given duration and they had a initial,
22 you know, index of starting conditions and they had a
23 final index, perhaps of an SSI, could you use this
24 model to try to see is it even working, I mean, I know
25 there's a parameterization specific for that.

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1 DR. ERICKSON: Yeah.
2 DR. ELLSWORTH: But I'm trying to get
3 some --
4 DR. ERICKSON: Yeah.
5 DR. ELLSWORTH: -- validation sense
6 about the model. That's what I'm -- it would be nice
7 if they had a little of that and --
8 DR. ERICKSON: Yeah. But again, well,
9 unless I'm misinterpreting you, I guess, you would be
10 getting into -- are you saying, does this model do good
11 absolute predictions for these microcosm/mesocosms.
12 But then, you would have to formulate and parameterize
13 the model --
14 DR. ELLSWORTH: Yeah. Each one.
15 DR. ERICKSON: -- for each of those 25
16 studies and I guess, the -- I don't think the state-of-
17 the-art is there to --
18 DR. ELLSWORTH: Right, no, not yet.
19 DR. ERICKSON: -- really support broad
20 -- I think, Dr. Bartell has done some really good work
21 with CASM on site-specific systems, but has involved a
22 tremendous effort to start doing, you know, things that
23 do good absolute predictions of a particular system.
24 And I'm not sure that even -- we even have the
25 information on these systems to be able to completely

1 do it for one, and each one would be an individual
2 complete effort.
3 And I would throw out the idea then as far as
4 saying that, again, starting with the
5 mesocosm/microcosm as an empirically relevant set of
6 material that defines, not so much worrying about
7 whether the model predicts those as -- the
8 microcosm/mesocosm as it defines an empirical set
9 against which the -- that we accept those effects are
10 of concern or not.
11 And that the model has a one-point
12 calibration to those, and that the model then is the
13 arbiter of the time dependence, and then unfortunately,
14 there is no microcosm/mesocosm data that -- maybe I was
15 misinterpreting your question. Are you saying, are
16 there any of these sets which have some time dependence
17 in them where we can start looking at?
18 DR. ELLSWORTH: I mean, typically, it'd
19 be really nice to have a sense that the functionality
20 in the model is appropriate for these systems if you --
21 I mean, I understand your relative extrapolation
22 concept. I think I understand that.
23 But there's really no validation that this
24 model is predicting the effect on aquatic communities
25 of atrazine; that's kind of what I'm worried about.

1 DR. ERICKSON: Well again, you know, I
2 would just fall back and say, the only thing we want
3 the model to do is to predict a reasonable effect of
4 time. And I will grant you that there's no
5 mesocosm/microcosm data which explicitly looked at
6 time-variable exposures to test that rela , even that
7 relative prediction against. And the -- and I guess,
8 the -- in a way, you're correct that the -- in terms of
9 the absolute predictions, I don't think the validation
10 -- one aspect of that validation isn't needed here.
11 Because, again, the model is calibrated to this
12 empirical set as far as the absolute level.
13 But the issue of the relative severity of the
14 different time effects, I don't think there's any data
15 within those microcosm/mesocosms to do that and the
16 question is, is there the plausibility within the model
17 processes to make this reasonable and appropriate. And
18 again, the data at long and short durations is sparse
19 in this dataset, but the -- it's not, I would say it's
20 not unreasonable that the model should be driven below
21 these points, because the --
22 I mean, the controls on the
23 microcosm/mesocosms obviously aren't shown here, but
24 there are each of these do have a control but the -- we
25 have the question of well, if there was another

1 treatment like two-fold below where this line comes
2 through, would that be an effect level or not.
3 And then here the model's passing over, you
4 know, the level score of 3, but that's the lesser of
5 the three effects is, and also is judged within the
6 context of just effects within a short duration, not
7 effects that stretch out over a season as we wanted the
8 index to do.
9 And so I'd say there are indications in the
10 data that the time dependence of the model is not
11 unreasonable, but there's not any definitive series of
12 microcosms and mesocosms that consistently tested that
13 relationship.
14 DR. ELLSWORTH: One last question on the
15 EC50, the different sets of simulations that you did
16 for the uncertainty analysis.
17 DR. ERICKSON: Yeah.
18 DR. ELLSWORTH: My question is if there
19 was an environmental effect that resulted in those --
20 in the actual individual plant species in those
21 studies, if it was because of an environmental factor,
22 then perhaps you would have gotten a correlation among
23 EC50s between different species, and in your analysis
24 with the independent sampling, that wasn't reflected.
25 I'm just asking if it should have been in there.

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1 DR. ERICKSON: Yeah. You know, that's a
2 subject near and dear to my heart, because I've spent
3 most of my research at EPA looking at environmental
4 factors that affect toxicity. And I haven't been able
5 to see anything in the atrazine literature that
6 identifies any real smoking gun.
7 There's been some efforts that haven't really
8 showed much of an effect like for temperature and that.
9 And the -- obviously, you know, light, there's the
10 exception of light but the -- but one thing I did note
11 in the dataset that sort of leads me to think that it
12 wasn't an environmental parameter is that there are
13 some studies that have looked at multiple species.
14 And I'd have to dig into my files to quote
15 the specific ones, but there was one that had one
16 species at the sensitive range relative to all other
17 species, and one species at the tolerant range. And so
18 if it was an environmental factor in that laboratory, I
19 don't think that would happen.
20 But I can't dismiss the environmental factors
21 as being part of the -- I'm sure they're, to some
22 degree, a factor in the variability. And in that case,
23 you know, our variation maybe shouldn't be the random
24 one but lowering or raising all of them. And like I
25 said, I have done that and it doesn't make any more, it

1 makes less difference than you see in this graph, and
2 so we can include that in our final analysis though,
3 so.
4 DR. PORTIER: I see a couple of more
5 questions, but I also am kind of cognizant of the time
6 and the fatigue factor that's going on here. I think
7 what I'd like to do, unless you can't hold your
8 question, is that we'll have the same panel here in the
9 morning, and we'll restart with some open questions to
10 the EPA staff. Continue this discussion before we go
11 in to the charge questions. Dr. Novak? Is that okay
12 or do you have a burning question? I see a burning
13 question unfortunately, so I'll -- go ahead and ask
14 your question.
15 DR. NOVAK: You know, I realize that I
16 am not a modeler. But I'm sitting here for three days
17 listening to somebody try to preach about this model,
18 and I'm going to quote Dr. Ellsworth: How do you know
19 if you're correct in your assumptions or with your data
20 if you don't have any form of ground truthing? Or to
21 say, hey, this is wrong or I'm right?
22 I mean, you gave a reason that you can't --
23 you would have to model for all 27 of the mesocosms.
24 Have you tried at least one, to ground truth? Well,
25 then, how do you know if you're correct, sir?

1 DR. ERICKSON: I'd say the CASM has been
2 modeled on other systems and been shown to be
3 successful as far as the processes and the structures
4 that it has. And the -- and like I said, even if we
5 did one mesocosm/microcosm and modeled it successfully,
6 which I suppose we could probably find data to do one
7 successfully, it doesn't address the basic assessment
8 issue. We're not interested in addressing the absolute
9 effects in any of these microcosm/mesocosms.
10 We're interested in something that will tell
11 us what the relative severity of a, you know, 30-day
12 exposure at 20 micrograms per liter is versus a, you
13 know, a ten-day at 100 micrograms per liter.
14 But we want that model then linked up to the
15 microcosm/mesocosm as defining what the level of
16 protection, so that the model index value we use is
17 related to what that model produces for the
18 microcosm/mesocosms that have those effects.
19 DR. PORTIER: Dr. Grue, you had
20 questions?
21 DR. GRUE: No, I can wait 'til tomorrow.
22 DR. ERICKSON: That means he's got a
23 whole 'nother topic. Please go ahead, 'cause I don't
24 want to end on such a skeptical question that I didn't
25 convince anybody of.

1 DR. GRUE: No. My mic -- this is Chris
2 Grue. My comment is that I think we need to remember
3 that this approach is really not that different from
4 the quotient where you're taking laboratory data to try
5 and predict or assess potential hazards in the field.
6 But here, we're using instead of an LC50 or an LD50,
7 we're using responses of communities as part of a
8 microcosm/mesocosm and we're actually calibrating this
9 model against those data. And everything is calibrated
10 against those data. I think that's the point you're --
11 point you're making.
12 DR. ERICKSON: Look, we had a -- in the
13 original IRED, they basically use the microcosm/
14 mesocosm to say that, you know, for durations -- in
15 which is clearly for durations in the, you know, two-
16 week to two-month range where the bulk of the data is,
17 the concentrations of concern are this and that. You
18 know, in the ten to 20 range, and that was insufficient
19 though.
20 I mean, we had to say something about, you
21 know, what happens if you have something that spikes up
22 to a hundred for just a few days. And what would this
23 simulation model, which takes the toxicity data and
24 looks at the, the mix of the plant species and has tied
25 the toxicity data to a mix of plant species, say what

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1 the -- if you do have that spike concentration, how
2 does it -- by using the model to integrate different
3 sensitive -- basically to integrate different
4 sensitivities of individual plant species over time,
5 and remember that the atrazine is a rather rapid on
6 again, off again reduction of growth. And to what
7 extent do we reduce growth in some of the species for a
8 certain amount of time, how does that relate to
9 reducing it to a lesser extent over a more extended
10 time.
11 It's the -- and in fact, to some degree, the
12 driving force of the model is just adding up over time
13 the relative growth reductions in a set of species.
14 And that, I mean, that, there's more to the model than
15 that, but that's the driving force of the model that
16 you have. Every species in the model has a certain
17 growth reduction on each day, and that accumulates over
18 the exposure period, and you're using the -- you're
19 basically using the toxicity relationships to integrate
20 exposure over time as far as the relative magnitude of
21 effect.
22 DR. GRUE: Yeah. My concerns aren't
23 necessarily with that point; that was more a point of
24 clarification. I do have some other questions for you,
25 but I'm going to wait 'til tomorrow to ask those.

1 DR. PORTIER: Okay. I think we'll break
2 for the day. I'm going to turn it over to Jim Downing
3 for any final comments.
4 MR. DOWNING: Right. I just had one
5 thing I wanted to point out to you, that all of the
6 documents that were presented today and all the
7 presentations, public comments will be available in the
8 EPA docket for this meeting, let's say, by the end of
9 the week; the next few days. We'll make that note so
10 everybody is aware of that. And, I guess, other than
11 that, I don't know of any other items of business, so I
12 guess we can pronounce ourselves adjourned until 8:30
13 tomorrow morning.
14 DR. PORTIER: We meet in this room at
15 8:30 tomorrow morning for the panel. The break room
16 will be available, but we'll meet in here. And I thank
17 EPA, and I look forward to seeing you tomorrow morning.
18 I'm sure there'll be more questions.
19 (WHEREUPON, the Meeting was adjourned at 5:20 p.m.)
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