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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 148th ACNW MEETING

5 ADVISORY COMMITTEE ON NUCLEAR WASTE

6 + + + + +

7 WEDNESDAY,

8 FEBRUARY 25, 2004

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10 ROCKVILLE, MARYLAND

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12 The Subcommittee met at the Nuclear
13 Regulatory Commission, Two White Flint North, Room
14 T2B3, 11545 Rockville Pike, at 8:00 a.m., B. John
15 Garrick, Chairman, presiding.

16

17 COMMITTEE MEMBERS:

18 B. JOHN GARRICK, Chairman

19 MICHAEL T. RYAN, Vice Chairman

20 JAMES CLARKE, Consultant

21 GEORGE M. HORNBERGER, Member

22 JOHN T. LARKINS, Executive Director, ACRS/ACNW

23 RUTH F. WEINER, Member

24

25

1 EXPERT PANEL:

2 DADE MOELLER, Keynote Speaker, Dade Moeller and
3 Associates
4 JEFFREY DANIELS, Lawrence Livermore National
5 Laboratory
6 KEITH ECKERMAN, Oak Ridge National Laboratory
7 DAVID KOCHER, SENES Oak Ridge, Inc.
8 MICHAEL THORNE, Mike Thorne and Associates (UK)
9 JOHN TILL, Risk Assessment Corporation
10
11 NRC STAFF:
12 HANS ARLT
13 JOHN BRADBURY
14 LATIF HAMDAR
15 BALER IBRAHIM
16 PHILIP JUSTUS
17 MATT KOZAK
18 TIM MCCARTIN
19 CHRIS MCKENNEY
20 TOM NICHOLSON
21 PHIL REED
22 A. CHRISTIANNE RIDGE
23 CHERYL TROTTIER
24 MITZI YOUNG
25

C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

8:01 a.m.

CHAIRMAN GARRICK: Good morning. The meeting will come to order. This is the second day of the 148th meeting of the Advisory Committee on Nuclear Waste. My name is John Garrick, Chairman of the ACNW. The other members of the committee present are Michael Ryan, George Hornberger, and Ruth Weiner. We also have a consultant with us today to the ACNW, Jim Clarke.

Today the committee will continue the working group on biosphere dose assessments for the proposed Yucca Mountain high level waste repository. Mike Lee is the designated federal official for today's initial session. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act.

I don't think we have received any written comments or requests for time to make oral statements from members of the public regarding today's sessions. However, should anyone wish to address the committee, please make your wishes known to one of the committee staff. As usual, it's requested that you speak clearly so that we can understand you and that you announce your affiliation and representation. I think

1 we'll just go directly to the chairman of the working
2 group session and proceed, Mike.
3 VICE CHAIRMAN RYAN: Thank you, Mr.
4 Chairman and good morning. Thanks again for a great
5 day yesterday. I think we had some informative and
6 thought provoking presentations. If you recall, we
7 had a homework assignment at the end of the day to
8 come in this morning and think about giving some
9 summary ideas of what you heard yesterday recognizing
10 we'll have several opportunities to discuss those
11 ideas as the day proceeds.
12 So I just wanted to open with our panel
13 chairman, Dade Moeller, and then ask him in turn to
14 maybe have you summarize a few key comments from
15 yesterday as we then go into our risk insights
16 discussion and hear about research activities in this
17 area. So Dade, thank you.
18 DR. MOELLER: Thank you, Mr. Chairman. To
19 lead off, I have written down a summary of my own
20 thoughts of what the highlights were from yesterday.
21 The panel members or even the members of the committee
22 may not agree. But I wanted to put them out of the
23 table so that we can discuss them. Then, as Mike
24 says, let's encourage all the panel members as well as
25 committee members and others to contribute your own

1 additions to my list.

2 One of the first things that I heard was

3 that there are two types of efforts in terms of doing

4 dose calculations and dose estimates. You do dose

5 estimates to evaluate compliance with the regulations.

6 We also concluded, or at least I believe we concluded,

7 that there are other calculations that you need to do

8 which extend information and incorporate other aspects

9 of the other calculation.

10 They are more for informational purposes,

11 educational purposes for perhaps hopefully that these

12 calculations will help members of the public better

13 understand what's being done and so forth. I think

14 that compliance calculations are - this isn't exactly

15 true - but they are at least straightforward. We know

16 what we need to do. The degree to which we can do it

17 is always open to question.

18 But in terms of the second set, I put down

19 some examples of what I heard yesterday. I would

20 encourage the NRC to encourage the DOE to do dose

21 calculations using all of the available sets that we

22 discussed yesterday of sources of dose coefficients,

23 in other words, do it using Title 10 Part 20, do it

24 using Federal Guidance Report Number 11, do it using

25 Federal Guidance Report Number 13. You might even

1 want to do it using NCRP Handbook 69. But that's open
2 to question.
3 The second thing I believe would be very
4 useful and it is good to have it written down so that
5 you can distribute it when questions come up is to do
6 dose calculations for different age groups. In other
7 words, you do it for the adult for compliance but do
8 it for a teenager and do it for an infant. We saw the
9 curves yesterday in which one set of curves showed the
10 dose estimates with time for Carbon 14.
11 Well, there were multiple questions about
12 those dose estimates. So certainly I believe NRC
13 should encourage DOE to reexamine those calculations.
14 We have heard time and time again about the biosphere
15 dose conversion factors. For many people, those are
16 a black box. However, DOE and the NRC, both sets of
17 staffs, have done multiple written reports in which
18 they have explained the components of the BDCFs.
19 I believe that the NRC might encourage DOE
20 to have available reports on that so that members of
21 the public, if they ask, and even members of the
22 technical community could read these reports and gain
23 a better understanding of just how those are being
24 done. Now, I want to add one other set of informative
25 reports. This was not discussed yesterday. So I want

1 to clearly acknowledge that it's simply one of my
2 suggestions.
3 We need a baseline report. Now, the
4 information is available if you read the various
5 environmental impact assessments, if you look at the
6 technical basis document for the biosphere. You can
7 find much of the information that is needed in what I
8 would call a baseline report. To be sure everybody
9 understands, here I have reference to conditions
10 within the region that will eventually be impacted by
11 the repository. In other words, what are the
12 conditions there today?
13 How much iodine is there in the
14 groundwater, technetium or plutonium or whatnot? You
15 could say why? Well, as all of us know, the Nevada
16 test sight is next door. They have done many
17 underground detonations. To me, it's very important
18 to document all of this information. This includes
19 natural background sources such as the uranium and
20 radium and so forth.
21 You could say even if we find plutonium or
22 neptunium or americium or et cetera in the ground
23 water, say someone goes out and makes a measurement
24 five minutes after the closure of the repository and
25 they find some I-129. Well, the response and the

1 almost logical response is that repository is leaking
2 and here is some iodine.
3 If you have done a baseline survey, which
4 has been done, as I say, I believe most all of the
5 data that you need are available, have those data
6 summarized in a document. That's what the condition
7 was before any waste was even placed in the
8 repository. That will be far better as a reference
9 document at that time then to go out and say the fact
10 that there's iodine there is not a problem because we
11 can do forensic tests and do atomic ratios or isotopic
12 ratios and forensically determine its source.
13 Well, fine. Well then good but it's much
14 better to have a basic document. Now, you might ask
15 who should do the compliance calculations? Well,
16 certainly both the NRC and the DOE will be doing them.
17 You might ask who should do these other extra
18 informative calculations? I believe again that NRC
19 should encourage DOE to do that.
20 The second item I have is the regulatory
21 process. We heard and we were reminded that it
22 consists of multiple steps. It permits factoring in
23 new information along the way. DOE well understands
24 this. Our science and technology panel was created to
25 continue the research, to enrich the database even

1 after the license application is submitted.

2 Why? Because there will be many

3 opportunities during that review period which

4 legislatively is stated to be three years long, from

5 2005 through 2007. Obviously the NRC staff will stay

6 active throughout that period of time. But let's

7 encourage people not to cease continuing to conduct

8 studies to reduce uncertainties and so forth.

9 The third item I have is related to

10 uncertainties. It ties in to what Dr. Till was

11 commenting on. He was pointing out, and the panel

12 obviously was not unanimous in that, but I'm unanimous

13 on it, that there are two types. One is factors that

14 have been fixed by the regulations.

15 You have to understand how Dr. Till is

16 defining this. He said there are no uncertainties.

17 He's meaning that in a strict sense. But what do

18 these include? Well, the -- He or she drinks two

19 liters of water per day. It's based on this

20 withdrawal we heard of 3,000 acre feet per day. It's

21 based on dose coefficients and at the moment Federal

22 Guidance Report Number 11.

23 Now, the panel seemingly yesterday said we

24 ought to encourage DOE to move to Federal Guidance

25 Report Number 13. But in that sense, you don't argue

1 with the dose coefficients in the Federal Guidance
2 Report because that is a decision that they are to be
3 used.
4 Now, factors that must be measured and
5 have a distribution of values include the obvious
6 things as we're irrigating the crops and there will be
7 uptake by the home gardens as well as the alfalfa and
8 so forth, food for the cows. There's uptake and those
9 uptake factors have uncertainties so we should
10 certainly continue to try to refine those. It's a
11 dynamic process as Dr. Kocher emphasized yesterday.
12 So that's one example. The biokinetics,
13 there I think, and I hope that this is not incorrect,
14 that one of the major uncertainties is the GI
15 absorption track factor for plutonium or neptunium or
16 americium. Then there's the dosimetry. That involves
17 the distribution of the radionuclides within various
18 body organs there, the types of radiation they emit,
19 the energy of those radiations, how that energy
20 deposits within the tissue and so forth.
21 So anything we can do along those lines,
22 we, NRC and DOE should be moving ahead. The NRC
23 should encourage DOE to prepare documents in which
24 they express the conservatisms and the uncertainties,
25 quantify them as best they can. What are some of the

1 uncertainties?

2 Well, one to me is the solubility of

3 plutonium. I know DOE has put a tremendous amount of

4 effort into this. They have studied colloids. In

5 fact, in the technical basis documents, there's a

6 whole section on colloids and plutonium colloid. So

7 they are making the effort. That needs to be put in

8 a form so all of us can understand. The uptakes of

9 the radionuclides, we have already talked about that.

10 The Kds for the movement of the radionuclides in the

11 soil, I gather that the Kds are one of the factors

12 that play a major role in uncertainties.

13 In a similar way, they should look at the

14 conservatisms. I don't think I've seen in anybody's

15 report, and someone will quickly correct me and please

16 do because I'd like to read about it, the long

17 effective half-lives of the alpha emitting neptunium,

18 plutonium, and americium give you a factor of two

19 conservatism in the dose estimates simply because of

20 the committed dose concept.

21 The acute versus chronic intake, the dose

22 coefficients, and I believe Keith has agreed on this,

23 are for acute. Not agreed, he knows. He can tell us.

24 It's for me to agree with him. But they are based

25 upon acute intakes. In other words, I take in the

1 whole annual intake on January 1. That's not going to
2 be the real world situation.
3 I think next we need to look at the fact
4 that there are three sets of standards; the intrusion
5 standard, the groundwater protection standard, and the
6 individual protection standard. To me, it would be
7 extremely helpful, and in fact Maryla Wasiolek
8 yesterday pointed out at least one case where which of
9 these - skip the intrusion standard - but for the
10 groundwater protection standard and the individual
11 protection standard, which one governs under what
12 circumstance and for what radionuclide?
13 To me, that's very important. In fact, if
14 you can do that, it helps people get a grasp of what's
15 going on without being confused too much by the
16 complexity of the regulations. What do I mean there?
17 Several things. The groundwater protection standards,
18 and please all of these statements will have
19 qualifications. But I think in terms of technetium
20 and iodine, the groundwater protection standards are
21 it. That's it.
22 Now, it's the formula around that Dr.
23 Kocher pointed out quite correctly. They have
24 established secondary standards so it will be the
25 picoCurie per liter limit in the two liters of

1 groundwater that you consume. But technetium and
2 iodine are in my opinion just essentially totally
3 controlled by the groundwater protection center.
4 Why do I say that? You can say there's an
5 effective dose from technetium and iodine and it has
6 to be considered in the individual protection
7 standard. But the effective dose for technetium based
8 upon FGR 11 is one-tenth of a millirem a year. Well,
9 in 15 millirem, one-tenth is not much of a
10 contribution. And for iodine it's two-tenths of a
11 millirem per year.
12 Well, I say therefore the groundwater
13 protection standard is controlling. Now, in a similar
14 manner, the groundwater protection standard is
15 controlling for radium 226 and 228 because I presume
16 that the bulk of the radium 226 and 228 that's in the
17 groundwater, which is now I think two or three
18 picoCuries per liter. It's somewhere in that
19 ballpark. In fact, they took one sample that I saw
20 the exceeded the five picoCuries per liter. Then they
21 resampled and it showed that that initial sample was
22 not correct.
23 I say or suggest that radium 226 and 228
24 are controlled by the groundwater protection standard
25 because if they are naturally occurring, they do not

1 play any role in the individual protection standard
2 because natural sources are exempt from the individual
3 protection standard. Now, where does the individual
4 protection standard play it's major role?
5 In my opinion, it's in neptunium,
6 plutonium, and americium because the bounding limit
7 under the groundwater protection standards for those
8 nuclides is 15 picoCuries per liter. Well, 15
9 picoCuries per liter permitted by the groundwater
10 protection standards gives you from three to more than
11 four times the 15 millirem a year limit. So
12 therefore, for most cases, the individual protection
13 standard will be governing.
14 Now, back to the secondary standards, Dr.
15 Kocher is absolutely correct. They have been
16 established by EPA. As I recall, it's 2,000
17 picoCuries for Carbon 14. It's 900 for technetium.
18 It's one picoCurie per liter for iodine 129. However,
19 I tried all four sets of dose coefficients. I do not
20 find four millirem per year consistently in any of
21 them.
22 Let me give you the numbers. Again, I
23 work alone so nobody checks my calculations. I
24 acknowledge they need to be checked. But if you apply
25 FGR 11 with those picoCurie per liter limits to two

1 liters of water per day for an adult, you get 3.1
2 millirem for Carbon 14, 3.9 for technetium, and 6.7
3 for iodine.
4 Now, I can understand the 6.7 for iodine
5 because EPA doesn't want to say six-tenths or four-
6 tenths of a picoCurie per liter. They want to say
7 one. And that's fully understandable. But someone
8 needs to look at those. Now, if we switch to FGR 13,
9 I came out with 3.1 for Carbon 14 and 5.7 for I-129.
10 I'm skipping technetium for the following reason.
11 When you shift to FGR 13, the organ with
12 the highest dose is the lower large intestine. In
13 that case, the dose to that organ, I don't know
14 whether the lower large intestine is an organ or
15 whether the colon is the organ. That needs to be
16 clarified. In any event, it comes out almost ten
17 picoCuries per liter.
18 Now, I'm winding down but I'm drifting
19 into Never-Never land. My fifth item is
20 considerations in terms of the groundwater. The
21 groundwater is extremely hard, as we said yesterday,
22 ranging from more than 200 to more than 1,100 parts
23 per million total dissolved solids milligrams per
24 liter. I have heard and have read the results of the
25 food consumption survey.

1 There was nothing in there about water
2 softeners. I realize the nature of the community and
3 probably not a single soul has a water softener. But
4 we are supposed to base our RMEI on the average member
5 of the community and his or her dietary habits and
6 living style. Well, there is a casino. There is a
7 hotel. There is a country store, whatever you want to
8 call it. I find it hard to believe that not one of
9 those facilities would have anything in the way of a
10 water treatment facility.
11 If they do, that's part of their living
12 style. Again, it may only be a minor thing. But I
13 would like to know about it. Is the water potable?
14 It has from 1.6 to 2.3 parts per million of fluoride.
15 One part per million of fluoride is ideal to prevent
16 dental care or to assist in preventing them. I
17 believe 2.3 will mop model your teeth if you consume
18 it long enough. Well, I don't know the ramifications.
19 But I ask, is the water potable?
20 Carrying on the earlier thing of
21 informative calculations, we have read that the
22 pumping permits, and I realize that's a permit only.
23 They are not pumping as much as the permits allow.
24 But at some time, and this is conjecture on my part,
25 but certainly before the closure of the repository,

1 you could pump that aqua for dry.

2 Now then, they have to move to a new

3 source. Whether it's practical to go 30 miles away

4 and drill a new well and pipe it over, I don't know.

5 But I would like to see DOE examine that. That would

6 add to their credibility. It need not be done,

7 insofar as I know, prior to submission of the license

8 application. It's something that could be done

9 afterwards.

10 The next to last, FGR 13, the panel pretty

11 much said go for it. That would, in my opinion, be a

12 tremendous step forward. My last point would be based

13 upon my experience, and I was not involved in WIPP but

14 Ruth Weiner was and others, after WIPP license was

15 approved, I have been told personally by Wendell Weart

16 that DOE disbanded its staff. Questions have come up

17 time and time again since that facility started

18 operation.

19 So my final urging, and it's a personal

20 statement, is that for neither the NRC nor DOE to even

21 think about disbanding their staffs until that

22 repository is closed and even after. If it's

23 approved, if it's filled and if it's closed, even

24 after that, do not disband those staffs because you

25 need the legacy of their knowledge, of your knowledge

about the facility as you move forward. I have taken up far more time than I intended. Keith, do you have comments, rebuttals, and additions?

DR. ECKERMAN: No, I think you hit all the points that I really had. I would view the compliance tool as a tool, as an instrument. I think you need to calibrate that instrument. That's these other satellite calculations that we have talked about. I think the compliance tool ought to use the latest Federal Guidance 13 dose coefficients which both the principal agencies have in the past endorsed people and allowed their use.

I would encourage the people that are responsible, if you don't have a copy of the ICRP CD, by all means, get this. We'll just have to calculate and use the ICRP 26 waiting factors that are in the regulations and recalculate what the effective dose equivalent is and use those coefficients. I'm still a little concerned about RMEI.

Is that definition being extended beyond what's really required by the law and whether that's done in a consistent manner? That's some detail that can be looked at later. But I think people should be very careful that they are not making some decisions in an inconsistent manner here as they treat RMEI. I

1 think that's basically reiterating most of what you
2 had said in one way or another.
3 DR. MOELLER: Keith, let me ask you for my
4 own education. Did you just say that the ICRP 26
5 tissue waiting factors are in the law, in the
6 regulations?
7 DR. ECKERMAN: This is the position the
8 agencies have taken. They say that you can use the
9 equivalent dose coefficients from the latest
10 dosimetry. But they want you to use the waiting
11 factors that are in part 20 and in the law. That's
12 the interpretation I have gotten from people.
13 Because of the robustness, it really
14 doesn't make a whole lot of difference. Numerically
15 you will see the difference with iodine 129 depending
16 on which set of factors you are using. That probably
17 ought to be clarified with the agencies because that
18 position I had heard some time ago.
19 VICE CHAIRMAN RYAN: And I think we heard
20 that if a licensee asks for that explicitly, they can
21 sure deal with it on an explicit request basis. But
22 I guess I didn't hear that it's a policy per se.
23 DR. ECKERMAN: Yes.
24 VICE CHAIRMAN RYAN: So it would be your
25 advice to qualify it.

1 DR. ECKERMAN: It has to be qualified. By
2 all means asked, don't take my position on it.
3 VICE CHAIRMAN RYAN: Thanks.
4 DR. MOELLER: Tim McCarten, are you in a
5 position to comment? Would you please if you can?
6 DR. MCCARTIN: No, that's not my area.
7 Chris might have some idea.
8 DR. MOELLER: All right.
9 MR. MCKENNEY: It is NRC policy that if a
10 licensee asks, they can get an exemption from the
11 definitions of part 20. Definitions in part 20
12 unfortunately do have exactly the waiting factors
13 listed in there. That is why there has to be a change
14 to allow the new system.
15 DR. MOELLER: But they can request it.
16 MR. MCKENNEY: Yes, they can request it.
17 DR. MOELLER: Thank you. David Kocher.
18 DR. KOCHER: It would make no sense to me
19 whatsoever to use the latest biokinetic models and
20 calculate effective dose equivalent. That just flunks
21 the laugh test. I would have to go look in my files.
22 But the memo I remember seeing from NRC talked about
23 you can use effective dose. I could be wrong about
24 that.
25 Dade, also I was wrong yesterday about the

1 drinking water standard apparently. I'm told that
2 there was a deal struck shall we say where the part
3 197 just has the dose standard in there and it doesn't
4 refer to the old MCLs. So you apparently are at
5 liberty to use different --
6 DR. MOELLER: Concentrations.
7 DR. KOCHER: You can derive different MCLs
8 from that based on newer biokinetic and dosimetric
9 models. That apparently is the case so I was wrong.
10 DR. MOELLER: Tim McCartin.
11 DR. MCCARTIN: Could I just qualify that?
12 I'm not aware of any deal that was struck. EPA chose
13 to write the standard in that particular way that they
14 do not explicitly point to the MCLs. There was no
15 deal that I'm aware of in that regard. That was an
16 EPA decision. The implication might have been that
17 NRC had something to do with that.
18 DR. KOCHER: No, I think this is an
19 internal EPA matter.
20 VICE CHAIRMAN RYAN: The decision was not
21 to point to MCLs at the end of the day.
22 DR. KOCHER: Apparently that's so because
23 part 197 doesn't refer to those explicitly. But
24 that's something that a lawyer in consultation with
25 EPA would have to fair it out. Congress, the Safe

1 Drinking Water Act amendments, may have something to
2 say on the issue if somebody really examined what that
3 means.
4 VICE CHAIRMAN RYAN: Tim had a comment.
5 DR. MCCARTIN: Yes, although the
6 differences between applying those MCLs and applying
7 the limits there are very small.
8 DR. KOCHER: Yes.
9 DR. MCCARTIN: It's not like there's a
10 significant difference between the two.
11 DR. KOCHER: It's how many angels could
12 dance on a head of a pin kind of thing.
13 DR. MOELLER: Dr. Till.
14 DR. TILL: I might just add a few things.
15 My first point is that compliance with standards for
16 public exposure is public business. I know that's why
17 you are here and that's why these meetings are open.
18 But in the same sense, this is as much a credibility
19 building process as it is a calculational process.
20 I have always said this. I have been
21 caught in the middle of it. I'm guilty myself as a
22 scientist of thinking that we can do the greatest
23 science, perfect calculations. But if you haven't
24 brought those exposed along so that they understand
25 what you did, then you are actually doomed to fail.

1 Yesterday I heard several times
2 opportunities for the Department of Energy or NRC or
3 whoever is responsible to earn some credibility. The
4 examples are the evaporators. Perhaps that would be
5 something simple to do if it solves the problem.
6 Visiting the dairy farm, if you have 5,000 cows out
7 there, I would know everything about that dairy farm
8 whether it plays directly or not. I would be able to
9 answer that question.
10 So I think it's important to keep in mind
11 that this is really a credibility building process.
12 I was very pleased to hear when this question came up
13 about the survey. The first time it came up, we were
14 told the survey was not done in Spanish. Finally, the
15 record was laid straight. It was done in Spanish.
16 That's crucial. So that's my first point.
17 My second point is, and I mentioned this
18 yesterday, about recommending that the Department of
19 Energy use the best science available in going through
20 this compliance process. I think that should be
21 policy. I think it needs to be decided how you do it
22 and how you implement policy. Just to make a
23 statement is one thing. But how do you decide when
24 there is new science and when you implement new
25 science?

1 That's like the dose conversion factors.
2 You can't pick and choose among the science. You
3 can't pick one dose conversion factor that makes your
4 dose lower for plutonium inhalation and higher for
5 plutonium ingestion. We know that was the case in the
6 last revision of the dose factors. So some kind of a
7 method that you are going to use the best science and
8 here's how we're going to do it.
9 This is Keith's point. I think this is a
10 crucial issue about the RMEI. I understand that
11 requirements to stay within the law. And that's
12 important because that's the way the law is set up.
13 But this is certainly not the traditional critical
14 group concept. I would certainly have, within these
15 stylized calculations, in my back pocket what the
16 critical group dose is as well just to be able to
17 answer that question.
18 I assume we're going to come back and talk
19 a little bit more today about this adult being the
20 individual exposed. I said yesterday I agree with
21 that. I want to talk a little bit more about it and
22 explain why. But I think that's going to raise some
23 questions with regard to the public. It came up
24 yesterday about children being exposed. That all
25 needs to be taken into account. There's a way to do

1 that. Maybe we can come back and discuss that some
2 more today.
3 VICE CHAIRMAN RYAN: We'll have
4 opportunities after the presentations to do that.
5 DR. TILL: Yes, I was very happy, Dade,
6 with what you said about the uncertainties of some
7 fixed and some not fixed. That's a little bit of a
8 change in the way we have done business in the past.
9 I recognize that. But the idea that the parameters
10 that define an exposure scenario for an individual in
11 the future in my view should be fixed.
12 Quite honestly, at the same time, I would
13 make that calculation with the variability in those
14 parameters and with a distribution. I think what you
15 will find is there isn't much difference. But to me,
16 like I said, it's a philosophical issue that's
17 important to lay very clearly on the table.
18 Another point that I have a little bit of
19 trouble with is this decoupling of the different
20 elements of the TPA. What we're working on, what
21 we're focusing on in this group are the biospheric
22 dose conversion factors. And that's fine.
23 VICE CHAIRMAN RYAN: John, just to be
24 clear, I think you mean the TSPA meaning the DOE
25 calculations.

1 DR. TILL: Yes, I'm sorry.

2 VICE CHAIRMAN RYAN: Okay, I just wanted

3 to be clear.

4 DR. TILL: I think what we're doing is

5 fine. It's fine to look at this. But then you need

6 to come back and look at the whole package together.

7 What worries me some is this, and it goes back to

8 credibility. I worry that this element of the

9 calculation is de-emphasized so much because the

10 uncertainty is so small and it plays such a small role

11 overall in the overall compliance process that it's

12 not given the attention it's due for the credibility

13 issues.

14 Quite honestly, if I had to predict

15 anything, I would say this is the element of the

16 compliance calculation that will give you more trouble

17 than anything in the long-term. It's because people

18 understand. They understand what you are trying to

19 do. They understand what people eat and what their

20 lifestyle is. It will get challenged. So it's

21 important that you come back and couple these together

22 in the long-term. Those are my points. Thank you.

23 DR. MOELLER: Let me go back to Dave

24 Kocher. I apologize, Dave, you were not through.

25 Please continue.

1 DR. KOCHER: The bad news is I hadn't
2 actually gotten started yet.
3 (Laughter.)
4 DR. KOCHER: I very much second John's
5 concern about this decoupling business for a number of
6 reasons. I think we all recognize we have a
7 fundamental quandary here. The reason we're putting
8 this stuff in the ground is because we think the
9 geosphere and engineered barriers do good things for
10 us. That's clearly where our greatest emphasis should
11 be placed in assessing total system performance.
12 But he biosphere plays some part. If you
13 are going to do it, you ought to try to do it
14 reasonably well. I also think that there may well be
15 some real couplings between the biosphere model and
16 the geosphere model that simply are not accounted for
17 in the present way of doing things. We learned
18 yesterday that in modeling root uptake from soil by
19 plants that there is a correlation accounted for
20 between distribution coefficients Kd and root uptake
21 factors Bv.
22 The same kind of correlation presumably
23 applies to whatever distribution coefficient you
24 assumed in your transport model to get to the well.
25 There could well be some correlations. When you don't

1 account for these, you may under-represent the overall
2 uncertainty in the system when you do stochastic
3 modeling.
4 I don't think there are a large number of
5 these couplings that would be significant. But it's
6 probably worth some thought. I also agree with Dave's
7 comment --
8 MEMBER HORNBERGER: Dave, can I? Just for
9 clarification, when you talk about coupling of the
10 transport system to plant uptake, you are suggesting
11 there could be a feedback on the transport from
12 uptake. I lost that.
13 DR. KOCHER: No, it could be that the
14 appropriate value of a root uptake value is correlated
15 with whatever Kd you assumed to transport the stuff to
16 the well because it's known in its soils that for high
17 Kd things, the root uptake factor is low. For low Kd
18 things, the root uptake factor tends to be high.
19 So by not accounting for these
20 correlations, you might under-represent uncertainty.
21 If you just treat everything as independent, of
22 course, if you have enough variables, your uncertainty
23 shrinks to very little. I don't think it's a big
24 deal. But it's worth thinking about have you cost
25 yourself something by doing this complete decoupling

1 of the biosphere model from everything?

2 MEMBER HORNBERGER: From what consistency

3 then correlation?

4 DR. THORNE: No, could I come in? I think

5 it's a genuine correlation. What Dave is saying is

6 that the mineralogy and texture of the soils is

7 related to the mineralogy and texture of the

8 underlying materials through which the radionuclides

9 are passed. Unless you recognize that these are

10 related materials, you won't build in the proper

11 correlations between the Kd values that are

12 appropriate to that material.

13 It's that underlying nature of the

14 physical system which I think goes back to Dade's

15 point that if you have a full site description report,

16 you will recognize those mineralogical and textural

17 relationships in the description. Then you will build

18 them into the model subsequently.

19 MEMBER WEINER: Isn't this what the PA,

20 performance assessment, in the general sense, does

21 anyway, or are you suggesting something beyond what

22 performance assessment does?

23 DR. KOCHER: What we have learned so far

24 is that these kinds of correlations are not accounted

25 for because the stochastic modeling of the part of the

1 performance assessment that gets you to a
2 concentration in a well is completely decoupled from
3 whatever kind of stochastic uncertainty analysis you
4 do for the biosphere component.
5 MEMBER WEINER: But the way the
6 performance assessment works is that each distributed
7 variable is sampled on. Yes, the samplings are
8 independent. But you are certainly taking into
9 account the uncertainties in both sets of variables.
10 DR. KOCHER: But the problem is this.
11 MEMBER WEINER: I'm just asking beyond
12 that.
13 DR. KOCHER: In your geosphere model, if
14 you by random sampling select a low value of Kd for
15 your transport calculation and then you at random
16 assume a low root uptake over here in the biosphere
17 model, you have ignored that correlation completely.
18 Let me give you a simple example. Suppose you have a
19 bunch of film badge readings.
20 You make a bunch of readings on a film
21 badge and you want to add them up to get the dose and
22 you want to take into account uncertainty. If you
23 treat the uncertainty in each film badge reading as a
24 random thing, the more badge readings you have, the
25 lower the uncertainty is going to get. But if there's

1 correlations, the uncertainty doesn't get as low. And
2 you have the same potential problem here.
3 MEMBER WEINER: Yes, and I can see that.
4 It seems to me that what you are suggesting, and I
5 know we did this on the web and I haven't looked at
6 the TSPA that closely, but there was an attempt to do
7 stratified sampling, do latin hypercube (PH) sampling
8 so that you at least sample more or less equally from
9 the entire range. Now, you're suggesting something
10 else. That's what I was trying to get to. You're
11 suggesting that the performance assessment include
12 positive correlations in addition to just the random
13 sampling of uncertainty.
14 DR. KOCHER: I'm just suggesting that this
15 is worth looking into to see if it matters. There
16 could be others. I haven't really thought about this.
17 Climate is a tricky business that I know nothing
18 about. But it clearly affects both suites of
19 models. Are there correlations in your
20 climate change model that you are losing by treating
21 climate as some kind of stochastic variable but treat
22 them completely independently in the geosphere
23 transport part and the biosphere part? Are you losing
24 something by this total decoupling? I have no idea
25 how important this is. But I'm just concerned that

1 something might be lost when you do this.

2 DR. MOELLER: Excuse me, David, I'm being

3 nudged from my left that we need to move along. But

4 go ahead and cover your other points. Perhaps we can

5 do the discussion later today.

6 VICE CHAIRMAN RYAN: That would be great.

7 DR. MOELLER: But raise your points.

8 DR. KOCHER: Yes, I have some specific

9 technical comments some of which I have transmitted to

10 the DOE people already and probably should wait until

11 later. It's about the modeling and parameters that

12 they chose. I won't deal with that here.

13 DR. MOELLER: Okay, thank you. Jeff, why

14 don't we move ahead then?

15 DR. DANIELS: My comments pretty much echo

16 what you have had to say, Dade. I would only like to

17 add that the extra informative calculations are an

18 imperative. It's very important that we understand in

19 a comparative sense what the age specific dose may be.

20 People want to know. The other thing that I think is

21 relevant here is there is a risk assessment

22 performed. It doesn't stop exclusively with

23 the dose calculations. It would be done with the

24 appropriate dose conversion factors along the lines of

25 Federal Guidance 13. While this is certainly in the

1 extra informative calculations, it's what the public
2 is not only asking for but is demanding.
3 Remember, we're talking here about a
4 situation that is a prospective understanding. We're
5 not talking about an epidemiologic study where people
6 are being exposed and there is evidence of effect. We
7 don't know what that effect might be. Unfortunately
8 we have a model that says it's linear through zero and
9 there's no threshold. At this point, that's the best
10 we can do. It seems to be a conservative model for
11 the purposes of analyses that are prospective.
12 So I think it's deficient not to advise
13 the public what those numbers are. I think it's also
14 important to recognize that because of the difficulty
15 in comprehending the way MCLs are derived in the
16 present based on the way they were derived in the
17 past, there's an issue here that says risk may be the
18 unifying thing. There's been arguments within the EPA
19 about how the MCLs should be appropriately
20 adjusted. The fact is that they won't be
21 raised. But they could be lowered. The fact is that
22 with all of that understanding taken into account,
23 there's a great deal of confusion among the public
24 about what might be considered right. But science
25 moves forward. Thanks to Keith and the new

1 biokinetic modeling processes that exist, there's a
2 better understanding of how that dose is converted.
3 There's an understanding within the context of today's
4 understanding of the risk what those numbers translate
5 into. Ultimately the public wants to know.
6 The other points that I would like to make
7 just in passing are I have to commend the process as
8 it exists right now because we're here due to the fact
9 that there is a defensibility and credibility to the
10 documentation. In the past, it may have been a back
11 of the envelope calculation that was done with a
12 certain degree of conservatism that everybody said
13 this is realistic or unrealistic in that case.
14 The compliance documents have now improved
15 to the point where we can take into account a
16 reasonably maximumly exposed individual. It's
17 important to emphasize what that means. Maximumly
18 exposed, this isn't just to say that it's going to be
19 everyone in the population. It's to say that we're
20 taking into account a certain degree of conservatism
21 as Dr. Till has mentioned, and we fixed it at two
22 liters a day for an adult.
23 Now, it's important to recognize within
24 extra informative information what that is
25 prospectively related to a child or a teenage. It's

1 also important to qualify the calculations to
2 recognize that indeed the dose conversion factors
3 assume, and you can correct me if I'm wrong, Keith,
4 but that you are going to get the annual dose all at
5 one time which is a little insincere but is
6 conservative.
7 With regard to pathway exposure factors
8 and uptake versus intake, I think the best that can be
9 said right now in the process is that these things be
10 documented well and that they be transparent in the
11 way that the calculations are conveyed both to the
12 public and to the regulatory agencies. Meetings like
13 this continue in the licensing process so that all of
14 the concerns, as you brought up, Dr. Kocher, are
15 vented. That's the points I would like to make.
16 DR. MOELLER: Thank you. Mike.
17 DR. THORNE: You might feel that coming
18 last I wouldn't have anything to say. But I have one
19 or two extra points. Let me endorse or suggest a way
20 forward on the RMEI. Obviously we are stuck with the
21 RMEI. I think what I missed yesterday was a narrative
22 that establishes the consistency between the RMEI and
23 the biosphere model configuration and
24 parameterization. That narrative would help us to see
25 why the calculation was what it was.

1 I think, just endorsing John's point, that
2 I would like to see a supplementary calculation with
3 a conventional critical group approach. There is a
4 gut feeling that it doesn't make an enormous
5 difference. But it would be nice to see that
6 quantified. And I don't think that's too difficult to
7 do.
8 Effectively, internationally there's a lot
9 of discussion on the geosphere biosphere interface
10 zone. It's recognized as a significant source of
11 uncertainty. Effectively, it's regulated out here by
12 the 3,000 acre feet rule. Again, if we're talking
13 supplementary calculations, that's an obvious
14 candidate for variant calculations to show the
15 implications of that regulatory decision.
16 I would mention that's currently being
17 addressed in the Bio-Prata (PH) project which I know
18 the Yucca Mountain project people have an involvement
19 in. So this is not going to be a new story to them.
20 I think the detailed analysis for contributions by
21 pathway was very welcome. Again, the words that come
22 to mind here are a narrative is what I'm looking for
23 there that describes why the results are what they are
24 and how they could be different if I made different
25 conceptual assumptions or different parametric

1 assumptions.

2 We talked about uncertainty and

3 sensitivity analyses yesterday. I think I'd like to

4 see an explicit recognition that both types of

5 analysis are appropriate and that they are

6 complimentary to each other in helping to explain the

7 system. We sort of touched on specific activity

8 models both on the iodine 129 and actually effectively

9 on the Carbon 14 and fish issues.

10 I think that reveals to you that specific

11 activity arguments can be useful. But they have to be

12 used with considerable care and you have to decide

13 what are the stable pools that are mixing with each

14 other in the system? If you don't get that straight,

15 you get the wrong answers.

16 Another big message I would send is Redox

17 sensitivity. For things like iodine and technetium

18 and a number of the actinides, chemical speciation and

19 changes with oxidizing conditions are a major factor.

20 I don't necessarily believe that those should be built

21 in at the level of assessment models. But it's

22 interesting when you look at the TSPA that the other

23 parts of the model are underlay detail models which

24 inform the actual assessment level model.

25 I don't see the same relationship between

1 the assessment level model in the biosphere and
2 detailed process-based models to define and justify
3 the parameterization and the conceptualization. I'm
4 thinking of things like soil column-type models where
5 you explicitly use Richard's equation where you
6 consider the kinetics of the processes. The
7 traceability from detailed process modeling is an area
8 that could perhaps be useful.
9 FEP analysis we briefly mentioned. One
10 thing that affects me about the FEP analysis is not
11 surprisingly because it's based upon international
12 experience the FEPs are described at a very high
13 level. They are things like human lifestyle or
14 inhalation which are nice motherhood words. But they
15 don't actually give me a very big handle on how to
16 build a real model.
17 But I think we saw very usefully that the
18 interaction matrix approach is being applied. I think
19 that gives you a very scrutable audit trail. I would
20 draw attention to the ongoing work of the
21 International Union of Radioecology in that area. I
22 would very much encourage that there is talk between
23 the DOE, the NRC and the IUR program in that area
24 because I think that's where we'll develop much more
25 structured modeling approaches.

1 I am happy with the compartmental modeling
2 approach. That's standard international practice, as
3 I say, at the assessment level, though I think we need
4 to underpin with process modeling. I am concerned
5 also that spacial heterogeneities in the system are
6 not represented in the model, that we treat the
7 biosphere as if each of those compartments was a
8 homogeneous system. We know that spacial in
9 homogeneity in soil characteristics will exist.
10 I was a little concerned with the fact
11 that when the activity has passed down through the
12 soil zone, and this goes back to Dave's question on
13 correlation and interactions, that the radioactivity
14 disappears from the system. Now, if I take the NRC
15 example where they irrigate for 15 years, 15 years
16 will drive a soluble nuclide down in the soil.
17 But when you turn off the irrigation,
18 there will be a net soil moisture deficit and
19 effectively there will be an upward suction. The
20 activity that moved down five or ten meters will move
21 back up again. You have the problem there that you
22 can build up a reservoir depth which is then recovered
23 to the soil zone and is available for exposure again.
24 It's that sort of interaction which is basically an
25 understanding that the surface hydrology and its

1 coupling to transport that is the sort of thing that
2 I see embedded in a process model.
3 I'm nearly there you will be glad to know.
4 These are the highlights. One thing we didn't touch
5 on yesterday is when I look at the underlying
6 literature, I would commend the literature. I think
7 the description of the new ERMYN model and the
8 description of where do all the parameters come from
9 is impeccably done. I can see where every number came
10 from which of course allows me to ask more questions
11 about them.
12 One of the things that strikes me there is
13 that many of the value hues (PH) are derived from
14 secondary reviews of the literature. This has a
15 number of potential problems. Some of those reviews
16 are very dated. One is that these is a Beas Review
17 from 1984, an excellent review in its time but 20
18 years old. Others are reviews that we use as a basis
19 for other models.
20 Sometimes those reviews don't fully
21 consider the full range of the primary literature.
22 Sometimes, as in IAE technical report series 364, they
23 are internally inconsistent. For example, animal
24 transfer factors are sometimes considerably higher for
25 goats than for cows for no reason from the underlying

1 primary literature and notwithstanding the fact that
2 the goat is ten times as small as a cow. That just is
3 logically wrong.
4 Sometimes the values are not applicable in
5 the local context. The Carbon 14 fact for fish which
6 is taking from IAE 364 is one example of that where it
7 might be okay if you were in a contaminated ecosystem
8 where everything was contaminated. But it's not okay
9 when you are in a fish farm where just the water is
10 contaminated.
11 There's a correlation to be mentioned.
12 When you have several secondary reviewers, you often
13 find that they point to exactly the same single
14 primary literature source. You can't treat the
15 numbers from the secondary reviewers as if they were
16 independent variables for the purpose of determining
17 a distribution.
18 I'm a bit surprised that the DOE has not
19 at some point undertaken its own comprehensive review
20 of the primary literature on transfer factors which
21 would seem to me as a desk study a relatively limited
22 cost operation and that you would get enormous
23 benefits from it. And the international community,
24 incidentally, would get enormous benefits from it.
25 Climate change, it is curious that there

1 is no recognition even of the possibility of
2 greenhouse warm states and the potential new analog
3 characteristics in the system. I'm not saying that
4 DOE should definitively assume that greenhouse warming
5 will occur. But it should at least be recognized as
6 a possibility and calculations should be made I think
7 for those alternative states. That's being addressed
8 extensively internationally.
9 Finally, on dosimetry, I think I agree
10 with everybody that use of good science implies use of
11 the latest ICRP, biokinetic, and dosimetric models.
12 We did have a discussion yesterday about where you
13 should look at variability and uncertainty. I would
14 suggest that possibly you might limit that to
15 sensitivity studies for alternative values for aerosol
16 solubility, alternative aerosol sizes, and alternative
17 gastrointestinal absorption and leave the systemic
18 bits of the model alone because that gets complicated
19 because the systemic models are carefully tuned.
20 There's a lot of correlations between the
21 internal parameters. If you get into that business,
22 I think we should leave that to Keith if anyone is
23 going to do it. That's what I have. Sorry, that was
24 quite a shopping list.
25 DR. MOELLER: No, that was great.

1 VICE CHAIRMAN RYAN: That was an excellent
2 summary of where we have been so far today. I guess
3 what I would suggest is that we turn our attention to
4 our first speaker. We can certainly pick up all of
5 these points as people think about them and digest
6 them and hear these presentations. Then we'll come
7 back for a full discussion and questions.
8 So, our first speaker up is Mr. Pat
9 LaPlante who is a senior research scientist from the
10 Center for Nuclear Waste Regulatory Analyses. For
11 those of you that did not recognize yesterday, we have
12 staff from the center on the TV screen. I'm sure they
13 can see us as well.
14 MR. LAPLANTE: Hello. Can everybody hear
15 me? My name is Pat LaPlante. I work for the Center
16 for Nuclear Waste Regulatory Analyses, the technical
17 support contractor for the NRC in the high level waste
18 program. Today I'm going to discuss risk insights for
19 biosphere modeling. I don't have a whole lot of time
20 so I'm going to provide a general overview. We'll
21 have time for questions, and we can get into some
22 details if you would like.
23 In general, I'm going to talk about how
24 our reviews of DOE documents are risk-informed. I'm
25 going to provide an overview of the biosphere risk

1 insights which will be consistent with what I
2 presented yesterday. I'm going to discuss the
3 agreements that came out of our DOE document reviews
4 and how those were risk ranked or significance ranked,
5 I should say, and discuss some of the effects of the
6 risk insights on our current work plans.
7 As I mentioned yesterday, we have been
8 conducting dose assessments for quite a while, since
9 the early '90s. So leading into the DOE document
10 reviews for the site recommendation, we already had a
11 fair amount of understanding of the basic system
12 processes. These were process level, modeling, and
13 sensitivity studies that have been published in the
14 past as well as an TSPA, total system performance
15 assessment code development activity which has gone on
16 since the early '90s to the present.
17 That's included continued refinement of
18 the biosphere models and parameters including looking
19 at intermediate results and doing confirmatory
20 calculations, verification, and so forth. That whole
21 activity has given us vast insights into how the
22 models are operating. So when we did the DOE document
23 review supporting the site recommendation report, we
24 did focus our reviews on those areas that we knew were
25 driving the calculations.

1 This was based on a process level
2 understanding because those were the tools that we had
3 at the time. The risk insights initiative, in full
4 swing, began after we had developed the comments on
5 the DOE documents. During that time, we had enhanced
6 our total system performance assessment code to allow
7 sensitivity analyses at the total system level on the
8 biosphere parameters because we had actually included
9 the biosphere model completely into our total system
10 performance assessment codes.
11 So this allowed us the ability to
12 understand how the individual biosphere parameters
13 were affecting the total system performance rather
14 than just the dose that was calculated within the
15 biosphere as a separate process model. The risk
16 insights initiative used this information to
17 significance rank the agreements we had already made
18 with DOE that they would provide information to
19 resolve our comments.
20 The risk insights essentially provided a
21 context to help us resolve the agreements. How much
22 information do we need on certain topics if they are
23 either important or not so important in the total
24 system calculation? In general, our technical work
25 over the years has been directed towards important

1 topics with large uncertainties. Obviously we're not
2 spending a lot of time focusing on the drinking water
3 consumption rate or that type of idea.
4 This slide provides just a basic overview
5 of our risk insights for the biosphere modeling. This
6 is consistent with what I presented yesterday. I've
7 broken it down into insights related to the
8 groundwater release, biosphere pathways, and those
9 related to igneous activity release. In general, for
10 the groundwater release pathways, we're seeing about
11 50 percent of the dose due to drinking water and about
12 40 percent due to crop consumption. Again, this is
13 for key radionuclides that are driving the
14 calculation.
15 The key parameters that we have determined
16 in the process level sensitivity studies include
17 distribution coefficients, plant transfer factors,
18 crop interception which is deposition of material on
19 the crop surface. In general in the crop
20 contamination models, you get a certain amount that's
21 deposited directly on the surface and a certain amount
22 that comes up through the roots. That's what gets you
23 your crop ingestion dose.
24 The uncertainty in the groundwater
25 biosphere calculations is low relative to other

1 abstractions. This influences the overall importance
2 of the groundwater release biosphere pathways and the
3 total system calculation.
4 For the igneous activity release scenario,
5 as I said yesterday, inhalation pathway dominates.
6 That's fairly clear. Key parameters include mass
7 loading and some of the exposure duration parameters.
8 Mass loading is sort of a lumped parameter that
9 includes a number of processes. Of course any of
10 those processes that are driving the mass loading
11 could also be important.
12 VICE CHAIRMAN RYAN: Excuse me. Because
13 of the problem with the slides, he needs a four
14 minute, everybody keep their place break. I hate to
15 interrupt you. But that way, folks will be able to
16 see your slides.
17 MR. LAPLANTE: Okay, sure.
18 VICE CHAIRMAN RYAN: So let's just take a
19 quick break right in place.
20 (Pause.)
21 MEMBER HORNBERGER: One thing I'd like to
22 know is that we keep using very qualitative terms;
23 low, high, medium, et cetera.
24 MR. LAPLANTE: When I say "low," I mean
25 relative to other abstractions.

1 MEMBER HORNBERGER: Relative to other
2 abstractions.
3 MR. LAPLANTE: The one I presented
4 yesterday gave you in a quantitative idea the level of
5 uncertainty that we're propagating just in the
6 biosphere calculations. Within our calculations, it's
7 within an order of magnitude that's slightly less than
8 that. DOE, as you heard, have more elements in their
9 model such as swamp coolers and slightly more involved
10 climate fluctuations and so forth.
11 They are propagating slightly more now.
12 They used to be propagating less than we were. Now,
13 with the new model, they are within about an order of
14 magnitude. But if you consider that, some of these
15 other abstractions, waste package corrosion or
16 whatever, have many orders of magnitude of variation.
17 So as those are causing the dose to flop around, the
18 biosphere is just in the background noise.
19 So that's the conceptualization at a high
20 level of how the uncertainty in the biosphere relates
21 to the total system uncertainty. You've seen those
22 horsehair diagrams, the TPA output. The variation is
23 quite large from the total system.
24 CHAIRMAN GARRICK: Question, depending how
25 you do in your uncertainty analysis, the sensitivity

1 analysis is a subset of that.

2 MR. LAPLANTE: Right.

3 CHAIRMAN GARRICK: It's very easy to pull

4 out. If you have a PDF that's an accumulation of a

5 lot of contributions, it's very easy to pull out the

6 PDFs that make that up and display very graphically

7 the sensitivity as well as the uncertainty.

8 DR. THORNE: Could I just comment on that?

9 I think we are in danger of missing something there.

10 We're in danger of thinking that all uncertainty is

11 parameter value uncertainty. To my mind, the bigger

12 issue in the biosphere is conceptual model. Have we

13 got the structure right?

14 CHAIRMAN GARRICK: Yes, sure.

15 DR. THORNE: You don't get at that by

16 doing a Monte Carlo simulation. You do that by

17 brainstorming alternative conceptual models and

18 running them through the system.

19 DR. ECKERMAN: Right, exactly.

20 MR. LAPLANTE: Right, although I think you

21 might agree that this biosphere is not extremely

22 complex compared to some biospheres. It's an arid

23 environment. There aren't a large variety of

24 activities. The rule constrains some of the aspects

25 of the conceptual model in a way. Also, given what

1 DOE presented yesterday, it's a little bit more of a
2 mathematical model.
3 When they ran a bunch of different
4 biosphere models, they get the same results. I know
5 a conceptual model might draw you to slightly
6 different biomathematical models. I understand when
7 you get into the details you can come up with all
8 kinds of different conceptual models.
9 But I think our models are maybe a level
10 above that that consider most of what we would expect
11 to be occurring in the biosphere. I don't see a lot
12 of alternative conceptual models that are missing. If
13 you know of one, we're certainly open to hearing
14 suggestions of what conceptual models are being
15 missed.
16 DR. THORNE: I think we're talking across
17 purposes in a sense. The conceptual model I had as an
18 example was the one I gave earlier where the
19 radionuclide moved to depths, is accumulated in
20 reservoir depths, and then because of changes of
21 either human irrigation or environmental conditions,
22 that reservoir becomes available. Now, that actually
23 falls outside the scope of the standard biosphere
24 models which typically operate top of the soil down
25 into about the base of the subsoil but don't operate

1 to 15, 20, 30 meters of depth. It's that wider
2 conceptualization that raises the issues in my mind.
3 MR. LAPLANTE: Is that type of process
4 really what you would expect, or is this more
5 speculative?
6 DR. ECKERMAN: No, letting the agriculture
7 land rest under heavy irrigation is often done. You
8 irrigate a field for a period of time especially
9 because the solids build up. Then you let that track
10 of land rest, not be in an agriculture practice, and
11 then come back and irrigate later.
12 MR. LAPLANTE: Right, I understand that.
13 DR. ECKERMAN: So there's a rotation like
14 how you rotate crops.
15 MR. LAPLANTE: But I mean the upwelling.
16 DR. ECKERMAN: The upwelling could occur
17 during those periods.
18 CHAIRMAN GARRICK: Certainly when I talk
19 about uncertainty I'm thinking both aleatory and
20 epistemic uncertainties. I'm not thinking of just
21 information uncertainties. You can convolute both
22 into the same distributions. You can disassemble the
23 information in such a way to display the relative
24 contributions of both types of uncertainty. And you
25 can decompose it into the sensitivity component as

1 well if you do it from the ground up with a
2 comprehensive uncertainty model.
3 MR. LAPLANTE: Isn't the iodine and
4 technetium fairly mobile in terms of wouldn't that
5 continue to wash through?
6 DR. THORNE: Technetium is only mobile in
7 oxidizing conditions. It's essentially completely
8 immobile in reducing conditions. Those are the
9 conditions that exist below the phreatic surface. So
10 if you have created a water table at depth, then
11 technetium will essentially be stuck where the Redox
12 potential is less than minus 100 millirems or
13 possibility even a bit higher.
14 With iodine, iodine tends to be immobile
15 in oxidizing conditions with high organic content in
16 the system. So if you have an organic layer and the
17 iodine hits it, then it will tend to stop. So it
18 depends on the chemistry.
19 MR. LAPLANTE: But would there be an
20 organic layer?
21 DR. THORNE: Well, that's part of site
22 characterization.
23 MR. LAPLANTE: Yes, okay. Moving forward,
24 for igneous activity, I think I already went through
25 that. So I think we're on the next slide. In the

1 next few slides, I'm going to go through the
2 agreements that were established that DOE would
3 resolve certain comments that we asked on the site
4 recommendation report.
5 I have separated these up into those
6 related to mostly or are more applicable to the
7 groundwater release biosphere pathways. Then after
8 that, I'll discuss some related to the igneous
9 activity release biosphere calculations. The
10 biosphere groundwater pathway modeling agreement
11 topics are generally ranked low significance. If
12 anyone is interested in seeing the detailed
13 descriptions or paraphrasing of the agreements, I have
14 included these on backup slides number 10 and 11.
15 I'm summarizing them in these view graphs.
16 But you can keep them handy. If you are interested in
17 looking at them, you can. The low significance,
18 again, is related to the low variability in the
19 biosphere. When we made the comments, we did
20 emphasize those parameters that were found to be
21 important in the biosphere process modeling decoupled
22 from the total system calculation.
23 These included soil partition
24 coefficients, Kds for soil leaching calculations,
25 plant transfer factors, the crop interception. We

1 also had some comments on the sampling approach. To
2 some degree this related to what Dr. Kocher was
3 mentioning about the decoupling. They had decoupled
4 their biosphere sampling from the total system
5 sampling. We were asking them to tell us whether that
6 was biasing the results or not.
7 That was maybe less of a numerical
8 importance issue as more of just a how are you doing
9 it. So in general with these risk insights, the
10 effect on our biosphere plans were that we really
11 don't have any plans to do major technical work in
12 this area. I think things are in pretty good shape.
13 DOE subsequently has improved their documentation, as
14 was noted.
15 They have gone actually quite far in
16 documenting everything. You can identify every
17 parameter that they are using in their modeling. So
18 that resolved these core agreements that we had on the
19 SR. Of course, we will continue to monitor as the
20 documents come in whether they are changing anything
21 and so forth. But we're not really conducting much
22 additional work in that area.
23 This is just to provide an example of the
24 type of technical information we used to supplement
25 our risk insights when we were focusing on these

1 particular specific agreement issues. I've chosen the
2 plant transfer parameter as an example. We did have
3 an agreement on that. We're asking DOE I believe to
4 justify the site relevance of their plant transfer
5 factor choices.
6 So to get an idea, numerically how is this
7 factor affecting our total system performance
8 assessment results, in addition to what we have known
9 from previous analyses, we did a simple perturbation
10 analysis where we perturbed the parameter that's
11 normally sampled at the high and low ends of the
12 range. We can see from here at the 10,000 years it
13 can increase from the base case, totally stochastic,
14 total system calculation about a factor of 3.7.
15 That's a fairly extreme perturbation
16 because normally you would want to look at does the
17 distribution of that parameter shift to a higher
18 level? This is actually going to the end of where the
19 point value would be. So the conclusion here would be
20 not very significant increase in risk, low risk
21 significance or low significance ranking.
22 Doing a similar look at the igneous
23 activity-related biosphere agreements, the igneous
24 activity biosphere agreement topics have more varied
25 significance rankings. Those related to mass loading

1 and inhalation of ash were ranked high or medium.
2 Those that were ranked low were related more to
3 documentation and bases for certain parameters or
4 modeling assumptions.
5 The inhalation pathway and mass loading,
6 as I have already mentioned before, is highly
7 significant. Our total system calculations, I've
8 already mentioned that so next slide.
9 DR. KOCHER: This is because this scenario
10 basically bypasses the geosphere.
11 MR. LAPLANTE: Yes, pretty much, release
12 of the inventory directly into the air from a volcanic
13 intrusion. You don't wait for the decay of things
14 like americium 241. Okay, next slide. So the effect
15 of these risk insights on our biosphere plans are
16 ongoing model development and risk analyses. So we're
17 continuing to dig into this area because it is
18 affecting the total system results.
19 This work includes refinement of the
20 inhalation models. We discussed a little bit
21 yesterday about looking into the particle size
22 assumptions and better integrating the transport and
23 mass loading models, getting a better understanding of
24 the duration of the mass loading over time and how
25 remobilization of ash after its been deposited might

1 affect that mass loading over time as well as the
2 magnitude of the value. Again, this is ongoing work
3 so we continue to look at it. I know DOE is
4 continuing to look at their approach as well.
5 So in summary, the use of risk insights is
6 integral to planning and conducting staff work. Risk
7 informing is an iterative process. It's a learning
8 process. We obviously continue to iterate our
9 calculations and assessments. As I said yesterday,
10 what we knew five years ago was more focused on the
11 process modeling. Within the biosphere, what's
12 important to that calculation? Now, with enhanced
13 capabilities, we can look how is the biosphere
14 affecting the total system results?
15 I guess the walk away with message would
16 be inhalation of volcanic ash is highly significant.
17 So we have additional work ongoing. The remainder of
18 the biosphere calculations are much less significant
19 to total system performance. Therefore, we don't have
20 any addition work planned other than to monitor what
21 DOE is doing. Of course, eventually we'll be
22 reviewing their license application. That's it.
23 VICE CHAIRMAN RYAN: Thank you very much.
24 Let me pick up on a point that Michael Thorne made
25 earlier. That is that the risk significant issue

1 identified which is inhalation of volcanic ash I
2 imagine would be particularly sensitive to those three
3 issues of solubility, particle size, and other
4 parameters that would pretty dramatically shift the
5 inhaled quantity.
6 MR. LAPLANTE: Yes.
7 VICE CHAIRMAN RYAN: Again, I concur with
8 the idea, and we touched on it yesterday, of we're
9 really talking about the intake, not the uptake. Let
10 me define that again. The intake is what I breathe
11 in. The uptake is once we get to the blood and we
12 take it forward into organs and calculate those. I
13 concur fully that Dr. Eckerman has a handle on that
14 for us all. We probably don't need to challenge that
15 nearly as much as we need to think about accurately
16 assessing that intake and the ramifications of the
17 variation of that intake.
18 MR. LAPLANTE: Right, yes, we would agree
19 with that.
20 VICE CHAIRMAN RYAN: Any questions or
21 comments? David.
22 DR. KOCHER: I guess I wanted to accept
23 your challenge about alternative conceptual models.
24 I'm pretty sure that a first order biokinetic model
25 for soil erosion is not right. I'm almost sure that

1 a first order biokinetic model for retention and
2 surface soil going downward is not right either.
3 MR. LAPLANTE: Right.
4 VICE CHAIRMAN RYAN: I'll ask the
5 question. What is?
6 MR. LAPLANTE: I would just say I think
7 it's recognized in the technical community that those
8 models are very simplistic models. In general, if you
9 talk to geochemists, they really don't like the Kd
10 approach because it's a vast simplification of a very
11 complex geochemical system. Yet, the dilemma is once
12 you go further into the details, you're dealing at the
13 atomic level with complex geochemical processes. It
14 ends up becoming a very long, drawn out project.
15 So I accept the comment. I think we do
16 need to take a look at how alternative models might
17 impact those processes. But we also have to be
18 sensitive to the fact that we can't spend a whole lot
19 of time and resources if it's not going to impact the
20 overall results. There might be some way to more
21 simply bound the effect.
22 VICE CHAIRMAN RYAN: Michael.
23 DR. THORNE: Perhaps it's just worth
24 looking at what's being done in one or two other
25 programs. The one I know about is the MACCS program

1 where we are, for example, at the Imperial College
2 using a 3-D transport equation for soil based on the
3 richness equation to get the flow in the system and
4 then admittedly using an equilibrium Kd in that
5 model. Then we're using a
6 biogeochemical model based on the SUTRA system but
7 with the add on flow and transport component. So in
8 a way, our soils are looking more like what you
9 actually do in process modeling in the geosphere
10 because the processes are actually quite the same.
11 MR. LAPLANTE: Have you compared those
12 models with the simpler models just as a matter of
13 interest?
14 DR. THORNE: We compared the earlier 1-D
15 version, the SPW-1 and SLT-1 models. Those were
16 studied in BIOMASS-2 in the validation exercise
17 against the lacimeter (PH) experiment. We've also
18 compared the data for effects like ground freezing
19 which we observed in our lacimeter (PH). So we looked
20 at things like validation of the model against solude
21 (PH) exclusion and solude (PH) recovery in freezing.
22 So in as far as we can validate those models, we have
23 done so.
24 The other one that we use, going back to
25 the point that I was making earlier, is the SHETRAN

1 surface water catch model which basically covers the
2 surface hydrology and subsurface hydrogeological
3 regime in a spatially distributed sense down to about
4 50 to 80 meters because that's the interesting zone.
5 I don't want to go into the details. But there are
6 programs where more physically-based models are being
7 deployed to underpin the assessment models.
8 In fact, when I go back, I'm having a
9 discussion with SKB who will be using a similar suite
10 of models, a mixture of possibly SHETRAN, Darcy Tools-
11 type models to explore these near surface processes.
12 But I think if you think near surface processes rather
13 than biosphere, you have a better flavor for what the
14 issues are.
15 MR. LAPLANTE: One thing to keep in mind
16 before Chris goes is for the igneous activity
17 calculations, I don't believe leaching is a
18 predominant factor in our modeling results because
19 most of those radionuclides, like americium and
20 plutonium, that are driving the dose are staying
21 pretty much in the ash blanket. Now, for the
22 groundwater pathways, we're mostly talking about
23 technetium, iodine, and uptunium (PH).
24 I know this could change if you change the
25 models. But the drinking water pathways is 50 percent

1 of that dose. So the question would be, how much
2 could you alter that other 50 percent of the dose
3 which is from the rest of the biosphere by
4 implementing a different soil model? That's the key
5 question. If it's going to be just a small amount,
6 then it obviously might not be worth it to spend a lot
7 of effort in that area.
8 We have a very large program with a lot of
9 uncertainty and other total system models that are
10 going to be more important for the total system
11 results and understanding repository behavior. Do you
12 want to divert resources from focusing on waste
13 package corrosion to get into detailed three
14 dimensional soil modeling? That's how we have to
15 weigh the decisions on how deep to go and use risk
16 insights and make those decisions. Chris, you wanted
17 to add something.
18 MR. MCKENNEY: I just wanted a point of
19 clarification. Those lacimeter (PH) studies and other
20 ones that I know of were all for below ground sources.
21 They were not for irrigation sources above. The
22 BIOMASS-2 were all lacimeter (PH) studies where the
23 source was added below the ground and the roots pulled
24 the water up the soil column which is a different
25 phenomena than what we experience with the over-

1 watering. They are there, but whether it's actually
2 an applicable analog would be a question.
3 DR. THORNE: Yes, I'll come back now. I'm
4 not saying that those are an accurate analog. What
5 I'm saying is that the type of structural model may be
6 useful in this context. It's interesting. The
7 experiments are now being jointly sponsored by ANDRA
8 because ANDRA is interested in the irrigation pathway.
9 So the extension of those experiments is now to the
10 irrigation pathway as well as the upwelling pathway.
11 VICE CHAIRMAN RYAN: Thank you. Any other
12 questions from others? Yes, Ruth.
13 MEMBER WEINER: Since your inhalation for
14 the volcanic intrusion has a high significance, what
15 kind of work are you doing to bound the uncertainty in
16 particle size in order to look at particle size
17 distribution?
18 MR. LAPLANTE: Well, we are currently
19 looking into the transport models. We're looking at
20 alternative transport models. As part of that, they
21 are looking into particle size assumptions that are
22 inherent to those models in the mass loading. All the
23 work is infused with particle size considerations.
24 The work is ongoing. Tim might be able to add more
25 technical detail to it or perhaps some of our staff in

1 San Antonio.

2 But like I said before, the key

3 uncertainty is we're dealing with volcanic ash. It's

4 fairly fine particles. There isn't a lot of data on

5 volcanic ash. We've collected some on volcanic ash in

6 Nicaragua. There is spotty information here and

7 there. But I think you have to look to analogs and so

8 forth. Tim.

9 VICE CHAIRMAN RYAN: Pat, maybe we could

10 defer to Keith Eckerman for a question. Most of the

11 action in occupational exposure circumstances are

12 below 20 microns. Probably somewhere around a micron

13 is not a bad number to think about for a lot of

14 occupational sites. Could you give us some insight as

15 to what's happening between say 10 and 100 microns of

16 what we really know? I know the ICRP has a model to

17 extend to larger particle sizes. What do you think of

18 that? What advice could you give us on that point?

19 DR. ECKERMAN: Well, the ICRP model, as

20 you just said, has a complete deposition model that's

21 run out to particles as large as 100 microns. You

22 have to consider the inhalability and how the

23 individual is actually coupled with the windspeed. It

24 gets complicated.

25 VICE CHAIRMAN RYAN: Well, let me just

1 shape that a little bit more.

2 DR. ECKERMAN: Let me just go back. In

3 occupational, through the years, like in Federal

4 Guidance 11, we used a one micron assumption with

5 regard to the particle size. Now, in publication 68

6 which is the ICRP document for the worker using the

7 newer model, we've gone to five microns as more

8 typical of the kind of aerosols that are encountered

9 in the work place.

10 Now, for the general public, assuming that

11 normal releases from facilities have gone through a

12 processing system and through filters and so forth, we

13 retain the default size as one micron. The data for

14 sizes out to AMEDS (PH) all the way from aerosols that

15 you have to characterize by their thermodynamic

16 properties rather than their particle size, density,

17 so from atomic sizes almost up to ten microns, our

18 dose coefficients appear on that ICRP CD to cover that

19 range.

20 It's difficult to get much to go beyond

21 much an AMED (PH) of ten microns with the current

22 information that's available. But for these studies

23 dealing with volcanic ash, the inhalation model that

24 you really should be using is of course not the old

25 one of Federal Guidance 11 but you should be using the

1 newer model because it's responsive to those issues.
2 I'm sure that's the case.
3 MR. LAPLANTE: Right, we're using or we're
4 currently looking into doing calculations with the
5 newer models to provide a better idea of how much
6 overestimation there is in using the previous models
7 because the newer models are more refined.
8 DR. ECKERMAN: Now, I think on the Mt. St.
9 Helens event, even the folks at North West Laboratory,
10 there was a lot of effort to collect particle size
11 information and so forth. That was a different kind
12 of --
13 MR. LAPLANTE: Yes, it was a different
14 kind of eruption. It's also arrange a lot in that
15 part of Washington State. I know there's air of
16 regions in Spokane. But it's not the best analog.
17 DR. ECKERMAN: Right, I agree it's not the
18 best.
19 MR. LAPLANTE: There have been discussions
20 between the NRC and DOE on that topic as well.
21 VICE CHAIRMAN RYAN: Could you expand just
22 a bit, Keith? You said you have to couple the
23 individual at the exposure with windspeed, direction,
24 and so forth. Gravitational settling obviously
25 becomes much more important as the particle size get

1 bigger and things leave air streams more quickly
2 rather than stay in them.
3 So what advice would you give in terms of
4 trying to create a range of scenarios? This is for
5 material that's been deposited and resuspended. So
6 that's really where we're starting. We're not looking
7 at the volcanic ash plume coming by. We're looking at
8 a redeposition and then the inhalation. What would
9 you do there?
10 DR. ECKERMAN: Well, first, it would be
11 useful to look at the information you have on particle
12 size in mass loading situations. What's going to be
13 resuspended, as you said, are going to be the fines.
14 With lack of any better information, I think I would
15 start by assuming that those may well be on the order
16 of five micron AMAD (PH) size.
17 MR. LAPLANTE: Right, I think our
18 understanding, and someone can correct me if I'm
19 wrong, but the resuspendable particles generally are
20 below the hundred micron range.
21 DR. ECKERMAN: Yes.
22 MR. LAPLANTE: That bounds the problem
23 there. Inhalables, I think less than ten or deep into
24 the lungs. So in between that ten and 100 there's --
25 DR. ECKERMAN: You must have data on what

1 the density of that material would be. I don't happen
2 to have that in the back of my mind. That's the first
3 thing of course you want to look at is what's the
4 physical density of the material?
5 MR. LAPLANTE: Right.
6 DR. ECKERMAN: That information I'm sure
7 is available to you.
8 DR. THORNE: It must be about two grams
9 per --
10 DR. ECKERMAN: And I would expect that
11 it's an order of a couple of grams.
12 MEMBER WEINER: The question I had is do
13 you have any idea of what fraction of what is
14 entrained in the ash plume would be in that particle
15 size range? That's what I meant by particle size
16 distribution really. How much? Because that's the
17 critical thing.
18 MR. LAPLANTE: What fraction of spent
19 fuel, is that what you are asking?
20 MEMBER WEINER: Yes, what fraction of what
21 is entrained in the igneous upwelling, if you will, is
22 of the particle size that can be resuspended?
23 MR. LAPLANTE: Right.
24 MEMBER WEINER: Has a micron AMED (PH) of
25 about one or two grams per cubic centimeter density.

1 MR. LAPLANTE: Well, that again I think
2 takes it back to the original source term release
3 calculations. We're looking at the whole calculation.
4 There's no analog really for a volcano erupting
5 underneath a repository. So there's inherently some
6 assumptions about particle sizes and so forth.
7 Generally, we're doing that conservatively. Tim would
8 like to say something.
9 DR. MCCARTIN: Yes, currently mass loading
10 is one of those parameters that has a lot of processes
11 in it. As Pat indicated, we are in the process of
12 trying to better quantify the uncertainties in all of
13 the assumptions and try to lay that out in a
14 systematic way what the assumptions are and better
15 understand ourselves what is the impact on the dose
16 estimate? As Pat appropriately mentioned before,
17 where do we want to focus the studies and the
18 interest?
19 VICE CHAIRMAN RYAN: I think in our
20 questions, Pat, we've covered the gamut from source to
21 transport deposition to resuspension to inhalation.
22 So there's a lot of ground covered there. Some of the
23 things carry through and some of them are unique.
24 Solubility is another one obviously that's a driver.
25 If you assume Y class or W class or under the new

1 categories and so forth, you come up with big changes
2 in numbers. I think you are on the right track. But
3 I didn't want to miss the opportunity to pick Keith's
4 brain while we're all here.
5 MR. LAPLANTE: Right.
6 VICE CHAIRMAN RYAN: Mike. Oh, I'm sorry,
7 go ahead.
8 DR. DANIELS: Do I understand correctly?
9 Are you actually making a coupled model here? You are
10 not uncoupling the BDCF process from the TSPA in this
11 particular case.
12 MR. LAPLANTE: Yes, that's correct. The
13 calculation mathematically is not uncoupled. For the
14 sake of implementing the calculation in our total
15 system performance assessment code, we do run the
16 GENII code with a unit concentration to start with.
17 Then the resulting dose is multiplied by the
18 concentration. That whole calculation is integrated
19 into the total system realization by realization
20 calculation approach.
21 So we're not doing the biosphere modeling
22 outside our total system model and then sampling those
23 results like what DOE is doing. We made a conscious
24 decision that we thought it would be better to have
25 that calculation integrated with the total system

1 parameter sampling and so forth so we could assess
2 sensitivities of individual biosphere parameters on
3 the total system results.
4 DR. DANIELS: Can you then also at least
5 qualitatively add these relationships that Dr. Kocher
6 was putting out? Can you somehow see if there are --
7 MR. LAPLANTE: You mean coupling the
8 biosphere with the saturated zone transport, like the
9 Kd issue that he was talking about.
10 DR. DANIELS: Exactly, is that possible?
11 MR. LAPLANTE: I was listening to that
12 discussion. We have the capability to coordinate
13 parameters in our TPA code. I believe we can
14 correlate any of them that we want to. We don't stop
15 the thinking if we don't explicitly correlate certain
16 parameters. We obviously thought about the issue of
17 G (PH).
18 Our hydrologists are making assumptions
19 about the chemistry of the material as it transports
20 through the groundwater. How does that impact the
21 chemistry of the material as it enters the biosphere?
22 Again, once you get into geochemistry, things become
23 very complicated very quickly. In the case of the
24 groundwater scenario, once that contaminated
25 groundwater comes out of that sprinkler and is sprayed

1 through the air and it contacts the soil, there's all
2 kinds of potential transformations that can take place
3 chemically.
4 So consulting with our geochemists, we
5 couldn't come up with a very clean association.
6 There's also the soil properties themselves that are
7 not the same as the properties in the groundwater path
8 geochemically. So they can be considered as separate
9 systems.
10 MEMBER CLARKE: Excuse me, the decoupling
11 issue is a good issue. But I think this might be a
12 bad example because it makes sense to me to have one
13 set of Kds for deep transport then another set of Kds
14 for the near surface soils.
15 MR. LAPLANTE: Right, we tried.
16 MEMBER CLARKE: I'm not sure.
17 MR. LAPLANTE: We tried in our modeling
18 process. I don't just put on the blinders on and say
19 I'm just focusing on the biosphere. We're constantly
20 interacting with our other abstraction modelers. If
21 there is something that they're doing that's
22 influencing something that I'm doing, we make that
23 integration and discuss what the potential
24 ramifications are.
25 There aren't a lot like Dr. Kocher said.

1 We haven't come up with a lot of these types of
2 interfaces. But there are some that come to mind and
3 that was one of them. There is chemistry assumptions.
4 How does that affect what we're doing in the
5 biosphere? The particle size issue obviously, we have
6 looked into that. The air transport modeler is --
7 VICE CHAIRMAN RYAN: And we appreciate
8 that's a work in progress so we'll hear more about
9 that later. I think we're at a point where we need to
10 press on to our next speaker if we may and come back
11 to any other questions on this issue.
12 DR. THORNE: Mine is just a quick one on
13 volcanic ash.
14 VICE CHAIRMAN RYAN: Please, yes.
15 DR. THORNE: The one thing that we missed
16 was the discussion of solubility. Radionuclides will
17 be incorporated in the ash if that event occurs. I
18 wondered whether any consideration had been given to
19 dissolution studies in simulated lung fluid for
20 volcanic ash because I think that might lower the
21 range of uncertainty very rapidly on the solubility
22 issue?
23 MR. LAPLANTE: Sounds like a good idea.
24 VICE CHAIRMAN RYAN: Great idea. But
25 where do we get the analog?

1 DR. THORNE: I'm suggesting you do it on
2 natural ash and look at staple trace elements in
3 natural ash leached out into lung fluid..
4 VICE CHAIRMAN RYAN: It's a possibility.
5 But again, you have the same is that a valid question
6 to at least wrestle through? Our next presentation is
7 from Ms. Cheryl Trottier, the branch chief of the
8 Radiation Protection Environmental Risk and Waste
9 Management Office of Nuclear Regulatory Research.
10 Good morning.
11 MR. TROTTIER: Good morning. I know the
12 request was for a perspective from us. What I was
13 hoping to do today was give you a little bit of
14 information, especially for the working group who
15 probably has no idea what we do in the Office of
16 Research at least to support Yucca Mountain, to give
17 you a little idea of what our research program is
18 like.
19 Basically within this branch, you can tell
20 by the name, we have a variety of disciplines. We
21 look at health effects, research, radiation
22 protection, methodologies, et cetera, and also issues
23 related to ways mostly involving dosimetry transport
24 issues like that. Basically what we do is generic
25 research. What that means is we don't directly

1 support Yucca Mountain.

2 We do research at least in this area of

3 the environmental issues mostly for decommissioning

4 sites. But because a lot of these topics, and a lot

5 of the topics you are talking about at the meeting,

6 involve other kinds of agency decisions, that kind of

7 research is very effective for multiple situations;

8 waste disposal or decommissioning.

9 At least actually at the advice of this

10 committee, we developed a research plan which Ill

11 advertise a little bit. This is the published version

12 of it. It's actually on the NRC website. Because we

13 had a very small program. We were always told how do

14 you know you're doing the right research and you need

15 to have some disciplined process.

16 So several years ago, we did develop a

17 research plan. We had a lot of stakeholder

18 involvement. We eventually had it peer reviewed. As

19 a result of all of this activity, we then prioritized

20 our research projects. Again, it's only in this area

21 which I will call, even though a lot of staff disagree

22 with this title, radionuclide transport in the

23 environment. It's not just transport. It's the whole

24 issue of environmental contamination.

25 So what I tried to focus on for this

1 particular session is that work that deals with
2 biosphere modeling. A lot of work we do does address
3 transport. I think you're going to have a separate
4 session. We can come and speak to you then about some
5 of our activities in that area.
6 In fact, prior to the research plan, we
7 really hadn't done anything in this area, at least not
8 in the time frame that I have been with this group.
9 The work we're doing is with PNNL. It was recently
10 initiated actually September 2002. So this is very
11 new work. We have set up certain objectives that
12 we're trying to address.
13 One of those is we have observed that a
14 lot of the models have parameters that either have
15 uncertainty, the data is very old. The idea was that
16 we would try to do an assessment of those parameters
17 and see where we might be able to inform the modeling
18 by attempting to address some of these uncertainty
19 issues. As I said, our overall budget is very small.
20 As you can guess, this is an enormous project.
21 So we began with a literature survey. Out
22 of that literature survey, that helped us to then
23 narrow down the field of things that we were going to
24 look at. This list is basically those lists of
25 activities that we hope we can address in the next two

1 years. This is basically a four year project,
2 hopefully, to be completed in four years.
3 We're going to focus on a few parameters
4 that we think we can have some hope of getting
5 accomplished in a fairly short amount of time. The
6 one area on the animal product transfer coefficients,
7 that may be more difficult. When we get to the next
8 slide, I'll talk a little bit about that. We have
9 already begun the process of looking at soil. That
10 will take up a fair amount of time over the next year
11 or two.
12 One of the things that we're really trying
13 to do here is work with the international community.
14 I know several of you have talked about that. There
15 are a lot of studies ongoing. The principal
16 investigator for this project has been working with
17 those who are involved in that. We're hoping actually
18 to be able to make use of some of the studies that are
19 going on in the former Soviet Union as a database of
20 trying to inform these parameter studies.
21 As a result of the literature review,
22 these are radionuclides that we decided to focus on
23 for this effort. As you can tell from the topics that
24 you are talking about, they are in fact radionuclides
25 that are important in this assessment of the Yucca

1 Mountain impact. The plants that we're proposing to
2 look at are as listed up there.
3 You can see a note next to the trees under
4 discussion. We're still in the process of discussing
5 with PNNL their feasibility of looking into these
6 larger crops. The time frame is an issue when you
7 have larger crops. So we haven't firmed up the
8 research plan for looking at the trees.
9 The same with animals. In the area of the
10 large animals, there's a lot of work going on right
11 now with cows. So we will be looking into that.
12 Again, the small animals would be handled within the
13 U.S. So that's again an issue that's under
14 discussion.
15 For now, the sampling locations have been
16 settled as being in the State of Washington which I
17 believe is actually near the Hanford site. In Nevada,
18 it is the Amargosa Valley. South Carolina, I forget
19 the town, but it is near the Barnwell site. The
20 concept was to pick sites with different degrees of
21 being arid and semi-arid, et cetera, not to pick all
22 from the same type. It would be nice to add a couple
23 more. But I don't know whether we're going to be able
24 to do that.
25 VICE CHAIRMAN RYAN: Just a quick question

1 if I may.

2 MR. TROTTIER: Sure.

3 VICE CHAIRMAN RYAN: We've heard a lot

4 about americium in our working group in the last

5 couple of days. Was that off the list for a reason?

6 Or is it bracketed by what you have there?

7 MR. TROTTIER: That's a good question.

8 I'm going to ask Phil Reed who is the project manager.

9 VICE CHAIRMAN RYAN: Thank you.

10 MR. REED: Yes, Phil Reed. We had

11 actually considered both the americium 241 and the

12 other long-lived isotope. But our focus here was

13 strictly on the groundwater irrigation pathway and not

14 in the volcanic scenario so we did not put it on our

15 top five priority. We actually have it in our top

16 six.

17 VICE CHAIRMAN RYAN: Okay.

18 MR. REED: If funding does become

19 available and if we switch to the volcanic scenario,

20 we will certainly look at americium 241.

21 MR. TROTTIER: Just as an opportunity to

22 remind you, again, our research is generic. So

23 obviously igneous activity is not a research topic for

24 us. I guess we can move to the next slide. As I

25 said, we have so far to this point published a

1 literature review. This is the literature review. It
2 is available on the NRC website.
3 Now, we have probably a few copies still
4 available. In our new electronic age, everybody wants
5 to look at everything on the web. It's much easier to
6 look at a book as a book. So it has a lot of
7 information in it. I really think the lab did a very
8 good job for this first step. As I said, this is very
9 early in the process. So unfortunately, I don't have
10 a lot of results to give you.
11 I would like to turn to slide nine please.
12 I don't want you to take any great stock in these
13 particular numbers because the QA on them is not 100
14 percent at this point. But the project manager did
15 this simply as a way to illustrate part of the issues
16 here. These are default values apparently in use for
17 various codes. As you can see, they are all over the
18 place.
19 And that is an issue. You do want to have
20 some understanding as to what causes these to be
21 different. Hopefully when we get done with this work
22 we will be able to have a better understanding of what
23 values we should be using for these transfer factors.
24 The next slide is very similar. The first one is
25 technetium. The second one is iodine. I realize the

1 numbers are very small for those in the back.

2 This is not a log scale. The other one

3 was a log scale. So these numbers are not as far

4 apart as they appear to be when you look at them in

5 this bar chart style. Nonetheless, it does show that

6 there is still a lot of variation among the codes that

7 are in use today. With that, I think I'll quit.

8 VICE CHAIRMAN RYAN: Cheryl, just a quick

9 question. I'm reminded of Dr. Thorne's comment about

10 the context of a model and making sure that you go

11 back to the fundamentals and the literature which you

12 have done. Could you react to his observation there?

13 Do you think that's on track and you are on track with

14 it?

15 MR. TROTTIER: Well, yes, I agree. I

16 think you have to look at the fundamental.

17 VICE CHAIRMAN RYAN: Thank you. Other

18 questions? David.

19 DR. KOCHER: I'll probably be completely

20 wrong again. Technetium, based on a very weak memory,

21 has been confounded by issues of potted plant studies

22 versus field studies. Help me, Michael. The potted

23 plant studies are now viewed to have limited

24 reliability. Those are the ones that give these

25 humongous values.

1 DR. THORNE: Right, yes.

2 DR. KOCHER: So maybe at a minimum when

3 you do literature reviews like this, if you haven't

4 already identified how the study was done and that

5 kind of dichotomy, it might be really helpful.

6 MR. TROTTIER: Right, I remember that

7 issue being there, yes.

8 DR. KOCHER: I think technetium is a

9 problem in a lot of these codes.

10 VICE CHAIRMAN RYAN: Ruth.

11 MEMBER WEINER: I look at your two slides

12 and I zero in on the codes I know something about and

13 forget the others. I know for example in MACCS2 there

14 were really only two or three radionuclides for which

15 the ingestion pathway was modeled and everything else

16 was done by analogy. So I would encourage you, if you

17 are in the process of recommending a model, to look

18 very carefully at what they actually did to get those

19 numbers.

20 MR. TROTTIER: Right, in fact, MACCS does

21 fall within my branch also. MACCS is undergoing major

22 revision at this point. It needs to be improved a

23 lot. That's one factor.

24 DR. MOELLER: What is the name of the

25 project leader at PNNL?

1 MR. TROTTIER: Bruce Napier.

2 DR. MOELLER: Thank you.

3 MR. TROTTIER: That's on one of the back

4 up slides.

5 DR. THORNE: Can I come back and take up

6 Dave's point? There is this difference between the

7 potted plant. I believe already the principal

8 investigator on this study has been in discussion with

9 my colleague George Shaw at Imperial College.

10 MR. TROTTIER: Yes.

11 DR. THORNE: We've conducted over about

12 the last 10 years comparisons between lacimeter (PH)

13 and column studies. We got to the stage at least for

14 chlorine, iodine, and to some extent technetium of

15 being able to relate the parameter values of the

16 models at the lacimeter (PH) scale and at the column

17 scale.

18 But you can't simply assume that the

19 transfer factor of one is the other. You need to go

20 through some sort of modeling exercise to see which

21 parameters are changed in a pot bound experiment

22 relative to a lacimeter (PH) experience because the

23 hydrology changes and the root density profile

24 changes. It's those sorts of things that affect the

25 uptake.

1 DR. KOCHER: There have been limited field
2 studies for technetium.
3 MR. TROTTIER: Right, I understand that.
4 VICE CHAIRMAN RYAN: Cheryl, you mentioned
5 studies in Russia. Could you expand a little bit on
6 what you are bringing from those studies?
7 MR. TROTTIER: I'm going to have Phil do
8 that because you might get half of my brain working
9 and half not working.
10 VICE CHAIRMAN RYAN: Okay.
11 MR. REED: Phil Reed again. These are
12 some studies that we're discussing through DOE with
13 their agreement with the former Soviet Union
14 countries. Apparently they have a lot of contaminated
15 soils and contaminated lands where the United States
16 does not. We would be interested in using those
17 particular actual lands and field studies to use for
18 our particular studies.
19 Also the fact that the cost is now
20 becoming more involved and it's almost getting
21 prohibited to do some of these animal studies
22 particularly with some of the radionuclides that we're
23 interested in. So we have talked with DOE about the
24 possibility of using their, I forget what their state
25 department agreement is with the former Soviet Union

1 countries, to make that data available to us and in
2 the process do some coordinated field studies that so
3 far have been pretty difficult to do in the United
4 States.
5 VICE CHAIRMAN RYAN: Thank you. That's
6 interesting. Other questions or comments?
7 DR. THORNE: One last one on arid zones.
8 I think one of the things that we saw when we were
9 looking at Chlorine 36 is a very strong correlation on
10 plant uptake with soil moisture stress. Basically
11 there was much greater uptake in arid conditions than
12 there was in temperate conditions. I think this is a
13 caution about applicability of the general literature
14 to the arid zone region.
15 MR. TROTTIER: Right, yes.
16 DR. THORNE: But it's also an indication
17 which I know you are aware of in formulating these
18 experiments. I would strongly suggest that
19 hydrological monitoring of the system is pretty
20 fundamental to any new studies which is interesting
21 because the bulk of the literature over the last 50 of
22 60 years, when you go to the papers, you will be hard-
23 pressed to find any information at all on the
24 hydrological status of either the lacimetery (PH)
25 studies or of the pot studies. That is a real

1 problem.

2 VICE CHAIRMAN RYAN: Thank you.

3 MR. TROTTIER: Good point.

4 VICE CHAIRMAN RYAN: We are at a break

5 point in the schedule. We are scheduled for a 15

6 minute break. Cheryl, thank you very much.

7 MR. TROTTIER: All right, thank you very

8 much.

9 VICE CHAIRMAN RYAN: We appreciate it. It

10 sounds like interesting work ahead. We will reconvene

11 at 10:25 a.m. please. Off the record.

12 (Whereupon, the foregoing matter went off

13 the record at 10:06 a.m. and went back on

14 the record at 10:24 a.m.)

15 VICE CHAIRMAN RYAN: If we could come to

16 order, please.

17 We have an additional speaker this

18 morning, Matthew Kozak from Monitor Scientific, and

19 his co-authors are Graham Smith and John Kessler from

20 EPRI, Graham Smith being from Enviros.

21 So, Matt?

22 MR. KOZAK: Thanks, Mike.

23 I appreciate the opportunity to come and

24 speak to you today. I'm here representing the EPRI

25 team that conducts performance assessments on Yucca

1 Mountain independently from DOE or NRC. And you
2 should know that EPRI has been conducting and is
3 maintaining the capability of conducting independent
4 performance assessments for 14 years on Yucca
5 Mountain.
6 And my purpose here today is, first, to
7 bring you up to date on what EPRI has done in the past
8 and is doing now in the area of biosphere. It's been
9 a very active program. And then I'm going to make a
10 few off-the-cuff remarks about some of the things that
11 I've been hearing said here at this meeting, if I may.
12 And so before I begin, I would like to
13 explain the mishmash of organizations you see up
14 there. EPRI is the organization that is sponsoring
15 the TSPA work. Over the past year, Monitor Scientific
16 has taken over the prime responsibility for the TSPA
17 itself. And one of our subcontractors is Enviros out
18 of the UK, and the principal investigator there is
19 Graham Smith.
20 So, in fact, I'm really presenting a lot
21 of the material that is Graham's work, but it was
22 cheaper for me to come than for him to come over. Or,
23 actually, he wanted to come, but he couldn't.
24 So I want to make it clear that this is
25 primarily other people's work, but it's integrated in

1 the TSPA.

2 Could I have the next one, please?

3 And, really, the main thing that I'd like

4 to do is to get across the idea that it has been a

5 very active program, and that there are a lot of

6 publications that we produced on this subject of

7 biosphere. We started in about 1996, or 1995 was when

8 the work actually originated -- and the first

9 publications coming out in '96 -- and a lot of the

10 early work on trying to establish critical groups, and

11 so forth.

12 This is back in the days when the National

13 Academy report first came out, and so there were a lot

14 of people trying to figure out what to make of this.

15 And EPRI really had a pretty strong role in helping to

16 identify key concepts that maybe should be considered

17 coming out of the NAS report. Next one, please.

18 At the same time that we were developing

19 sort of an independent capability of doing biosphere,

20 EPRI has been going along producing a large number of

21 TSPAs over the year, about one every two years -- an

22 update to the TSPA. And since '96, the biosphere has

23 been an integral part of the EPRI TSPA.

24 And here are the four most recent that

25 actually incorporate something about biosphere.

1 Previous to that they were Part 191-type analyses, and
2 so there wasn't any emphasis on biosphere.
3 And for those of you who are following the
4 EPRI program, you should know that we have just
5 completed the most recent TSPA analysis. It's in
6 press. It went to publication in December, and so it
7 should be out on the street shortly. And that
8 particular report contains a significant update to the
9 EPRI biosphere portion.
10 In addition to sort of the things that we
11 tend to see in the States, the EPRI program has been
12 an active participant in these international programs,
13 BIOMOVS and then BIOMASS. And, really, one of the key
14 areas particularly early on was, again, looking at
15 some of these things on how to define critical groups
16 and the segue into the RMEI, and so forth, and a lot
17 of the discussions that went on related to that.
18 But the group that dealt with a lot of
19 those issues was actually chaired by John Kessler from
20 EPRI, and so some of these other reports that are --
21 that have been published by the IAEA from the BIOMASS
22 program had a strong contribution for the EPRI program
23 as well.
24 Here is sort of a sampling of additional
25 publications that you may or may not be aware of.

1 These are sort of more recent publications to the
2 original ones that -- there was a large spate back in
3 '96, and more recently Graham and his co-workers have
4 been publishing again on a number of issues related to
5 Yucca Mountain.
6 So just to summarize, it is a very active
7 program. I would urge you to take a look at some of
8 the publications. They're good publications. There's
9 a lot of good information in them. It is entirely
10 independent from the DOE/NRC world, and so it provides
11 an independent viewpoint on a lot of technical issues.
12 We've done a lot of work on trying to
13 incorporate international developments into our
14 program. In fact, I've had to argue frequently with
15 Graham that he really does have to go back and use
16 Federal Guidance Report 11 instead of more recent
17 dosimetry, but that's a whole different matter. If
18 you go to the EPRI TSPAs, you'll see how we've
19 integrated that into -- into our TSPAs.
20 And beginning my segue into my comments on
21 what I've heard here, we've been using deterministic
22 biosphere dose conversion factors as a stand-alone
23 calculation at the end of the TSPA. And in the coming
24 year, we're planning on starting to work into doing
25 some Monte Carlo sensitivity analysis on the

1 parameters associated with that.

2 And as an independent group, we have come

3 up with the conclusion, based on analysis, that we can

4 use this approach, that the dynamics of the system are

5 such that the response of the biosphere is much more

6 rapid than the response of the geosphere. And that's

7 one part of the argument that suggests that you can

8 use this approach.

9 Another part is the decoupling of the

10 geosphere parameters, such as the Kd approach that

11 Dave was talking about earlier, from surface soil --

12 Kd's that are used in agricultural soils or properties

13 that are in agricultural soils, as opposed to the

14 alluvium, the deep alluvium. There is not any

15 particular reason to couple those.

16 And so we've come up with this independent

17 -- independently from the DOE/NRC kind of approach.

18 Modeling the dynamics of the system, we've been able

19 to demonstrate that, at least based on our

20 understanding of the system, that this is -- this is

21 an appropriate approach to use.

22 The second point I wanted to mention in

23 the discussions that we've heard here is -- we heard

24 a little bit about Greenhouse gas warming effect and

25 how it plays a role in the TSPA. And you should be

1 aware that EPRI, in the past, has had explicitly
2 Greenhouse gas warming kinds of scenarios in their
3 TSPA, and were aware that DOE and NRC have considered
4 this also.
5 And up until about two years ago, it was
6 an active part of the EPRI program, and then at that
7 point we stopped looking at it, because it didn't
8 matter. We found that it had inconsequential effects
9 on the total system performance. And so while we
10 understand that these things are out there and that
11 this is a potential effect, that it no longer shows up
12 as an explicit part of our TSPA.
13 The second thing that I wanted to address,
14 which may end up being more controversial than the
15 other things I've said, is we've had a lot of
16 discussion about these ancillary analyses that we
17 would do on the side, because people want to see them.
18 And I think we want to be careful about
19 this, because we are on a licensing path. And there
20 are uncertainties that are associated with making that
21 regulatory decision, and I think there are separate
22 uncertainties that are associated with scientific
23 evidence.
24 And it's sort of this argument that we had
25 yesterday that we may have scientific uncertainties,

1 and they could be substantial, but if the
2 uncertainties are all down at extremely low dose
3 levels, we don't care from a licensing perspective.
4 And I think we need to keep that clearly in mind.
5 We don't want to start sending DOE
6 marching orders that they need to start doing all
7 kinds of scientific studies, if it's going to affect
8 the licensing path. I mean, I think that's a very
9 important point that we need to keep clearly in mind.
10 Which are the uncertainties associated with the
11 regulatory process, which I'll call regulatory
12 uncertainties?
13 Those have a different flavor from the
14 scientific uncertainties. There can be a lot of
15 scientific uncertainties, but they may not affect the
16 regulatory decision. And so I think we need to really
17 keep that clearly in mind.
18 And that's all the comments I wanted to
19 make. I'll keep it short and sweet. Be glad to take
20 any questions.
21 VICE CHAIRMAN RYAN: Thank you, Matt.
22 Any questions? John?
23 DR. TILL: Yes. I'm just curious about
24 this Greenhouse effect. If you have looked at that,
25 is that published in the literature, so then --

1 MR. KOZAK: Yes.

2 DR. TILL: It is? So then this can be

3 dismissed as an issue.

4 MR. KOZAK: Well, I think this -- this

5 crept into the argument as -- as another one of these

6 scientific things that people want to see that you've

7 considered it. I think if you look at the full body

8 of literature, if you look at the DOE FEP analysis,

9 for instance, they may ultimately -- at the end of the

10 day in their TSPA, they say, "We can use paleo

11 climate."

12 But if you look at their FEP analysis, I

13 think you'll find that, yes, they recognize that the

14 Greenhouse effect occurs. They've done studies of it,

15 and they've essentially dismissed it. And that's

16 essentially what we've done. And to a large extent

17 it's based on the properties of the Yucca Mountain

18 system and how it would behave under the Greenhouse

19 situation. There's a slightly elevated rainfall, but

20 it's not -- it's not a drastic effect. It's not like

21 a coastal site where you have rises in the sea level,

22 falls in the -- falling sea level.

23 DR. TILL: Well, that doesn't exactly

24 answer the question. I mean --

25 MR. KOZAK: Yes.

1 DR. TILL: -- Michael had raised it as an
2 issue, and at least the question -- I guess he said he
3 was surprised this had not been included in the DOE
4 analysis.
5 MR. KOZAK: Right.
6 DR. TILL: Okay? So, I mean, if indeed it
7 has been considered --
8 MR. KOZAK: Yes.
9 DR. TILL: -- and considered carefully,
10 the way you get it off the table is make sure that
11 it's clearly documented somewhere --
12 MR. KOZAK: Yes.
13 DR. TILL: -- in the literature.
14 MR. KOZAK: Yes.
15 DR. TILL: The answer, you're saying, is
16 that it is. And it is --
17 MR. KOZAK: I believe it is, yes. That
18 would be my response is, yes, I believe it is well
19 documented that that does not have a significant
20 effect on the system.
21 VICE CHAIRMAN RYAN: Do you have some
22 specific references, Matt, that you could maybe point
23 us to? I don't want to try and pick your memory while
24 you stand there, but if you could think about --
25 MR. KOZAK: Well, I can speak to the EPRI

1 documentation.

2 VICE CHAIRMAN RYAN: Yes, that's what I'm

3 asking.

4 MR. KOZAK: Yes. In the EPRI

5 documentation, the '96 and the '98 versions of the

6 TSPA, although it could be as late as the 2002 TSPA --

7 I know within that range is when we decided to stop

8 spending significant effort on it, because our results

9 showed that there was no real effect.

10 VICE CHAIRMAN RYAN: And these are on the

11 list that you've given us.

12 MR. KOZAK: Yes.

13 VICE CHAIRMAN RYAN: Okay.

14 MR. KOZAK: Yes. Those would be the TSPA

15 documents that are on there.

16 VICE CHAIRMAN RYAN: Okay. I just want

17 to --

18 MR. KOZAK: Yes.

19 VICE CHAIRMAN RYAN: -- be clear about

20 where it was.

21 Dave?

22 DR. KOCHER: I want to understand your

23 comment about the dynamics of the biosphere system.

24 I gather what you're driving at there is you -- that

25 you think equilibrium-type models are appropriate. Or

1 do you have in mind a certain time scale that's short
2 when you think about things like that?
3 MR. KOZAK: Yes. When we derived the
4 biosphere dose conversion factors, we used a dynamic
5 model and reach an approach to steady-state. I won't
6 say it's equilibrium or -- what was the word
7 yesterday? Saturation. It's a steady-state -- it
8 reaches a steady-state. And when it reaches, you can
9 model it out until it -- you can do the calculation,
10 the dynamics, until it reaches some approach to that
11 steady-state, and then you say, "I'm done."
12 And you look at how long that takes, and
13 it's not that long in the analyses that we've done.
14 It's not -- it's not thousands of years. It's not --
15 and if you look at the rate of change of the plumes
16 coming from Yucca Mountain, if you remember the ones
17 on the TSPA SR yesterday, that rapid rise that
18 everyone was talking about, that's on a log scale out
19 in the hundred thousand to million decades.
20 That's actually a very slow rise, and so
21 it's basically a stationary -- you can think of it as
22 a series of stationary steady-states that the
23 biosphere has a chance to respond to.
24 DR. KOCHER: And I assume that the time to
25 steady-state or some approximation of it is pretty

1 much driven by how you model retention in soil?

2 MR. KOZAK: Yes. Yes, the surface soil

3 compartment is what drives the approach to steady-

4 state. That's correct.

5 DR. KOCHER: So you would think order of

6 a few thousand years and less is -- is basically

7 nothing on the time scale we're talking about here?

8 MR. KOZAK: I think a few thousand years

9 -- I don't think we've seen anything that's a few

10 thousand years.

11 DR. KOCHER: And it's all in the

12 assumptions, of course.

13 MR. KOZAK: Yes. On the order of a

14 thousand years would almost be constant concentration

15 on these scales.

16 DR. KOCHER: Okay. Great. Thank you.

17 MEMBER WEINER: Since you mentioned the

18 cumulative distribution functions, the TSPA results

19 that Dr. Swift showed yesterday --

20 MR. KOZAK: Yes.

21 MEMBER WEINER: -- do you have -- could

22 you point out for me any significantly different

23 results that your independent TSPA showed? Or just

24 summarize them qualitatively?

25 MR. KOZAK: Yes. Our results show

1 something quite similar. The results that we just
2 came out with, our most recent ones which I can speak
3 to, since I was most intimately involved with those,
4 show a very similar type of behavior. The exact
5 numbers may be slightly different, but the key points
6 are that it's well below the regulatory limit in --
7 within the regulatory time period, and it doesn't rise
8 to incredibly high numbers after that.
9 I mean, if you looked at those TSPA SR
10 numbers yesterday, keep in mind that the highest peak,
11 way out at a million years, is below the public dose
12 limit. It was below 100 millirems. So it's not --
13 they're not astronomical doses, even though on that
14 scale it looked like they were going way up. They're
15 not -- they're not really high.
16 MEMBER WEINER: I'm more interested --
17 MR. KOZAK: And we find something quite
18 similar.
19 MEMBER WEINER: Oh, you have that --
20 MR. KOZAK: Yes.
21 MEMBER WEINER: Are there any input
22 parameters where you differ markedly from DOE? I'm
23 interested in the -- since yours is an independent
24 TSPA, independent of both DOE and NRC --
25 MR. KOZAK: Yes.

1 MEMBER WEINER: -- I'm really interested
2 in what -- if you could highlight the differences.
3 MR. KOZAK: Okay.
4 MEMBER WEINER: And not so much, you know,
5 that it's a low dose or a high dose, but just --
6 MR. KOZAK: Sure.
7 MEMBER WEINER: -- what the differences
8 are.
9 MR. KOZAK: We are a considerably smaller
10 program than DOE or NRC.
11 MEMBER WEINER: Yes.
12 MR. KOZAK: And as a result, we rely
13 fairly heavily on their breakdown of the raw
14 information. Based on that, we come up with an
15 independent evaluation of whether or not that's
16 reasonable or if their are conceptual models represent
17 what we consider to be the best available science kind
18 of approach, and then we come up with an independent
19 approach.
20 So if we immediately go to parameters,
21 we've got to be careful, because our models are
22 different. We've got a totally different modeling
23 structure. And within that, then there's also
24 independent estimates of the parameters.
25 And so what we do is we have people on

1 subcontract who are really high-level people. We have
2 Ed Sudicky from University of Waterloo doing the
3 groundwater modeling; Frank Schwartz from Ohio State
4 doing some of the data interpretation for the
5 groundwater hydrology. So these are very well-known
6 top-level people. Graham Smith is well-known for his
7 biosphere work.
8 And so we rely on those people to come up
9 with -- by evaluating the information that both DOE
10 and NRC come up with -- to come up with their own
11 independent ideas. But primarily where we focus our
12 attention is in the assumptions and the modeling to
13 come up with independent models rather than focusing
14 so much on the parameters. We do that, too, but
15 that's probably not the crux of the difference between
16 them.
17 So it's a hard question to answer is what
18 I'm talking a long way around about is -- is we really
19 have taken a totally different approach and come up
20 with somewhat similar results, rather similar results
21 I would say.
22 MEMBER WEINER: I guess what I was trying
23 to get at was -- and maybe you can't answer the
24 question that simply -- is some significant
25 difference, either in model or in parameters or in

1 results somewhere, what -- are there any significant
2 differences? And what are they?
3 MR. KOZAK: In the realm of the biosphere,
4 there are -- I can't give you specifics off the top of
5 my head. I'm sorry.
6 CHAIRMAN GARRICK: What do you see as the
7 primary purpose of the EPRI TSPA? I know it's
8 independent and --
9 MR. KOZAK: Yes.
10 CHAIRMAN GARRICK: -- and I know industry
11 needs to have --
12 MR. KOZAK: Yes.
13 CHAIRMAN GARRICK: -- access to their own
14 resources for getting an essence of what's going on.
15 But what do you see as the primary purpose of this
16 TSPA?
17 MR. KOZAK: I think it serves as a good
18 in-depth review of both programs to make sure that --
19 CHAIRMAN GARRICK: How is it used in that
20 context? What do you --
21 MR. KOZAK: Well, I mean, we publish our
22 work and go to conferences, and so forth. And if a
23 significantly different conceptual model -- for
24 instance, let's say for some of the things we're
25 talking about here -- significantly different

1 conceptual model for inhalation, for instance, I don't
2 think we do, but that's an example.
3 If we were to have that, we'd go and
4 present it, and we would try to get it on the table --
5 get it out and published, and the information out
6 there soon enough so that it could be taken on by DOE,
7 that they would get the benefit of our independent
8 viewpoint. They could take it on if they felt they
9 needed to, or that NRC would be able to take it on as
10 they saw fit.
11 So that's really the role that we play is
12 to be able to provide information as an independent
13 evaluator of the system that might be useful to the
14 regulatory process.
15 CHAIRMAN GARRICK: Now, you've been doing
16 this for a long time. Do you -- can you point to
17 areas where you think you've influenced --
18 MR. KOZAK: Oh, yes.
19 CHAIRMAN GARRICK: -- the DOE and the NRC
20 models?
21 MR. KOZAK: Definitely. EPRI, in a number
22 of cases that I could point to, started putting some
23 of these things out first, and sort of drew
24 interaction matrices. We were the first person --
25 we're the first group to produce an interaction matrix

1 for parts of the Yucca Mountain system, for instance,
2 and that was one of the things that we saw here. That
3 was back '96, I think.
4 So that's one approach that we brought
5 from the international community and published it.
6 Whether or not it was actually seeing our work that
7 influenced DOE to start producing interaction
8 matrices, or whether it was their participation in
9 international programs, I can't say.
10 But there are a number of things along
11 those lines. We've done different types of source
12 term modeling, which is outside of the realm of this.
13 But in our TSPA, our source term modeling has been
14 significantly different from either NRC or DOE, and
15 has led to some changes in the DOE modeling.
16 CHAIRMAN GARRICK: Yes. Now, just one
17 final comment. I don't like decoupled models unless
18 what's been decoupled doesn't make any difference.
19 MR. KOZAK: Right.
20 CHAIRMAN GARRICK: What's your comment
21 about that, about your biosphere -- how coupled is
22 your biosphere model to the geosphere model?
23 MR. KOZAK: In terms of intimate coupling
24 that you need to have information from one compartment
25 that's used in the next, there's very little. But the

1 point is is that we've gone through -- about it in a
2 justified manner. We've said, "We recognize that
3 these couplings can occur, and so we want to look at
4 the dynamics of the system to justify that we can
5 decouple them."
6 My belief is that probably even though we
7 haven't seen that necessarily in this meeting, my
8 belief is probably that DOE has done that, too.
9 CHAIRMAN GARRICK: Yes. Okay. Thank you.
10 VICE CHAIRMAN RYAN: Michael.
11 DR. THORNE: Could I ask a question of
12 clarification? On the Greenhouse modeling, you
13 mentioned that the precipitation was slightly
14 increased in the Greenhouse --
15 MR. KOZAK: Yes.
16 DR. THORNE: How was the increase in
17 precipitation quantified or limited for those
18 calculations?
19 MR. KOZAK: I'm going back a couple of
20 years, and I hesitate to misspeak. We had -- we had
21 a professor of climatology on our team at the time who
22 was going through the data and the modeling that were
23 available at the time to come up with an independent
24 estimate.
25 That independent estimate was consistent

1 with the types of effects that both DOE and NRC have
2 seen from the Greenhouse gas effects in their
3 interpretations of the data and modeling as well.
4 DR. THORNE: Okay. The reason I ask, for
5 other people, is that GCM-type modeling, both
6 transient and point-estimate type, or point-in-time
7 estimate, have moved on a lot in the last sort of five
8 or six years. But one of the things I'm struck with
9 continuously is that while there is some broad
10 agreement on temperature change in those models, the
11 projections of precipitation change, even for areas
12 like Northern Europe where it's rather constrained --
13 MR. KOZAK: Yes.
14 DR. THORNE: -- are quite often very
15 variable. And one of the problems that I see with the
16 Greenhouse gas business is that you may get a
17 reasonably constrained envelope for the temperature
18 changes from modeling exercises, but you don't get
19 such a reasonably constrained envelope for the
20 precipitation changes from those modeling exercises.
21 And if you're in a non-analog situation, it's very
22 difficult to use past data to constrain the
23 precipitation regime.
24 MR. KOZAK: Yes. Although to some extent
25 -- I was going to say to some extent there is -- some

1 of the information that I'm aware of, in terms of the
2 paleo record, the correlations of CO2 records in
3 icepacks to rainfall in arid regions, and so forth, I
4 think is one of the significant bases. So you can
5 draw a correlation between Greenhouse gases in the
6 environment at a particular time and the paleo climate
7 at that time.
8 So I think that there are -- and I'm
9 stepping out of my -- my realm of particular expertise
10 here, but I know that that's one of the threads of
11 evidence that has been used.
12 DR. THORNE: Yes. And I think that's a
13 legitimate argument, but I think you have to recognize
14 that those CO2 levels are pre-Quaternary. So they're
15 more than 1.6 million years ago. In fact, often quite
16 a lot older.
17 MR. KOZAK: Yes.
18 DR. THORNE: And that a lot of other
19 elements of the climate system, like the rise of the
20 Tibetan Plateau, the drift of Antarctica, have also
21 occurred over that period. So I'm -- the world was
22 different then, and I'd be very cautious about using
23 those as a strong thread of argument, though I think
24 it -- basically, in this business we're looking for
25 every bit of argument that we can get.

1 MR. KOZAK: Yes, absolutely.

2 VICE CHAIRMAN RYAN: We have a response

3 here.

4 DR. SWIFT: Peter Swift, Bechtel SAIC and

5 Sandia Labs. The Department of Energy has not

6 attempted to use general circulation models directly

7 to do forward modeling of climate for Yucca Mountain.

8 The Department made a decision there that -- this

9 would have been many years ago, but uncertainty in

10 forward-looking climate models was just going to be

11 very great and was not going to provide a credible

12 basis for going forward.

13 Instead, we chose to look at paleo climate

14 data -- a broad range of possible sources of

15 information -- available sources of information about

16 past climates in the region, and then to model --

17 conceptually model, not numerically model, forward

18 climates with an assumption that future climates would

19 repeat those of the past.

20 We're well aware that anthropogenic change

21 may disrupt that assumption. It may create

22 anthropogenic changes that would lead to future

23 climate changes that do not follow patterns of the

24 past.

25 With respect to the magnitude of those

1 changes, changes in -- there certainly is uncertainty
2 about future precipitation and temperature. So we
3 have uncertainty bands on our future states, so we
4 have a -- and on the present state, too, for that
5 matter. But the monsoonal climate comes in drier and
6 wetter versions. So, too, is our glacial transition
7 climate, and so, too, for that matter is our future
8 flow glacial climate.
9 Those enter the geosphere modeling system
10 through changes in the amount of infiltration entering
11 the unsaturated zone. So we have low infiltration
12 states and high infiltration states, and intermediate
13 ones, for each of our future climate conditions.
14 So it's our belief that the uncertainty
15 associated with anthropogenic changes in precipitation
16 will still fall within the range of basically wet and
17 dry infiltration states that we have for our future
18 climate states.
19 Now, can we prove that? No, that -- this
20 is a conceptual statement. We believe that the
21 anthropogenic effects will not take us out of the
22 range of uncertainty already included in our models.
23 There has been quite a lot of
24 consideration given to that. That's the best I can do
25 for an answer.

1 MR. KOZAK: Yes, that's -- thank you.

2 VICE CHAIRMAN RYAN: Any last questions?

3 Yes.

4 MEMBER CLARKE: Just a follow up to Ruth's

5 question that came out in response to another question

6 -- that you're handling the source term a little

7 differently. How about transport in unsaturated zone,

8 VADOS zone --

9 MR. KOZAK: Yes.

10 MEMBER CLARKE: -- saturated zone,

11 dimensionality -- any major differences in the two

12 models that we're hearing --

13 MR. KOZAK: The short answer is yes, there

14 are differences in all those aspects. I guess to

15 borrow Dave's comment, we don't want to get up in the

16 weeds on things that are outside of the biosphere.

17 But my understanding is that other people from our

18 group will be addressing the ACNW in future meetings,

19 and certainly at that point -- in fact, I think Frank

20 Schwartz is supposed to be talking at one of the

21 upcoming ones. And he would certainly be the one to

22 address a lot of the conceptual model stuff on the

23 geosphere.

24 MEMBER CLARKE: Thank you.

25 MR. KOZAK: He's outstanding.

1 VICE CHAIRMAN RYAN: Thank you. Oh, yes.
2 I'm sorry. Dade?
3 DR. MOELLER: I don't know if it would be
4 proper, but could we ask Dr. Swift or Dr. Wasiolek
5 what impact the EPRI work has had on DOE?
6 VICE CHAIRMAN RYAN: Sure. Please be my
7 guest.
8 DR. WASIOLEK: Basically, what is going on
9 here is that Graham Smith, who is the primary author
10 or one of the primary authors of biosphere models for
11 the EPRI work, is very heavily involved in what's
12 going on in the European community in all programs
13 that are international programs that are -- like most
14 currently completed BIOMASS program, and there are
15 several programs that are going on now, like BIOPROTA
16 or BIOCLIM, and there is a whole variety of programs
17 that looks at various aspects of biosphere modeling.
18 And we are familiar with the programs. We
19 are familiar with BIOMASS and biosphere model
20 developed for BIOMASS or in -- in this effort is one
21 of the models that we compare our model with in the
22 model validation. So we just take the very same model
23 that was used for EPRI, and not because it was used
24 for -- in the EPRI evaluation, but because it is the
25 most current European model, which just happened to be

1 used by EPRI.

2 So it's a sort of coincidental correlation

3 here, I would say, plus we are -- we are not on the

4 uninhabited island. We've participated in

5 international effort. We've participated in BIOPROTA.

6 I am a task leader on one of the BIOPROTA -- I mean,

7 Mike contributes very heavily to -- I mean, he is one

8 of our primary contributors, and we really appreciate

9 this, because we are getting input from the whole

10 international community.

11 I am a member of IUR, and so we're just

12 trying to stay on top with the current development of

13 biosphere models, and so does EPRI. So this is where

14 the -- where the commonalities come in place, and not

15 because of the association with particular

16 institutions. It's just the -- that we are all trying

17 to stay abreast with the current development in the

18 discipline.

19 DR. MOELLER: Thank you. I'm glad I

20 asked.

21 (Laughter.)

22 This is a terrific answer.

23 VICE CHAIRMAN RYAN: Thank you. Any other

24 last questions? We've had a request for a couple of

25 additional speakers during this time, so -- Steve

1 Frishman I think wanted to speak. Yes?

2 MR. FRISHMAN: I just wanted to sort of

3 follow up the presentation before you have your

4 further extended discussion by pointing out that I

5 think it's important to sort of go back to before the

6 beginning of this whole discussion. And if you have

7 it handy, look at page 8 of Peter Swift's first

8 presentation yesterday. It's the false color IR

9 photograph of the region.

10 The discussion for the last day and a half

11 has, to not coin a phrase, been in the box. Now, the

12 system doesn't end at the end of the blue flow paths

13 shown on this map or on this photo. So if you go sort

14 of back to basics, when you're talking about

15 contaminants being released into the environment, very

16 quickly you get to questions of what are the -- what

17 is the fate of those contaminants?

18 And this discussion, as has the biosphere

19 model, both used by DOE and NRC, doesn't ask that

20 question. Well, we're in a situation where we know in

21 general terms the fate of those radionuclides that are

22 transported out of the repository, and that fate is

23 that they come back to the biosphere, just outside of

24 this box if they're not captured by a well.

25 And we know that we are in a closed basin.

1 We know the bottom of that basin, the bottom of the
2 gradient, which is Franklin Lake Playa, which is an
3 area south of the box, and just the very beginnings of
4 the white area due south of the box on the photograph.
5 This is an area that is an evaporative lake. When
6 there's a lot of water in the system from heavy rains,
7 it's a lake. It flooded one time this summer and
8 washed out a road across it.
9 Now, it's dry most of the time. It
10 generates a lot of dust. The water is -- when it's
11 not a lake, the water is very close to the surface.
12 If you try to walk across it, you sink in the mud, if
13 you break through the salt crust on the surface. So
14 it's an integral part of the system, and it is the --
15 the primary sink under current climate conditions for
16 the radionuclides escaping from Yucca Mountain.
17 Now, what happens if we have different
18 climate conditions? The extreme that we know of is
19 one that, at least according to the modelers, fits --
20 is bounded by the -- that the climate model that's
21 used, and the extreme representation are spring
22 deposits right at the foot of Yucca Mountain.
23 Those spring deposits right now are on the
24 order of 100 meters above the water table, and the age
25 on those spring deposits, the youngest that I know if,

1 is on the order of between 8,500 and 9,000 years. So
2 we have -- we have one extreme which is we're very
3 near the edge or very near that extreme, which is the
4 dry condition right now, and we know where the sink
5 is.
6 And we have another at least extreme from
7 the record, which is a water table 100 meters higher
8 and springs flowing out, so, therefore, Amargosa
9 Valley being essentially a large area of standing
10 water, and water that the water table is constantly
11 feeding.
12 Well, the biosphere model takes only the
13 current condition of pumping. And I think that it's
14 not out of the question that we have to, at this
15 point, say that the biosphere model is limited and
16 actually artificially truncated, both in space and
17 time, because it doesn't deal with the -- the sink of
18 those radionuclides that are right now thrown out if
19 they get below the root zone.
20 They not only, under current conditions,
21 probably do come back up, but they also are in a
22 condition to where they can, with a little bit more
23 moisture, however you break that balance, they can go
24 back down to the water table and be redeposited out in
25 the Franklin Lake Playa area, picked up by the wind,

1 and moved right back into that same biosphere where
2 you're trying to do your measurements.
3 So I think when you talk about conceptual
4 model, the conceptual model is an incomplete
5 conceptual model at this point, not -- not necessarily
6 wrong but I think clearly incomplete. And it also
7 does not take into consideration the -- even the
8 10,000-year time period, where it's possible that we
9 would not get a very rapid rise in the water table to
10 the point of springs at the location that we see this
11 one near the foot of Yucca Mountain.
12 But there are also indications of other
13 small spring deposits farther out in Amargosa Valley
14 at a lower elevation. So I think it's -- it's fine to
15 discuss the biosphere under the current condition, but
16 it has to be looked at under other conditions as well.
17 And I guess I've sort of not always,
18 because it hasn't gone on always, but I've been
19 concerned about the regulatory framework and how it is
20 applied into this system, because the regulatory
21 framework sort of makes you do it wrong. And in this
22 case, it makes you take everything out of the well,
23 and it's I think in part because the EPA rule sort of
24 drives you to the current human condition, and the
25 current human condition is that you're going to take

1 the water out of the well.

2 But if you're looking for realism, the

3 realism is that not all of the water goes up the well

4 as the regulation requires, but whatever doesn't --

5 whatever radionuclides don't go up the well come out

6 in Franklin Lake Playa to be broadly dispersed in the

7 environment.

8 So this brings to at least one more point

9 that needs to be made -- and the Europeans are much

10 more conscious of it than the people in this country

11 -- and that's that when you're talking biosphere

12 you're not only talking dose to humans, you're talking

13 about radionuclides in the environment.

14 And that's also apparently left out of

15 this whole discussion, whereas in Europe it's becoming

16 more and more common to be brought into the

17 discussion. And the regulation I think is negligent

18 in that area, at least on EPA's side, and it's -- some

19 people maybe as cynical as I figure we'll get another

20 bite at the EPA rule pretty soon. And I think that's

21 one area that we're going to be exploring, along with

22 many others.

23 So, but the biosphere discussion right now

24 I think is artificially truncated in space and time

25 and also in scope. And I'll leave that with you for

1 your future -- for your discussion.

2 MR. COLEMAN: Steve, would you -- this is

3 Neil Coleman, ACNW staff. Would you identify the

4 spring deposits that you mentioned, where they are?

5 MR. FRISHMAN: Well, there's one where if

6 you look at the blue flow lines, right at the foot of

7 Yucca Mountain you see a white line that is another

8 drainage. It's the first one that goes off to the

9 southwest. It goes all the way down to the boundary.

10 Then just to the left of there is a red

11 square or a red cross indicating a well. That's a

12 well that Nye County put down in the area of that

13 spring deposit. And then there's another one sort of

14 on the other side of the hill just north of it, on the

15 other side of the hill from there.

16 MR. COLEMAN: I believe these are the ones

17 referred to as the Lathrop --

18 MR. FRISHMAN: Yes.

19 MR. COLEMAN: -- along 95?

20 MR. FRISHMAN: Right.

21 MR. COLEMAN: Okay. I think you mentioned

22 that this was at the foot of Yucca Mountain, these are

23 20 kilometers away, 12 miles, not quite at the foot of

24 Yucca Mountain.

25 Also, the fact that you have spring

1 deposits there doesn't mean that you have -- you
2 referred to standing water bodies. At one time it was
3 thought that Las Vegas Valley was one big lake, and
4 Marty Mifflin pointed out that these, in fact, were
5 not lake deposits but spring deposits. You had,
6 certainly, a lot lusher vegetation than you see today.
7 But I just wanted to clarify --
8 MR. FRISHMAN: I'm not suggesting that
9 Amargosa Valley was one big lake. But at --
10 MR. COLEMAN: Well, you used the term
11 "standing water bodies." I just wanted to specify
12 this is 20 kilometers from Yucca Mountain, and these
13 are paleo spring deposits.
14 MR. FRISHMAN: Right. And we do know that
15 the water table, at its maximum, has been about 100
16 meters higher than it is right now. And it's no
17 coincidence that these spring deposits are at about
18 that same elevation. So I'm not suggesting that I
19 know that it was one large lake at one time, because
20 there are lots of factors that control whether it was.
21 But there was certainly surface water in the area.
22 And if you go back to I think a 1982 panel
23 from the National Academy that was chaired by Tom
24 Pickford, one of the things that they discussed about
25 the Yucca Mountain site, or a site like Yucca

1 Mountain, was concern for it as a repository, because
2 at some future time people would have access to
3 springs that could be contaminated due to releases
4 from a repository. And that becomes sort of the Yucca
5 Mountain picture.
6 And they -- they suggested in that report,
7 if I recall, that sites like that should probably be
8 -- not be looked at because of the potential future
9 danger to -- to people given climate changes and water
10 table changes.
11 Well, for your consideration.
12 VICE CHAIRMAN RYAN: Thank you.
13 Other questions or comments? Are there
14 other comments from other speakers? Yes.
15 MS. TREICHEL: Judy Treichel, Nevada
16 Nuclear Waste Task Force.
17 In the discussion, there are suggestions
18 that studies be done on victims of Hiroshima and other
19 -- perhaps Chernobyl -- where there has been
20 radiological damage and exposures to people. And I
21 found it very interesting when the suggestion was made
22 that there should be a baseline study in the area of
23 Yucca Mountain. And you will find a lot of people in
24 communities there that really want that to happen, and
25 they've never been able to get DOE to actually do

1 that.

2 And I know that there's at least one group

3 down around Shoshone and Tekopa and Death Valley

4 Junction where they've tried to find their own money

5 and find free -- free help in doing that with

6 epidemiological studies, and so forth, and they've

7 not -- I don't -- as far as I know, they haven't been

8 able to get it on.

9 But it would be interesting to go from the

10 reverse in this case and find out -- what you would

11 find out is that, by and large, the people are well.

12 And how come they're well? Why is this a good place

13 to live? And why would it be justified to create a

14 risk or to create the possibility that they would get

15 sick?

16 And you've got Amargosa Valley, which as

17 a place to live is also very attractive, and certainly

18 more rain would make it even more attractive. But

19 Nevada and Nye County and Clark County are one of the

20 fastest-growing areas in the nation, and that's

21 probably why.

22 And the Amargosa Valley region is one of

23 the few places in this country where the land is

24 affordable, and the opportunity is there that if you

25 wanted to be a subsistence farmer, if you just wanted

1 to go out, have a bunch of children, live off the land
2 so to speak, you could really do that.
3 And so that's why I think people out there
4 and people like me and others who care really --
5 really get sort of disgusted at some of the discussion
6 that goes on about the contamination and what it would
7 be and how it would work, and the idea that, well,
8 maybe if you put in water softeners that would be a
9 big help.
10 They don't need water softeners. They
11 have very good water. And even if you put water
12 softeners in, you wouldn't be irrigating with soft
13 water. You wouldn't -- you don't even drink soft
14 water.
15 But -- and the idea that you would ever
16 pump the aquifer dry -- that doesn't happen. If you
17 have wars now in the west, it's wars over water. And
18 we don't allow aquifers to be pumped dry, and that's
19 why the state engineer is sort of the sheriff in
20 Nevada these days.
21 So I just don't feel that a lot of it is
22 justified, and it certainly would do somebody some
23 good to check and see why those people are as healthy
24 as they are now and why Amargosa Valley is as
25 attractive as it is.

1 Thank you.

2 VICE CHAIRMAN RYAN: Thank you very much.

3 Any additional comments?

4 I think the schedule that we have is we're

5 probably at a break where we can break for lunch, Mr.

6 Chairman.

7 CHAIRMAN GARRICK: Sure.

8 VICE CHAIRMAN RYAN: And I think what our

9 -- let's just take a couple of minutes and think about

10 the rest of our working group session. I'd like to

11 come back after lunch -- we've had I think an

12 excellent start this morning on summary comments.

13 I would like to do that again, based on

14 this morning's presentations and any other comment you

15 might like to make about the working group session

16 overall, and then have further discussion with ACNW

17 members and any comments from other participants, and

18 spend from 1:00 to perhaps 2:00 or 2:30 with that

19 discussion, and then have an additional period for

20 public comments. And then we'll have a close of the

21 working group session.

22 And keep in mind that I think we can

23 combine -- the last item on our published agenda is to

24 think about a letter that the ACNW will generate, and

25 I think what I'd like to suggest is that we pick up

1 points for that letter in our discussion earlier, so
2 we're not repeating the same points over again.
3 So we'll try and combine those two things,
4 and then I think aim roughly at adjourning somewhere
5 around the 3:00 time or so with the working group
6 session to give people a little bit of advance for
7 planning the rest of their day.
8 Does that sound reasonable, Mr. Chairman?
9 CHAIRMAN GARRICK: Yes.
10 VICE CHAIRMAN RYAN: Okay. We'll stand
11 adjourned until 1:00.
12 (Whereupon, at 11:14 a.m., the
13 proceedings in the foregoing matter went
14 off the record and resumed at 1:01 p.m.)
15 VICE CHAIRMAN RYAN: Okay, thank you very
16 much for your attention. This is our last session for
17 this working group roundtable on biosphere issues and
18 modeling.
19 I think what I'd like to do now is have
20 each of the expert panel members offer their kind of
21 summary and closing comments, being careful not to
22 repeat too much of what was said in our summary this
23 morning from yesterday, but maybe focusing on today's
24 issues and then some of the global items and comments
25 that you might want to talk to us about.

1 I think I'll then go starting my far left
2 at the table and coming back this way, getting the
3 consultant and member comments and then we'll bring
4 our workshop to a close at that point. And that will
5 give us, I think, an excellent review for the
6 preparation of a letter which we might do.
7 I do not plan to have a separate letter-
8 writing discussion because I think this will actually
9 serve both purposes to both summarize and to give us
10 specific things to think about as we then move into a
11 letter-writing phase, perhaps a little later on. So
12 that will be two separate activities.
13 Let me turn the meeting back over to Dr.
14 Moeller for a review from the expert panel members.
15 DR. MOELLER: Okay, we'll go the opposite
16 direction.
17 Dr. Thorne, would you begin, please?
18 DR. THORNE: Yes, I think there is not a
19 lot that I want to add to what -- the remarks I made
20 this morning. I think I'm still bemused a bit by this
21 business of climate change. We heard that it had been
22 studied in the program and I'm sure that's right, but
23 there hasn't been a model underpinning of future
24 climate. As I said yesterday, future climate is very
25 much a new analog situation for the paleoclimate data,

1 so I find myself a little stuck. There hasn't been a
2 modeling study looking at greenhouse warning, no GCM
3 simulations undertaken. And then a statement you rely
4 on the paleodata, but the paleodata doesn't apply to
5 the new analog situation, so I'm still in this
6 uncertain feeling about how you bound temperature and
7 precipitation data for the future if you don't really
8 on models and if you can't legitimately rely on
9 paleodata. And there's a big question there about the
10 adequacy of the models, but either you accept some
11 sort of modeling projection of future climate or you
12 have no way of specifying a bound on future climate,
13 except sort of physical plausibility arguments that
14 say something like I don't think it's going to turn
15 into the Himalayas.
16 I'm struggling as to how DOE can provide
17 a bounding argument for future climate change that
18 allows them to eliminate it formally from the rest of
19 the assessment, if that's what they're trying to
20 achieve.
21 DR. McCARTIN: The regulation does limit
22 the climate to arid to semi-arid, so there is some
23 bound by regulation that can't go to say a tropical
24 jungle certainly, but arid, semi-arid is provided as
25 a limit.

1 DR. THORNE: Right, so I think that might
2 be the point to build on and the question will be an
3 agreement on how far you go before a climate stops
4 being defined as semi-arid and that's perhaps the
5 point for discussion.
6 DR. MOELLER: Any other comments?
7 DR. THORNE: No, that was the main one
8 that arose, I think
9 DR. MOELLER: The regulations also say and
10 Tim McCartin can undoubtedly help us, that you can
11 only use something -- I'm paraphrasing. You can only
12 use information that's on the table up to the day the
13 license application is submitted or something like
14 that although you've told us that we can incorporate,
15 improved or reduced uncertainty or parameter. But I'm
16 wondering in terms of climate change we're restricted,
17 I gather to a model that's been developed before
18 December 31st of this year or does it even apply?
19 DR. McCARTIN: I'm not sure what you're
20 referring to. Certainly it's limited to present
21 knowledge. We're looking at current conditions, but
22 I mean with everything in NRC license, I mean, if
23 after the license is submitted there's some scientific
24 breakthrough and oh gee, we now understand this that
25 would be expected to be evaluated. It would have a

1 significant effect.

2 DR. MOELLER: I'm wrong. I totally

3 misinterpreted. Thank you.

4 DR. THORNE: If I can come back, I think

5 in this case there is present knowledge in that when

6 you do GCM calculations in the future, by definition,

7 those are global simulations because they're all total

8 globe models with a grid that covers everywhere. When

9 we've used them for Northern Europe what we've done is

10 extracted a sub-domain which applies to Northern

11 Europe.

12 But you can do exactly the same thing for

13 the Western United States. You can say here are runs

14 that have been done by various people for various

15 purposes. I can acquire the data sets, abstract the

16 results and look at the range of variability of the

17 results and this might help with Tim's point. If

18 we're defining what semi-arid means, you could look at

19 the results from those models, say what the range of

20 them is and evaluate them against the semi-arid

21 criterion and that might help you to come to an

22 informed scientific view about how far you can

23 legitimately go in that directly.

24 DR. MOELLER: Okay, thank you. Jeff

25 Daniels?

1 DR. DANIELS: I'd like to just add to the
2 comments I made this morning, that I think it's
3 critical to have some quantitative approach that sort
4 of allows us to look at all three of the modeling
5 approaches, the NRC, the work that's being done at
6 EPRI and the work that was done for DOE, so that
7 there's a fluid understanding of where they are
8 different and where the comparisons are the same.
9 I find it very hard to decipher from a
10 qualitative presentation where all of the issues are
11 specifically identified. Now we talk about it, but
12 I'd like to see something more substantial in terms of
13 dismissing some issues and how other issues have been
14 addressed quantitatively, if I understood some of the
15 presentations.
16 The other thing I'd like to point out is
17 I think there has to be some further bounding analyses
18 that take into account some of the uncertainty in the
19 technetium issues that were brought up which includes
20 both the potting soil in the field study environments,
21 issues that relate to iodine biology and if there is
22 an issue with a pathway specific uptake, that those be
23 addressed as well.
24 And finally, I think that there has to be
25 a definitive statement as to what is prescribed and

1 what is going to be varied. I think it's very
2 confusing that we're following regulations on certain
3 things and we're asking the same questions over and
4 over again and I think it's very important that they
5 be identified up front as to how it's prescribed and
6 that there is an opportunity to improve those
7 calculations, either by request or by new information
8 that becomes available.
9 And I would recommend that DOE does
10 request the opportunity to use the latest dosimetric
11 calculation.
12 DR. MOELLER: Thank you. John Till?
13 DR. TILL: Just one point. I don't know
14 if this is relevant at all, but if you think about the
15 future and if there should ever be a challenge to
16 compliance at Yucca Mountain, it's probably going to
17 come from measurement data. In other words, somebody
18 measures something in something. And my question is
19 really how well the background at the site has been
20 categorized and I know everyone's response is going to
21 be to say well, I know this is done very well. It has
22 to be done very well. This is of such importance.
23 But quite frankly, I have not seen a DOE site where
24 background has been characterized thoroughly and
25 correctly. And what I mean is things like discerning

1 and defining plutonium background, for example, from
2 the weapons, from the Nevada test site.
3 This might not be relevant to what you do
4 at all, but I think in the long term, it's going to be
5 absolutely crucial for the operation of this site.
6 DR. MOELLER: Well, for new data, of
7 course, they do have QA hoops to jump through, but
8 you're talking beyond that. What about baseline data?
9 DR. TILL: Yes, baseline data, exactly.
10 But I'm talking about things like products that are
11 grown, agricultural products and to define what
12 exactly what background is right now for those
13 products, water, surface soil, whatever the media, a
14 very defensible characterization of the radiation
15 background.
16 DR. MOELLER: Thank you. Okay, Dr.
17 Kocher?
18 DR. KOCHER: Yes, I don't for one minute
19 doubt the capabilities of any of the people working on
20 these programs, but I must say that I'm kind of
21 disappointed in the effort that's been put into the
22 biosphere modeling. Much of it is not site specific,
23 if I understood. We just saw the tips of icebergs
24 here. We didn't really get into the details.
25 But I saw no evidence of any kind of site-

1 specific information on food chain transfer
2 parameters, distribution coefficients, things like
3 that that enter into the model.
4 Yes, I know that at the end of the day in
5 terms of a licensing decision, these kinds of things
6 probably don't matter, but if you're going to do
7 something, do it reasonably well because you don't
8 know what other kind of challenges are going to come
9 along. It's not totally obvious, for example, what
10 use, if any, will be made of these calculations beyond
11 10,000. I mean a court of law may have a different
12 view about what those calculations mean than what the
13 NRC and EPA do.
14 One of the things I did a little bit of
15 homework before I came here was I read this little
16 slim blue report of a review of the DOE biosphere
17 program that took place about three or four years.
18 And I was kind of struck by the things that were sort
19 of requested in here that still were left unattended,
20 many of which deal with site-specific issues of
21 transfer parameters and the model for retention and
22 the soil root zone probably not being right and here
23 are some things you think about.
24 I'm conflicted because it probably doesn't
25 matter, but yet I'd like to see it done better.

1 That's just not a very helpful statement. That's
2 really the way I feel about it though. There are just
3 some things that need some attention, if you're really
4 going to pass muster as a biosphere model by itself.
5 VICE CHAIRMAN RYAN: Just so everybody can
6 share in their thoughts today, would you tell us a bit
7 more about that publication so we can know what it is?
8 DR. KOCHER: This was a report from the
9 International Atomic Agency. It was a review of DOE's
10 biosphere modeling program. It was a small committee
11 chaired by Roger Clark. They did their work in the --
12 I think it was December 2000, January 2001 time frame.
13 VICE CHAIRMAN RYAN: Is there a document
14 number on it, that would be helpful?
15 DR. KOCHER: No, it does not have any kind
16 of -- it was published by the agency in the year 2001.
17 VICE CHAIRMAN RYAN: Okay, thanks. That's
18 fine.
19 MR. COTORNARY: Dr. Ryan, we're familiar
20 with that report. We can get copies for everyone.
21 VICE CHAIRMAN RYAN: I'm sure you would
22 be, but I just wanted to make sure everyone in the
23 audience had a chance to hear it. Thank you, Neil.
24 DR. MOELLER: I wonder if it would be
25 appropriate, Keith, you're waiting to speak.

1 DR. ECKERMAN: Well -- go ahead.

2 DR. MOELLER: What I was thinking, again,
3 Dr. Wasiolek is here. Would you comment at all on
4 that? Specifically in terms of whether the degree to
5 which your input parameters are based on site specific
6 data.

7 DR. WASIOLEK: Well, as far as -- well
8 let's start with the recommendations that were in the
9 IAEA panel report. We tried to address -- this is one
10 of the reasons, this report was one of the reasons why
11 we decided to change the model, so we could address
12 many of the panel's recommendations and we did so.

13 A lot of these are discussed in our
14 current documentation why we have chosen to select
15 specific parameters, values and we tried to present
16 arguments why we went with certain values and not the
17 other.

18 Wherever we can we try to use site
19 specific parameters when they are available. We
20 certainly use site specific parameters when it applies
21 to characteristics of dietary and lifestyle
22 characteristics of the receptor because there were
23 surveys that we have, census this data. These are
24 available.

25 Yes, this is true that we lack in the area

1 of environmental transport. And therefore, we very
2 frequently would go and use literature data. We will
3 do literature review and base our model input
4 parameter values on existing published information.
5 We try as best as we can to go to reputable sources to
6 grab something that is -- that has some weight behind
7 it.
8 We are aware that there are like, there
9 are data bases like Radflux which -- did it ever get
10 released, by the way? Officially and not under the
11 table?
12 DR. THORNE: You mean as a CD? That's
13 what I have. It's never been officially released.
14 DR. WASIOLEK: These are details like
15 this. I have had a Radflux for those who don't know,
16 it's a European Community has under the auspices of
17 International Union of Radioecology. There was this
18 very precious effort to create a data base of transfer
19 coefficients that are both under -- which incorporated
20 all the IUR data base of transfer coefficients, plus
21 coefficients, transfer coefficients that have time in
22 them.
23 And then I mean I really had my hopes high
24 because I got under the table a disk, a CD, and I've
25 had it in my drawer for I don't know how many years.

1 Can I use it? No. Because we are working in the
2 highly regulated environment. These are not the types
3 of publications that we can use although I mean you
4 can use them in academia. You can use them under some
5 other circumstances, so very frequently this was a
6 problem that we were facing. We were aware of some
7 available information, some data base. And it was a
8 big effort. It's not something that you can do in your
9 spare time. I mean there were a lot of people
10 involved and yet, they could not finish the job and
11 make the CD available in an official format to
12 everybody.
13 So it has original data. It has the
14 original measurements. It does not contain some
15 chewed up something. So we were trying, as best as we
16 could to rely on available information, adjust it
17 wherever we could for site specificity and in terms of
18 characteristics of the receptor, I think we did a
19 pretty job of that.
20 In terms of environmental transport, we
21 have a lot of generic information. But we try to bind
22 it as far as we could, such that we made sure that we
23 did not underestimate the value of the dose which
24 certainly, I'm sure, is appreciated by the
25 stakeholders.

1 DR. KOCHER: Can you do something about
2 your item model in soil? Please.
3 DR. WASIOLEK: Well --
4 DR. KOCHER: Please.
5 DR. WASIOLEK: We can --
6 DR. KOCHER: You can't claim that that's
7 an overestimation of dose.
8 DR. WASIOLEK: Maybe Dave would like to
9 comment on that.
10 DR. KOCHER: It's possible that you're too
11 low by a factor of a 100 or a 1000 given the way you
12 modeled the system?
13 DR. WASIOLEK: I think that if you factor
14 in iodine-27 we are too high by several orders of
15 magnitude.
16 DR. MOELLER: There's work remaining
17 there. Thank you. That was helpful.
18 We'll move --
19 DR. THORNE: Could I? I think I would
20 just like to endorse the remarks that have just been
21 made. I think it was behind one of my remarks this
22 morning that for a small amount of additional resource
23 and I don't point this on DOE, I point this on waste
24 management organizations in Europe and the U.S.
25 together. I think we could have moved to a much more

1 comprehensive data base at the sort of level of
2 comprehensiveness that I think that we for internal
3 dosimetry.
4 It's worth recognizing that we don't have
5 the same well characterized, well defined data base
6 for environmental transport parameters. We have a
7 number of partial data bases as has been outlined and
8 IAA technical report 364 is an absolutely wonderful
9 example of that. You look through it. You think this
10 is an IAA standard document. It's got all the numbers
11 I need. No it hasn't. It's got a sprinkling of some
12 numbers, some of which I trust and some of which I
13 don't trust. And I'm hoping the current EMRAS project
14 for the agency, if properly funded and directed, ought
15 to deliver us the sort of level of comprehensive
16 documentation of transfer factors that we haven't
17 quite got in the Radflux data base and that we know
18 that everybody has got in their drawer around the
19 world. But it just needs to be brought out and
20 systematized in that fully qualified assured for use.
21 We just aren't at that stage yet.
22 DR. MOELLER: I wonder, David, if you
23 could -- you said iodine doses in your opinion are
24 under estimated by a significant. Now why -- could
25 you share with us specifically why you believe -- why

1 you have adopted, reached that conclusion?

2 DR. KOCHER: As I understand it, and

3 again, I'm just looking at -- I haven't seen the

4 details. As I understand it, their model assumes that

5 iodine is quite mobile in the surface soil region, so

6 therefore that equilibrium or its steady state, the

7 concentration of iodine 129 in soil is not that much

8 higher than the concentration in water because it kind

9 of just flushes right on through. You don't have this

10 long-term build up over hundreds of years like you do

11 for plutonium say.

12 But there's plenty of information out

13 there to indicate that iodine is a lot less mobile in

14 surface soils than people commonly believe and so the

15 equilibrium, the steady state concentration of iodine

16 129 in the surface soil compartment conceivably could

17 be a lot higher than what they're assuming and of

18 course, the food chain dose is directly proportionate

19 to that increase.

20 DR. MOELLER: Thank you. Well, that

21 clarifies it certainly for me.

22 DR. THORNE: Can I clarify as well? There

23 is an experimental program in the Narick side which I

24 mentioned this morning, where we've been putting

25 iodine, actually using iodine-125 as a tracer and

1 putting it into soil columns with a moving water table
2 and tensiometer and soil solution and Redox probes so
3 we can try and get some handles on that. But
4 obviously, it's a limited scale program and I think
5 there's room for quite a lot more research in that
6 area.
7 VICE CHAIRMAN RYAN: Michael, when do you
8 expect results from those studies?
9 DR. THORNE: They're being written up at
10 the moment.
11 VICE CHAIRMAN RYAN: Okay.
12 DR. MOELLER: Okay, we'll move last to
13 Keith Eckerman.
14 DR. ECKERMAN: I'd just come back to some
15 of our discussion with regard to the decoupling that's
16 been done and we've talked a lot about the decoupling
17 of the geosphere and biosphere, but there is a
18 decoupling within the biosphere of man from the
19 environment, particularly through the use of the
20 committed dose coefficients.
21 Now the total problem, looking at it,
22 there's a host of time constants in this problem and
23 you really are approaching it largely by looking at
24 the specific solution at a point in time rather than
25 having wrestled with the general solutions of the

1 problem. And part of the -- I talked about earlier
2 this morning about calibrating the system and in part,
3 sometimes instruments have a self-calibration in it
4 that you could look at and in fact, there are aspects
5 of a more general solution with coupling that would
6 have been satisfying for individuals to look at to
7 understand how the time constants are all working in
8 this process.
9 Coming back to the dose coefficient, the
10 assumptions that we're making in dose coefficients are
11 part and parcel the same that you're assuming in the
12 whole analysis that the system is linear and so there
13 isn't a real hang up between chronic exposure and
14 acute exposures, particularly when you look over the
15 integral.
16 And in many of the new biokinetic models,
17 we've dealt more with a lot of the short term
18 compartments and so -- and when you're dealing with
19 the effective dose you're seeing an approach to the
20 integral converging a lot faster than what you may
21 think based on looking at and thinking about the half
22 lives of the materials we're dealing with.
23 But there's no reason you could not put
24 the information that is available into the model and
25 couple man tighter with the biosphere responses to

1 really look at this in detail and that may well have
2 to be done and to answer some of the general questions
3 and that would include the consideration of an
4 individual as he ages through life in living in that
5 postulated reference of biosphere that you've created.
6 I think you have to be a little bit
7 careful again thinking through the issue of the
8 coupling of the models and what you might gain from
9 that in a more general analysis.
10 DR. MOELLER: All right, I personally
11 really have nothing to add to what's been said, so I
12 think, Mr. Chairman, with that, this side of the table
13 is wrapped up.
14 VICE CHAIRMAN RYAN: Okay, well, thank you
15 very much for chairing the expert panel. I want to
16 thank each and every panel member for their time and
17 efforts over the last few days and all the time you
18 put into preparing to come and be with us today. I
19 think we're -- we've been enriched by your commentary
20 and observations and without this panel we wouldn't
21 have gotten nearly as much out of this two-day working
22 group session as we have.
23 So with that being said I'd like to turn
24 our attention to Jim Clarke, do you want to start with
25 any comments, observations? The floor is yours.

1 MEMBER CLARKE: Thank you. Let me start
2 with what I was going to end up with since many of the
3 other comments that I had have been very well
4 articulated already. But towards the end of the day
5 yesterday, John Garrick asked what I thought was a
6 very interesting question. He asked what about
7 chemicals? What do we know about chemicals? Who
8 might be able to help us here?
9 And it strikes me that there are two
10 reasons for that. One is to put radiation in
11 perspective which I think needs to be done. It may be
12 unique. It may not be unique, but it may not be
13 helpful to dwell on that.
14 Secondly, there are a number of chemicals
15 that have been studied a lot. I would mention lead,
16 benzine, vinylchloride, arsenic, just to name a few.
17 And the whole area of biokinetic models for chemical,
18 internal chemical exposures is an area of great
19 interest, if only to replace our reliance on animal
20 testing. The fact that we still do rely a lot on
21 animal testing may help put it in perspective. In any
22 event, I still think there's merit for pursuing this
23 for a couple of reasons, the reasons I mentioned,
24 putting radiation in perspective and seeing what the
25 approaches that are being taken for toxic chemicals

1 could add to our analysis.

2 My other comments, environmental exposure

3 analysis has always impressed me as a great example of

4 the devil being in the details and this is not a

5 meeting to get into the details. I understand that,

6 but some things have come out along the way that

7 suggest that someone should perhaps make a pass

8 through the assumptions that are being made. For

9 example, when we saw the information on relative

10 contributions, there was, I thought, a good example of

11 something that appeared very counter intuitive, that

12 Dr. Kocher brought up and again it suggests to me that

13 it's worth another pass looking at the assumptions

14 that were made, if.

15 If only for a few reasons. One would be

16 to check consistency. In some cases, bonding

17 assumptions were made and others, distributions were

18 made, so just an overall consistency check. And a

19 check with the consistency of our understanding of the

20 construct of RMEI. When you integrate all of this

21 over all the pathways and all the different kinds of

22 exposures, do you, in fact, end up with RMEI, as we

23 understand it to be?

24 And then finally, I think that would go a

25 good ways towards making a lot of this more

1 transparent. So a very nice list of here's what we
2 did, here's what we assumed. This is the degree of
3 uncertainty we think is associated with it. This is
4 the degree of conservatism we think is associated with
5 it and this is how we think it's consistent with RMEI.
6 I think it would just be a nice thing to have.
7 VICE CHAIRMAN RYAN: Thank you very much.
8 DR. MOELLER: I'm sorry --
9 VICE CHAIRMAN RYAN: Please.
10 DR. MOELLER: This morning when the
11 discussion or when Dr. Garrick asked the question who
12 has looked at chemicals versus radiation, I'm sure
13 Doctor, Professor Clarke is acquainted with Ed
14 Calabressi at the University of Massachusetts at
15 Amherst. I went up there last summer and he had a
16 program on toxicology, you know, a seminar, a meeting.
17 And his objective was to look at the health effects or
18 health responses, human body responses as you increase
19 the dose of chemicals and as you increase the dose of
20 radiation.
21 And it was well attended. It was a
22 toxicology meeting. There were only one or two of us
23 who were not professional toxicologists, so I found it
24 very educational from that point and I came away with
25 the following fact or something that I gained, the

1 following lesson that I gained and he and all of the
2 people who presented the papers, it was international.
3 There were people from Europe and all over.
4 I came away with the conclusion that you
5 should not just adopt a linear relationship or a
6 threshold relationship, but he said look at the data.
7 And he presented slide after slide of data on
8 different chemicals and showed -- and he said that if
9 you really look at the data, you'll come out with the
10 fact that not everything behaves in the same manner.
11 And he showed though slide after slide or graph after
12 graph of reactions to chemicals in which a small
13 amount was beneficial, the J-curve he called it, down
14 and up and he really stressed the fact that you should
15 look at the data and nonetheless, having said that the
16 fact in terms of most of the chemicals was that the J-
17 curve applies.
18 There were one or two speakers who claim
19 the same J-curve applies for radiation, but that
20 really wasn't the major subject of the conference.
21 The conference was really more on chemicals. And I
22 don't know if that helps at all, but in other words,
23 he said look at the data, don't adopt a generic dose
24 response curve for everything.
25 DR. ECKERMAN: I might just add that the

1 lead, an example you just mentioned, is one in which
2 they -- the lead model that was developed for the
3 radiation side recognized, of course, the skeleton as
4 a storehouse of lead and that has been brought into
5 the chemical considerations with regard to blood
6 levels of lead in children.
7 And of course, the very early cross over
8 link was recognized from Day 1 in the Manhattan
9 Project was the nephrotoxin, the toxicity of uranium
10 and of course, that had always been part of -- so the
11 heavy metal kind of cadmium leads, there's direct
12 applicability of a lot of the modeling that we do.
13 Dealing with the organics is the difficulty, of
14 course.
15 VICE CHAIRMAN RYAN: Thanks, Keith. Ruth?
16 MEMBER WEINER: Since my chemical thunder
17 has been stolen, I'll confine myself to nonchemical
18 comments. I think the point was made, but it deserves
19 reiteration that you do really need a baseline of
20 information about the biosphere.
21 Now the site was extremely well
22 characterized. There are volumes and volumes of the
23 site characterization report, but I did not see the
24 results of that report connected to the biosphere
25 analysis. And if that connection exists, I think it

1 should be made overt.

2 From that, I'd like to reiterate what

3 several people said about the RMEI. I think Dr.

4 Moeller began this workshop with a little lecture on

5 realism versus conservatism and I'd like to know how

6 the RMEI is correlated with a realistic picture, who

7 is the RMEI? The regulation itself specifies two

8 numbers and almost everything else, if you read the

9 regulation is available for estimation. It just

10 specifies the two liters per day and the 3,000 acre

11 feet. That's it. And everything else you can

12 estimate.

13 I think this is an area that needs to be

14 very transparent to the public and I would second the

15 notion that the RMEI be related in some way to the

16 notion of critical population because critical

17 population is something that has been presented

18 publicly and people have some idea of what that means.

19 And we need that same idea for the RMEI.

20 Sometimes we get bounding values and

21 sometimes we get realistic values and that's in the

22 nature of this kind of analysis. However, there

23 should be some definition of the circumstance. When

24 do you use a bounding value -- and this is really for

25 NRC who is going to review this license application.

1 When should a bounding value be used or what are the
2 guidelines for using bounding value versus a realistic
3 value and how do you really define realistic?
4 Moving to the question of climate change,
5 we do need a very transparent definition of semi-arid.
6 Dr. Clarke asked me what's semi-arid and I said
7 Albuquerque is semi -- where I live is semi-arid.
8 Twelve inches of rainfall a year. But that needs to
9 be very clear.
10 We've heard two -- I heard two different
11 views of the incorporation of climate change notions
12 into the TSPA and Dr. Swift said that climate change
13 won't exceed the paleoclimate changes as modeled by
14 DOE if you represent climate change by infiltration.
15 I think NRC, if they look at this notion,
16 it needs to be substantiated. I'd like to know if NRC
17 agrees with it, disagrees with it, what they have to
18 offer in that area.
19 And finally, since ash inhalation for the
20 igneous event is considered to be the heaviest impact
21 for the igneous event, we really do need a particle
22 size distribution for the ash and by particle size
23 both AMAD and density and size.
24 And as well as everybody uses the standard
25 Galcian dispersion model to disperse everything.

1 Well, an igneous dike is an area source. It's not a
2 point source. We are not saying at what temperature
3 it is released, whether there's thermal lofting.
4 There is no detail given as to how good the modeling
5 of the dispersion itself is and this is really part of
6 the biosphere and I think that is something that needs
7 to be looked at.
8 And I said finally, but I wasn't through,
9 so I'm sensitive to what Dr. Eckerman said about
10 lifetime dose. People move around. The Census Bureau
11 has done a very careful analysis and has quantitative
12 estimates of how long a person resides in a particular
13 place. They've done a very, very careful job of that.
14 On the average, people in the United States move every
15 three years.
16 However, there is a good way to take the
17 Census Bureau's quantitative estimate of residents in
18 a given place and apply that and it's not just you
19 don't have to apply the every three year average.
20 This is a very carefully worked out thing.
21 If we are looking at lifetime doses,
22 lifetime doses to adults, or however, the RMEI is
23 defined and however that's correlated with childhood
24 exposures and adolescent exposures, I think you also
25 need to look at how long people live in a particular

1 place. That's all.

2 VICE CHAIRMAN RYAN: Thank you. I think

3 Dr. Moeller had one comment on the RMEI.

4 DR. MOELLER: Well, there are two comments

5 on the RMEI. If you read Title 10 part 20 and

6 unfortunately, I just haven't read it in the last week

7 or two, but it says that the dose limits that the

8 Nuclear Regulatory Commission comments or sets in

9 Title 10 part 20, that those dose limits are for the,

10 I believe it's something like the individual receiving

11 the maximum dose.

12 MEMBER WEINER: Yes, yes.

13 DR. MOELLER: All right, at the time that

14 Part 20 was promulgated in 1991, I was heavily

15 involved in the review as the regulations were being

16 drafted and finally perfected and finally promulgated.

17 And the review group that I was on pleaded with the

18 NRC to not say to the individual receiving the maximum

19 dose. We said the ICRP has developed this concept of

20 a critical group and you should use that.

21 Well, apparently the process was too far

22 along to make any change, so what the Nuclear

23 Regulatory Commission did which we appreciated very

24 much was they issued a Regulatory Guide and in the

25 Regulatory Guide they said if a licensee or an

1 applicant desires to use the concept of the average
2 member of the critical group in place of the dose to
3 the person receiving the maximum, that was acceptable
4 to them. So a regulatory guide is not a regulation,
5 but it outlines a procedure that if the applicant
6 follows it, the Nuclear Regulatory Commission will
7 accept it.
8 So in the case of the Nuclear Regulatory
9 Commission, the average member of the critical group
10 is part of their regulations in a secondary way.
11 All right, let's just over to EPA. EPA
12 initially directed their regulations and standards to
13 the maximum exposed individual. A number of us
14 pleaded with them, I didn't play a major role, but a
15 number of people talked to them and they changed it
16 from the maximum exposed individual to the reasonably
17 maximally exposed individual and when they did so, if
18 my memory is correct, they said our desire is to have
19 this be synonymous with the average member of the
20 critical group.
21 So I presume that if DOE preferred and
22 desired and came to the Nuclear Regulatory Commission
23 and said would it be permissible for us to use the
24 average member of the critical group with Amargosa
25 Valley, I'm not the NRC, but on the basis of what I've

1 heard, they would approve it.

2 DR. KOCHER: Yes, in fact EPA has

3 regulations on the books that say the dose to any

4 member of the public shall not exceed and that's an

5 impossible standard to test.

6 VICE CHAIRMAN RYAN: George.

7 MEMBER HORNBERGER: My turn. I just have

8 one major comment I want to make but I'll perhaps, as

9 a preamble, may lead into it.

10 Let me say just a couple of things about

11 climate change. I actually -- I don't disagree that

12 somebody needs to make sure that this gets addressed.

13 I actually think that it will turn out to be fairly

14 straight forward and I think that I actually believe

15 the EPRI position that they have looked at it and

16 found that it really is a no nevermind.

17 I haven't seen any credible climate model

18 forecast that converts southern Nevada to the tropics.

19 That's just not credible. And so what you see is all

20 of the climate models agree that it will be warmer in

21 a greenhouse, not a lot warmer, a few degrees C.

22 warmer. The precipitation forecast, as Michael has

23 said, are a lot more tenuous and so some of them show

24 drier and warmer. Some of them show a slightly

25 enhanced monsoon which brings a little more

1 precipitation, but none of them, as Peter alluded to,
2 gets anywhere near an interglacial 400 millimeters of
3 precip.
4 Furthermore, if you then look at all of
5 the TSPA models that have been done, it is, in fact,
6 infiltration rate that drives -- is very, very strong
7 condition on calculated doses. And so the higher the
8 precipitation, roughly speaking, means the higher the
9 calculated doses.
10 So I think that this is probably going to
11 be fairly easy to take on. I don't disagree that it
12 should be taken on. I'd be surprised is somebody
13 hasn't already done so and perhaps we just haven't had
14 the paper brought to our attention.
15 This leads me to the main comment that I
16 have is that whenever we have discussions like this,
17 it is really easy, I think, to point to science issues
18 that we would like to see addressed because there are
19 all sorts of fascinating questions out there like
20 climate change and what it might do to change water
21 use efficiency in plants and on and on and on.
22 And I think that we wind up always being
23 faced with some kind of a balancing act. It's not
24 necessarily best science. It is credible science. I
25 like the word that John Till used. We have to

1 maintain maximum credibility. Sometimes that means
2 that we have to use the absolute best science
3 available. Other times, I think that we are satisfied
4 with what loosely might be thought of as a bounding
5 analysis because it just doesn't matter.
6 And the balancing act is being driven
7 toward more and more measurements or better and better
8 science and actually figuring out whether this site is
9 suitable for a waste repository and those two things
10 are not in my estimation one and the same.
11 And in this kind of venue we often get
12 caught up with the interesting science questions and
13 don't necessarily have that balanced view on getting
14 the job done.
15 VICE CHAIRMAN RYAN: Thank you, George.
16 John?
17 CHAIRMAN GARRICK: Yes. Coming from a
18 background of nuclear safety and risk, there are
19 certain things each time we have one of these sessions
20 that I look for and one of the things that I look for
21 is what we have been able to ferret out of a
22 discussion that would allow me to write down some sort
23 of importance ranking associated with the topic,
24 namely, the biosphere.
25 Certainly issues were identified and

1 they're very interesting ones and they include
2 everything that we've been talking about here,
3 background characterization, uptake models, model
4 coupling, the use of site-specific information,
5 realistic calculations versus compliance, definition
6 of the RMEI comparison with other interpretations and
7 so on.
8 But still, I think that in terms of
9 understanding what the issues are with respect to
10 their contribution to performance, and how the
11 biosphere plays out with respect to that, it seems as
12 though there's still quite a bit of work to do
13 although we got some very good insights into that
14 yesterday.
15 So importance ranking and context is a
16 very important issue here and we got some insight into
17 that, but it appears that there's still quite a bit to
18 do and that as far as risk insights are concerned, we
19 don't seem to be anywhere near as far along in the
20 biosphere as we are in the geosphere and I'm sure
21 there's good reasons for that.
22 The other issue that is of great interest
23 to me is this issue of who's doing the realistic
24 calculation. We heard excellent discussions yesterday
25 about the perspective that if you're getting a license

1 application, obviously you're going to gear your
2 analysis and gear your application to meeting the
3 requirements of the regulations. And no question that
4 that takes you away from doing a kind of analysis that
5 you would do if your whole view was to get the best
6 possible result you could in terms of what
7 realistically might happen.
8 And we have some very interesting
9 discussions about that on the pros and cons, but I'm
10 still not clear, it's still not clear to me who's
11 accountable for doing the realistic analysis here
12 because as best I can tell, it's not being done.
13 Now the other thing that I was very
14 interested in at the outset here was the issue of the
15 prescriptive nature of the biosphere calculations and
16 whether or not they might mask realistic issues. And
17 I thought we had an example of that. For example, if
18 you take the 3,000 acre feet and assume that all the
19 radionuclides that reach that region are -- have --
20 are able to be pumped up into the surface and into the
21 food chain, then you have on the one hand made an
22 extremely conservative assumption with respect to the
23 removal of radionuclides from the biosphere, but
24 you've made a very nonconservative assumption with
25 respect to the final disposition of radionuclides as

1 was very well pointed out by Steve Frishman. And I
2 thought that was a very interesting observation.
3 And it reminds me of so much risk work we
4 did in the nuclear power industry where you have
5 several performance parameters, core damage frequency,
6 release fractions and dose. And we discovered very
7 early in our risk work that when you do a fix to
8 reduce one of those, you don't necessarily fix the
9 others. When you do a fix to reduce the core damage
10 frequency, on the contrary, you may increase the dose,
11 the off-site dose.
12 And I have questions about that here.
13 When you make an assumption about the biosphere such
14 as the disposition of the radionuclides, what does
15 that mean in terms of how you've underestimated other
16 things if your approach had been to do a realistic
17 analysis.
18 Another area that I agree with David
19 Kocher on this one and I didn't see much in that I
20 would have liked to seen more was are we getting our
21 money's worth from the billions of dollars of site
22 characterization work that's been done and how has
23 that manifested, how is site characterization
24 manifested in the biosphere work? And I didn't see a
25 whole lot of evidence of that.

1 I would think that the site specificity
2 issue is something that is going to be of great
3 importance to the public and the more that they can
4 see a connection between what we learned from the site
5 characterization program and how it impacted the dose
6 calculations, I think the better off we are.
7 So those are some of the things that come
8 to mind and I think that one of the things that I like
9 to do whenever we have a session like this is to
10 identify what appears to be the most important issues
11 and I think the things that I've mentioned are in that
12 category and some of them are analytical issues and
13 some of them are data collection issues and some of
14 them are modeling issues and what have you. But I
15 think that's all I need to say right now.
16 VICE CHAIRMAN RYAN: Thank you, John.
17 Boy, it's hard for me to add after all of these smarts
18 who have said what's on their minds.
19 DR. KOCHER: Can I ask John a question?
20 VICE CHAIRMAN RYAN: Sure.
21 DR. KOCHER: If I understood you right,
22 you said you didn't really come away with a lot of
23 warm fuzzies about risk insights in the biosphere
24 part?
25 CHAIRMAN GARRICK: Yes, that's correct.

1 I saw a lot of useful information and some risk
2 insight, but I saw very little that would give me the
3 feeling that there was a real risk analysis model that
4 was the underlying driver of the results.
5 DR. KOCHER: Okay, I was wanting to
6 explore what you meant by that.
7 CHAIRMAN GARRICK: What I would like to be
8 able to see here is that the end of the exercise here
9 we have a PDF on the dose and I'd like to be able to
10 decompose that PDF into the contribution from
11 different segments of the model that you might call it
12 the infiltration model, the near field model, the
13 geosphere model and the biosphere model.
14 That's the kind of models that we've
15 learned how to develop on reactor risk assessments.
16 DR. KOCHER: And the question you posed
17 early yesterday or the problem you posed about you'd
18 really like to see, get a firm idea of uncertainty in
19 the biosphere part compared with uncertainty on the
20 other part and I don't really think you can come away
21 with a warm fuzzy about that because it depends on
22 when in time we're talking about and a host of other
23 things, so I agree with you, that issue is kind of
24 still -- most of us believe that the uncertainty is
25 under the ground somewhere because we've studied this

1 stuff to death for 50 years. But there are issues --

2 CHAIRMAN GARRICK: But you can't take

3 snapshots of different discrete time intervals. You

4 can do things to at least develop a sense of

5 understanding about how things might be for different

6 discrete time pieces.

7 VICE CHAIRMAN RYAN: It's going to be hard

8 to add to that, but let me try and add a few thoughts.

9 I think first of all I'd like to recognize all of our

10 speakers and presenters for these last two days. I

11 know they put a lot of time and effort into preparing.

12 I want to thank the staff at the Center who is on the

13 TV screen for their participation and for their

14 preparation and for their representatives here today.

15 And I'd like to especially thank Mike Lee who has been

16 the lead staff person in putting together the

17 biosphere working group and organizing all of the

18 attendees and participants and that's a tremendous

19 amount of work and we all appreciate your effort very

20 much, Mike, thank you.

21 Let me try and summarize with a few

22 themes. I think the themes that I take away from this

23 biosphere working group are some interesting aspects

24 that are probably unique to this project. There's a

25 very specified and stylized calculation and we've

1 heard a variety of opinions and issues regarding that
2 stylized calculation, ranging from fixed values, we do
3 it in that specific way. And then we underpin with
4 examinations of models and supporting evidence and so
5 on. That's one aspect.
6 So we have a fixed requirement and we have
7 a lot of other science questions and modeling
8 activities that are underpinning that assessment
9 that's pretty fixed. The second to me and it comes
10 from I guess my bias of focusing on short term
11 exposures in the work place as an area of major
12 concern as opposed to chronic exposures in an
13 environmental setting of somewhat a complex nature
14 that's very much protracted in time over lifetimes and
15 many lifetimes and that, I think, is something we can
16 all think about as having special aspects that maybe
17 need our thought and attention.
18 I think we have to be careful to take too
19 much away from this working group because it's part of
20 many working groups that we heard about, you know,
21 from package performance to the waste interaction,
22 waste package interaction, the environment of the
23 repository itself to performance confirmation and soon
24 to be upcoming the geosphere working group that will
25 examine the coupled part of this.

1 So in all of these pieces and parts will
2 integrate in DOE's license application and it's the
3 totality of all that that I think will be assessed and
4 judged and I caution us all not to pick on one or two
5 parameters or issues from this working group as
6 critically central and that's part of the risk ranking
7 process and I think everybody realizes that, but I
8 just remind everybody that this is one slice of a big
9 piece and it's helpful for us to look at them that
10 way. In fact, it's the only practical way to do it
11 without spending weeks on end in one room.
12 And with that I think, Mr. Chairman, I'll
13 turn back the working group session and declare it
14 closed and turn back the meeting to you.
15 CHAIRMAN GARRICK: Excellent. Okay, let's
16 see. I think that probably what we ought to do is
17 we've got -- it shows on our agenda that we should
18 have discussion of the letter. Yes.
19 MEMBER HORNBERGER: At the risk of going
20 backwards. it just struck me that probably one of the
21 first things that Dave suggested was that we should
22 have some kind of discussion on this age dose business
23 and I don't think that -- did we bring that to
24 closure? Did I nod off?
25 None of our panel mentioned that in the

1 final summary.

2 VICE CHAIRMAN RYAN: We talked a lot about

3 age dose issues. What particular --

4 MEMBER HORNBERGER: Well, I mean we talked

5 about it, but I didn't hear any resolution. I mean I

6 heard it as a question, what are we going to do.

7 DR. ECKERMAN: I thought the dosimetric

8 information you need to look at age is available. I

9 thought we had passed that off to the supportive

10 satellite calculations that have to be done because of

11 the regulation focusing in on the adult.

12 There are other -- there are a number of

13 other ways to handle that problem. One would have

14 been to have looked at a per capita kind of a dose

15 coefficient, but that largely forces you over to

16 pretty much the adult anyway because most of one's

17 life is spent as an adult rather than as a child. But

18 I think the age in my mind, the age issue has to be

19 addressed with respect to the supportive information

20 and it may well not be an issue with regard to the

21 compliance kind of calculations. So I would

22 definitely encourage that -- that would be my

23 resolution to the comment.

24 CHAIRMAN GARRICK: Yes.

25 DR. THORNE: Just a clarification on that

1 as well. I think if you're going to make that
2 comparison, what you can't do is do the infant
3 calculation and the child calculation and then compare
4 with the RMEI because the RMEI isn't the same kind of
5 thing that you need to do infant, child and adult as
6 if you were doing a critical group calculation for
7 each one.
8 DR. KOCHER: Yes.
9 CHAIRMAN GARRICK: Dade, do you want to
10 add to anything that's been said about that, since you
11 asked the question?
12 DR. MOELLER: I don't believe that I do.
13 I thought that Keith wrapped it up in several ways in
14 that the -- and I hope that I'm not misquoting you,
15 but the fact that the dose -- that a person spends
16 most of his or her life as an adult. The dose
17 coefficient for an adult, if it's applied even over
18 the full lifetime of an individual yields reasonable,
19 very close estimate to the dose.
20 Now it's of interest to know the dose to
21 an infant or a teenager, but that only takes place, I
22 don't know what an infant is, you know, whether it's
23 up to 2 or 3 years, but it's a short time. You're a
24 teenager from 13 to 19, whatever that is, 7 years. So
25 in that respect I felt that it was resolved.

1 MEMBER HORNBERGER: I guess what wasn't
2 clear to me was on a chronic exposure why this was or
3 should be a big issue.
4 DR. ECKERMAN: And it shouldn't be a big
5 issue.
6 CHAIRMAN GARRICK: Well, I want to add my
7 thanks to what Mike said to the panel and the
8 consultants and the members of the committee.
9 These working group sessions are extremely
10 valuable. They give us a chance to bore in on issues
11 that are important to the job we're trying to do. We
12 know that all of you put in a lot more time than your
13 pay scale probably warrants and some of you have come
14 from long distances and they are a very valuable part
15 of our whole process.
16 So we are very grateful to you and we hope
17 that, of course, that we have an opportunity to
18 interact with all of you more as we move closer and
19 closer to a license application.
20 I think what we'll do now, the committee
21 has to somehow figure out what we're going to do with
22 all of these fine words of wisdom and we need to
23 figure out and agree as a committee the points we'd
24 like to cover in a report to the Commission.
25 And so what I think we'll do is we'll do

1 that, but I think that before we engage into that
2 process, we'll take a 15 minute break and then come
3 back and work on our reports.
4 Thank you.
5 (Whereupon, the proceedings went off the
6 record at 2:07 p.m.)
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CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Nuclear Waste 148th Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings as recorded on tape(s) provided by the NRC.

Rebecca Silberman

Rebecca Silberman
Official Transcriber
Neal R. Gross & Co., Inc.

Risk Insights for Biosphere

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Center for Nuclear Waste Regulatory Analyses

148th Meeting of
Advisory Committee on Nuclear Waste
February 24-27, 2004

RISK INFORMING REVIEWS OF DOE BIOSPHERE DOCUMENTS

- Prior Biosphere Analyses Provided Basic Understanding
  - Process-Level Modeling and Sensitivity Studies
  - TPA Code Development
- Reviews of DOE Documents Emphasized Important Biosphere Parameters and Pathways
- Risk Insights Initiative
  - Biosphere Sensitivity in "Total System" Context
  - Used Significance Ranking to Prioritize Agreements
  - Provided Context for Closing Agreements
- Technical Work Plans Directed at Important Topics with Large Uncertainties

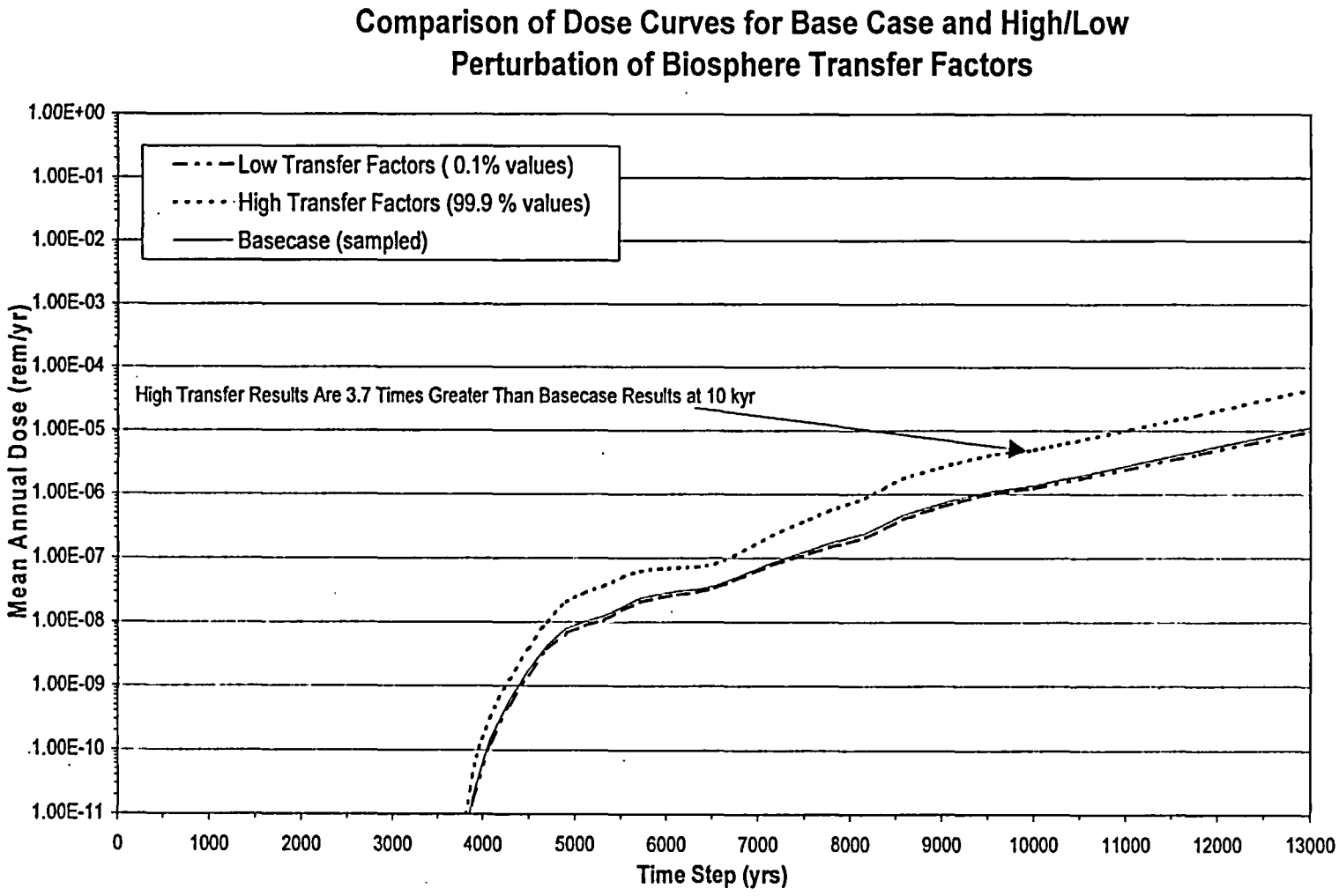
RISK INSIGHTS FOR BIOSPHERE MODELING

- Groundwater Release to Biosphere
  - Groundwater Dose: About 50% Drinking Water and 40% Crop Consumption
  - Key "Process Level" Biosphere Parameters: Distribution Coefficients, Plant Transfer Factors, Crop Interception
  - Uncertainty is Low Relative to Other Abstractions
- Igneous Activity Release to Biosphere
  - Inhalation Pathway Dominates
  - Key Parameters: Mass Loading, Exposure Duration
  - Uncertainty is High (Continues to be Investigated/Quantified)
- Total-System Sensitivity Analysis Results: Mass Loading

BIOSPHERE AGREEMENTS: GROUNDWATER RELEASE

- Biosphere Groundwater Pathway Modeling Agreement Topics Are Ranked Low Significance
- Emphasized Important Parameters in Biosphere Calculations (But Low Importance to Total System Results):
  - Soil Partition Coefficients (Kd's) for Soil Leach Modeling
  - Plant Transfer Factors
  - Crop Interception
  - Biosphere Sampling Approach
- Effect on Biosphere Plans: Staff Have No Plans for Additional Technical Work
- DOE Improved Documentation -- Resolved 4 Agreements

USE OF SUPPLEMENTAL RISK INFORMATION TO RESOLVE AGREEMENTS ON PLANT TRANSFER



ACNW Meeting
2/25/04

BIOSPHERE AGREEMENTS: IGNEOUS ACTIVITY (DIRECT RELEASE)

- Igneous Activity Biosphere Agreement Topics Have Various Significance Rankings
  - Agreements Related to Mass Loading/Inhalation of Ash (including remobilization) Ranked High or Medium
- Inhalation Pathway and Mass Loading Are Highly Significant in Total System Calculations
  - Inhalation is Dominant Pathway
  - Mass Loading is a Sensitive and Uncertain Parameter
- Low-Ranked Agreements Mostly Deal with Clarification of Documentation

BIOSPHERE AGREEMENTS: IGNEOUS ACTIVITY (DIRECT RELEASE); cont'd

- Effect on Biosphere Plans: Ongoing Model Development and Risk Analysis
- Refine Inhalation Models and Parameters
  - Mass Loading and Exposure Times
  - Particle Size Effects
  - Remobilization of Volcanic Ash

SUMMARY

- Use of Risk Insights is Integral to Planning and Conducting Staff Work
- Risk Informing Is An Iterative Process
- Inhalation of Volcanic Ash
  - High Significance -- Additional Work Ongoing
- Remainder of Biosphere Calculations
  - Low Significance -- No Additional Work Planned

BACKUP SLIDES

BIOSPHERE AGREEMENTS

- Groundwater Biosphere Pathway Agreements
  - TSPAI3.33: Site relevance of soil partition coefficients (Kd's) (L)
  - TSPAI3.34: Site relevance of soil to plant transfer factors (L)
  - TSPAI3.35: Relevance of crop interception to radionuclides (L)
  - TSPAI3.36: Document uncertainty in soil leach factors (L)
  - TSPAI3.37: Justification for biosphere sampling (L)

BIOSPHERE AGREEMENTS

- Igneous Activity (Direct Release) Biosphere Agreements
  - IA2.06: Link Soil Removal and Remobilization Processes (M)
  - IA2.07: Document Basis for Airborne Particle Concentrations (H)
  - IA2.08: Justify Assumption for Ingestion of Inhaled Particles (L)
  - IA2.11: Relate Dust Measurements to RMEI Behaviors (M)
  - IA2.12: Clarify How PM10 Measures Extrapolate to TSP (L)
  - IA2.13: Justification for Sampling Transition Period BDCFs (L)
  - IA2.14: Clarify How Blanket Thickness Effects Mass Load (L)
  - IA2.15: Clarify that External Exposure to Ash Was Included (L)
  - IA2.16: Document Conservativeness of No Climate Change (L)
  - IA2.17: Bases for Bounding Eolian/Fluvial Effects (H)

Biosphere Research: Food-Chain Pathways

148th Meeting of Advisory Committee on Nuclear Waste

February 25, 2004

Cheryl Trottier, Chief

Rad Prot, Env Risk, and Waste Mgt Branch

Division of Systems Analysis and Regulatory Effectiveness

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Research Activities

- Research is generic in nature – mostly addressing decommissioning needs
- Research plan developed in 2002 identified a need to look at environmental pathways models
- Initiated project at PNNL to support biosphere modeling

Research Objectives

- Provide Data and Information on Radionuclide Behavior in Plants and Animals for use in Performance Assessment Models and Computer Codes
- Assess Factors (e.g., Regional, Soil, Chemistry) Affecting Radionuclide Uptake in Plants
- Quantify Uncertainties Associated with Food-Chain Pathway Data

Project Tasks

- Determine Radionuclide Soil-to-Plant Concentration Ratios
- Study Radionuclide Uptake of Vegetation by Irrigation Water
  - Radionuclide Uptake by Roots
  - Crop Intersection Factors
- Determine Radionuclide Animal Product Transfer Coefficients
- Evaluate Alternative Conceptual Models for Food-Chain Pathway
- Assess Biosphere Modeling Parameters and Data
  - Biosphere Dose Conversion Factors
  - Age Dependency Studies
- Coordination with International Studies

Experimental Matrix

- Radionuclides: ^{129}I, ^{99}Tc, ^{237}Np, ^{239}Pu, ^{63}Ni
- Plants: Alfalfa, Onion, Corn, Potato
- Trees: (Under Discussion) Pistachio, Pecan
- Animals
  - Large: Discussions with Foreign Investigators
  - Small: Chickens/eggs (Under Discussion)
- Sampling Locations : WA, NV, and SC (Soil and Water)

Research Products

- "Literature Review and Assessment of Plant and Animal Transfer Factors Used in Performance Assessment Modeling", NUREG/CR-6825, August 2003. Contains Literature and Chemistry Species Data and Information.
- IAEA Working Group: Participant on Revision of TRS-364 "Handbook of parameter values for the prediction of radionuclide transfer in temperature environments"

Backup Slides

Program Management

- Program Manager: Phillip Reed (NRC) 301 415-7845

- Project Manager: Bruce Napier (PNNL)
- Principal Investigators:

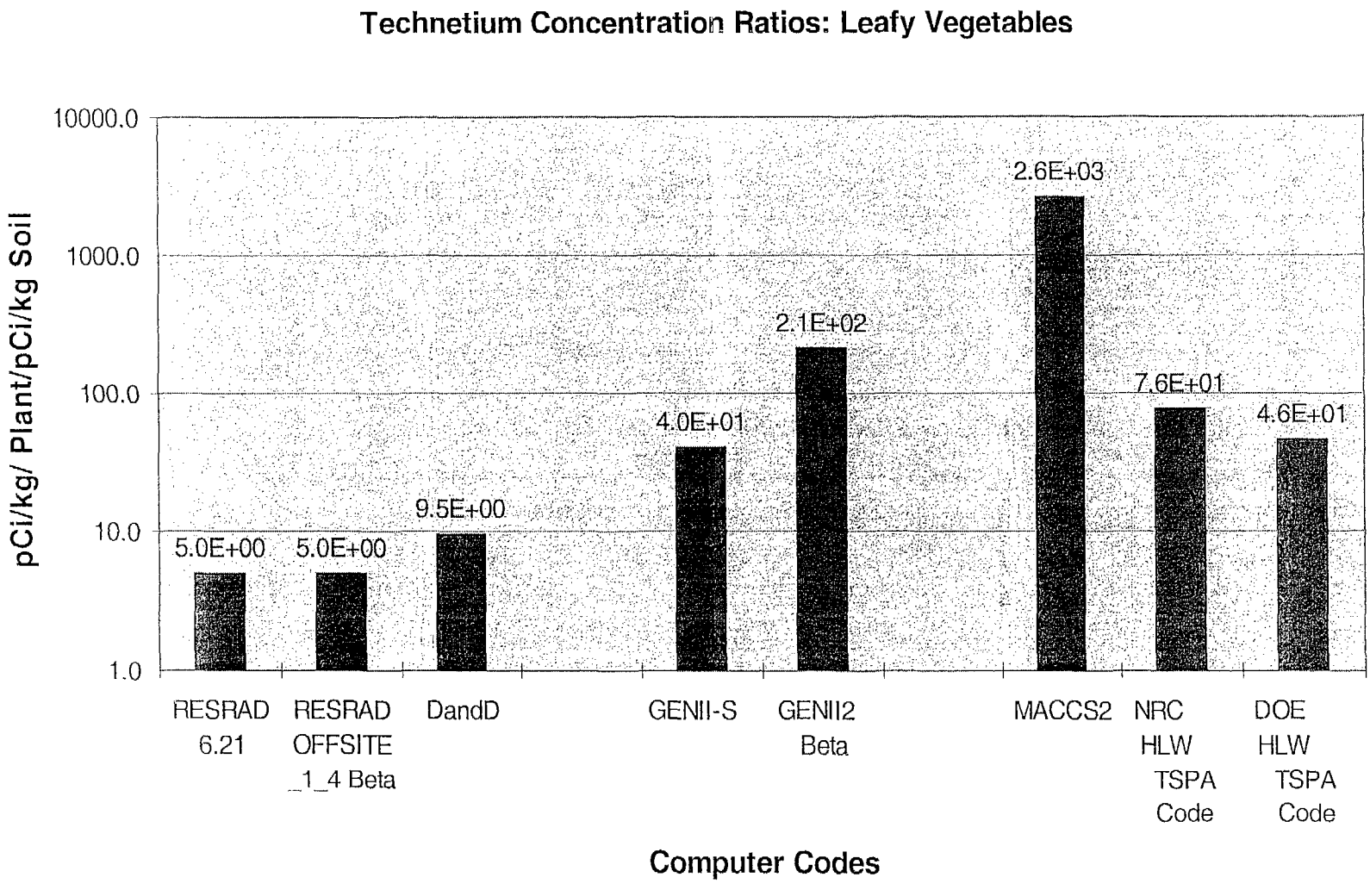
  Bruce Napier (PNNL)

  Dominic Catalbo (PNNL)

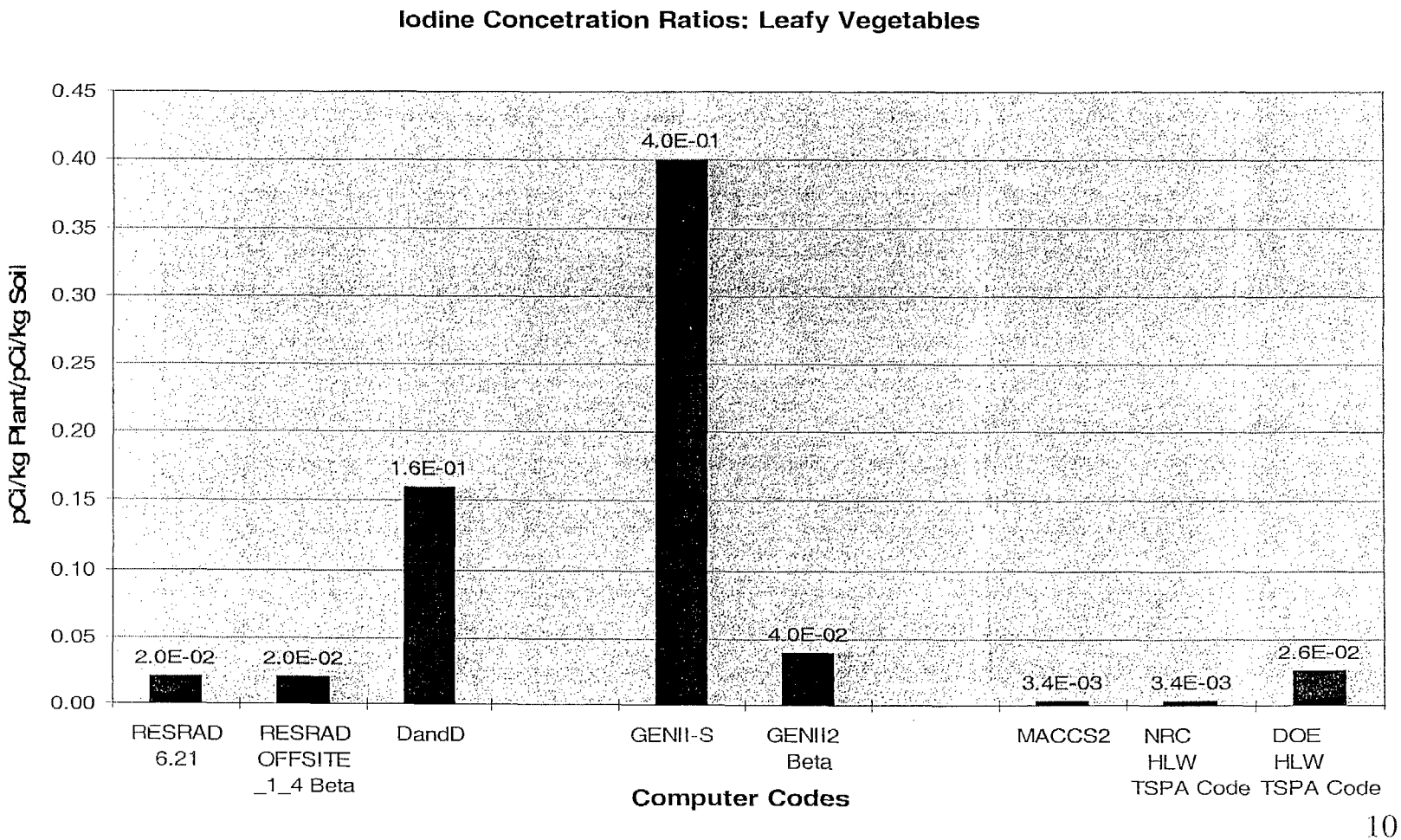
  Lyle Lasser (PNNL)

  Ken Krupka (PNNL)

Concentration Ratios in Computer Codes I



Concentration Ratios in Computer Codes II



Summary of EPRI Evaluations of the Yucca Mountain Biosphere

Matthew W. Kozak
Monitor Scientific, LLC
Graham Smith
Enviros
John Kessler
EPRI

ACNW Meeting
Two White Flint North
24-25 February 2004

ENVIROS EPRI MONITOR SCIENTIFIC

Key Publications

- Smith G M, Watkins B M, Little R H, Jones H M and Mortimer A M (1996). Biosphere Modelling and Dose Assessment for Yucca Mountain. EPRI TR-107190, 3294-18.
- Smith G M and Kessler J (1996). Critical Groups for Geological Disposal Performance Assessments. In Proceedings of an International Conference High Level Radioactive Waste Management, American Society of Civil Engineers/American Nuclear Society, Las Vegas.
- Smith G M, Watkins B M and Little R H (1996). Biosphere FEP List Development Specific to Yucca Mountain. In Proceedings of an International Conference High Level Radioactive Waste Management, American Society of Civil Engineers/American Nuclear Society, Las Vegas.

ENVIROS EPRI MONITOR SCIENTIFIC

Key Applications in TSPA

- EPRI (1996). Yucca Mountain Total System Performance Assessment, Phase 3, EPRI TR-107191, Electric Power Research Institute, Palo Alto, December.
- EPRI (1998). Alternative Approaches to Assessing the Performance and Suitability of Yucca Mountain for Spent Fuel Disposal, TR-108732. Final Report November 1998, Palo Alto, California.
- EPRI (2002). Evaluation of the Proposed High-Level Radioactive Waste Repository at Yucca Mountain Using Total System Performance Assessment: Phase 6, EPRI, Palo Alto, CA: 2002. 1003031.
- EPRI (in press 2004). Evaluation of the Proposed High-Level Radioactive Waste Repository at Yucca Mountain Using Total System Performance Assessment: Phase 8.

ENVIROS EPRI MONITOR SCIENTIFIC

International Activities

- EPRI participated in BIOMOVS II and then BIOMASS
  - Focus on developing standard approaches to defining the biosphere for the purposes of long-term assessments for deep geologic disposal of radioactive waste.
  - John Kessler chaired a working group within BIOMASS focused on developing the principles for the definition of exposure groups.
- "Reference Biospheres" for Solid Radioactive Waste Disposal. IAEA-BIOMASS-6. Part of the International Atomic Energy Agency Coordinated Research Program on Biosphere Modelling and Research (BIOMASS), Vienna.

ENVIROS EPRI MONITOR SCIENTIFIC

Additional Publications

- Pinedo P, Wasiolek M, Wu W, Smith A, Smith G and Kessler J (2003). Biosphere Assessment Technical Issues, Comparison of Dry Sites. In Proc. International Conference on HLW, Las Vegas, American Nuclear Society.
- Smith G M and Kessler J (1998). Defining and Justifying Assumptions for Exposure Groups in HLW Repository Performance Assessment. Proceedings of International Symposium on Radioactive Waste Disposal: Health and Environmental Criteria and Standards, Stockholm, Swedish Radiation Protection Institute, the Stockholm Environment Institute and the US Environmental Protection Agency.
- Watkins B M, Smith G M, Little R H and Kessler J (1999). A Biosphere Modelling Methodology for Dose Assessments of the Potential Yucca Mountains Deep Geological High Level Radioactive Waste Repository, Health Physics, April 1999, Volume 76 No4.

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Summary

- EPRI has contributed to understanding the Yucca Mountain biosphere since 1996
- Integration of developments in the international community with those in the USA
- Continuous integration with updated version of the EPRI TSPA
- To date, only deterministic biosphere dose conversion factors (BDCF)
- Probabilistic BDCF analyses planned in current year

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