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ADVISORY COMMITTEE ON NUCLEAR WASTE

JANUARY 8, 2002

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW)

131st MEETING

+ + + + +

TUESDAY,

JANUARY 8, 2002

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ROCKVILLE, MARYLAND

+ + + + +

The ACNW met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 11:00 a.m., George M. Hornberger, Chairman, presiding.

COMMITTEE MEMBERS:

GEORGE M. HORNBERGER, Chairman

RAYMOND G. WYMER, Vice Chairman

B. JOHN GARRICK, Member

MILTON N. LEVENSON, Member

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1 ACNW STAFF PRESENT:

2 HOWARD J. LARSON, Special Assistant, ACRS, ACNW

3 RICHARD K. MAJOR

4 LYNN DEERING

5 LATIF HAMDAN

6 SHER BAHADUR

7 AMARJIT SINGH

8 JOHN T. LARKINS

9 RICHARD P. SAVIO

10 CAROL A. HARRIS

11

12 ALSO PRESENT:

13 TIM McCARTIN

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I-N-D-E-X

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4 10 CFR Part 63 Adjourn 5

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

(11:03 a.m.)

CHAIRMAN HORNBERGER: The meeting will come to order. This is the first day of the 131st meeting of the Advisory Committee on Nuclear Waste. My name is George Hornberger, Chairman of the ACNW.

Other Members of the Committee present are John Garrick, Milton Levenson and Raymond Wymer.

During today's meeting, following the planning and procedure session, the Committee will discuss proposed revisions to 10 CFR Part 63, discuss proposed letters and finalize plans for a Committee retreat.

John Larkins or Howard Larson 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. We have received no written comments or requests for time to make oral statements from members of the public regarding today's session. Should anyone wish to address the Committee, please make your wishes known to one of the Committee staff.

It is requested that speakers use one of the microphones, identify themselves and speak with

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1 sufficient clarity and volume so that they can be
2 readily heard.

3 Before proceeding, I would like to cover
4 some brief items of current interest. It has been
5 announced recently that Bill Reamer will become the
6 Deputy Director, Division of Waste Management,
7 replacing Josie Picone who will become the Deputy
8 Director, Office of State and Travel Programs. Mr.
9 Jack Sorenson, ACRS staff Senior Fellow, completed his
10 term with the Office on December 31, 2001. He has now
11 joined the Office of Nuclear Material Safety and
12 Safeguards to assist in risk-informing activities.
13 The trade press recently reported that politicians in
14 the Swedish town of Oesthammar have voted to allow
15 drilling in bedrock in the community to see if it is
16 suitable for a final spent fuel repository. Mr. Phil
17 Justice has been assigned as NMSS liaison for the
18 ACNW.

19 We are going to proceed to our discussion
20 of the proposed amendment to 10 CFR Part 63 and John
21 Garrick is the cognizant member. I'll turn it over to
22 John.

23 MEMBER GARRICK: Thank you. We're going
24 to hear from the staff on a proposed rule on 10 CFR
25 Part 63 which has to do with the specification of the

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1 probability for unlikely features, events and
2 processes or as they are affectionately known as FEPs
3 and as I understand it, the Commission has voted this
4 proposed rule, but it has not been published yet for
5 public comment because the SRM is still being held up
6 for reasons that maybe Tim will explain.

7 What is involved here is that the EPA
8 Yucca Mountain standard is really -- involves three
9 standards, three separate standards: the so-called
10 All Pathway standard, the Human Intrusion standard and
11 the Groundwater standard.

12 And in the EPA standard, the concept of
13 very unlikely events has been defined as a specific
14 number and these are excluded from all three
15 standards. So these numbers, these thresholds become
16 very important because they drive the issue of what
17 can be considered or what has to be considered and
18 what doesn't have to be considered.

19 And for the Human Intrusion and
20 Groundwater standard, the category called unlikely
21 events may also be excluded, but the EPA left it up to
22 the Nuclear Regulatory Commission to define what is
23 meant by unlikely.

24 So this is a topic of considerable
25 interest to the Committee. The problem here is that

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1 it is sort of after the fact advice that something we
2 were talking about earlier and it's somewhat difficult
3 for the Committee to have had much of an impact on the
4 voting of the Commission. And this is one of the
5 flaws that we've spoken about in the past that's
6 inherent in this whole advisory process. But we don't
7 want to dwell on that at the moment. We are going to
8 talk about it at our retreat.

9 One of the things that I'm very interested
10 in, in this whole discussion is I think maybe an issue
11 that's just as important as what these numbers ought
12 to be is the issue related to the process of
13 assembling or disassembling or aggregating FEPs
14 because you can imagine that you might have something
15 that's just above an acceptable threshold and through
16 redefinition of the FEPs or the scenarios or what have
17 you, you end up with a set of conditions that are
18 actually below the threshold and I'd be very
19 interested in the discussion in being assured that
20 that kind of manipulation is protected somehow.

21 So with that, Tim, Tim McCartin, we're
22 looking forward to your clarifying where we are in
23 this issue and perhaps answering some of our
24 questions.

25 MR. McCARTIN: Hopefully. Thank you, Dr.

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1 Garrick.

2 As you noted, we'll be talking about the
3 probability of unlikely events. I would like to make
4 a few introductory statements and one would be, as you
5 alluded to, although we are anticipating an SRM
6 shortly, we do not have one, so this presentation
7 should be viewed as the staff opinion. It isn't the
8 Commission's opinion yet until a proposal is
9 published.

10 Likewise, I do know that I believe we try
11 to and get benefit from participation with the
12 Committee and I would say it is unfortunate that we
13 did not -- were not able to come to the Committee with
14 our proposal prior to going to the Commission.
15 However, we were aware of that. We knew the
16 limitations of it. We were operating with an SRM on
17 final Part 63 that directed us to do an expedited rule
18 making and gave us a relatively short time period to
19 do this. And so there really wasn't an opportunity to
20 interact appropriately or as we typically would like
21 to do.

22 However, we think that going out with the
23 proposal, rather than getting the Committee's maybe a
24 very hurried quick opinion, we're proposing a 75-day
25 comment period. During that public comment period we

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1 would like to come back to the Committee, discuss the
2 public comments we get and get the Committee's
3 reaction at that time and certainly we would factor in
4 any Committee's opinions, views in the final to this
5 amendment. But it really -- we had approximately 2 to
6 3 weeks to do this before getting into the concurrence
7 process and so writing this in two to three weeks
8 really does not lend itself well to getting a lot of
9 input and thereby the Commission saying do an
10 expedited rule making which is direction to skip some
11 of the things you normally would do.

12 Also, along those lines, I'll repeat it at
13 the end, but when we're talking about unlikely events
14 in this context, I think it's very important to
15 recognized that unlikely is for this application only.
16 It is a very good qualitative word. We aren't
17 suggesting that we're defining the word "unlikely" for
18 all the uses that might be used in regulation at NRC,
19 but merely in this application.

20 Generally, I'd like to give you a little
21 of the regulatory background, some of the technical
22 background that we thought about and then finally I'll
23 give what our proposal for the probability value for
24 unlikely events is.

25 I will probably slip into using the

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1 unlikely events. The language is actually features
2 events and processes and sequences of events and
3 processes, but a shorthand way of saying is I just use
4 the word "events", but I mean the full spectrum.

5 The background, as actually Dr. Garrick
6 alluded to, the EPA standards were finalized on June
7 13th of last year. There were three standards: the
8 individual protection standards, human intrusion and
9 groundwater protection. Very unlikely FEPs are not to
10 be considered in any of these calculations. Unlike
11 FEPs are to be considered only for the individual
12 protection standard. They're excluded from
13 consideration in groundwater protection and human
14 intrusion.

15 The final standards went a little further,
16 obviously as proposed in the EPA standard the cutoff
17 for very unlikely FEPs was a one chance in 10,000 of
18 occurring within the 10,000 years, what we sometimes
19 refer to as the 10^{-8} per year cutoff. That's for very
20 unlikely FEPs. The probability for unlikely FEPs were
21 not defined and they left that to the NRC.

22 In looking at the preamble to the
23 standards, it's important to look at how unlikely is
24 to be applied. As I mentioned human intrusion,
25 groundwater protection. They're very specialized

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1 calculations. The human intrusion calculation is done
2 to look at the robustness of the repository to the
3 consequences of intrusion. Likewise groundwater
4 protection is to evaluate the degradation of the
5 groundwater resource. They're very specialized
6 calculations.

7 And further, in looking at these
8 calculations, the preamble to the standard really
9 talks to focusing the calculations on likely or
10 expected performance, so the reason for excluding
11 unlikely is you're trying to get to what is the likely
12 behavior, expected behavior for these two specialized
13 calculations.

14 Final part 63 was published in November of
15 last year. In it, the Commission indicated that they
16 intended to conduct a separate rulemaking to define
17 unlikely and indicated that the numerical value would
18 be somewhere between 10^{-8} , 10^{-4} per year.

19 Our approach in looking at how to define
20 unlikely, conceptually we thought it was easier to
21 think of three broad categories: very unlikely,
22 unlikely and likely. Clearly, we already had a
23 definition, a quantitative definition very unlikely,
24 the 10^{-8} per year and in looking at those three
25 categories we felt it was easier conceptually to think

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1 of very unlikely and likely. If you set the values
2 for those two, you clearly have the middle defined and
3 so looking at a lower bound for what should be
4 considered a likely FEP, we felt that somewhere
5 between 10^{-6} and 10^{-4} range was an appropriate value
6 for what could be considered likely as a lower bound
7 for likely.

8 Quantitatively, what does that really
9 mean? The 10^{-6} per year is essentially a 1 percent
10 chance of occurring within the 10,000 year period. We
11 felt that a 1 percent chance of occurring is neither
12 expected nor likely. 10^{-5} per year is a 10 percent
13 chance of occurring within the 10,000 years. And then
14 if we go to 10^{-4} per year, it's a very high
15 probability of occurring within the 10,000 years.
16 Obviously, it's very likely that it would occur.

17 And I know I was accused early on of the
18 Goldilocks Syndrome here and one's too low, one's too
19 high, the middle one is just about right and the 10^{-5}
20 per year would seem to be a 10 percent chance of
21 occurring as the lower bound for likely, that if you
22 got much lower than that, sort of like 10^{-6} , 1
23 percent, that should not be considered likely. The
24 10^{-4} per year, that would seem to be, you would want
25 to be a little lower than that. It's almost certain

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1 to occur. It's very likely to occur.

2 And thus, our proposal, we felt that
3 unlikely FEPs would be best characterized by a
4 probability range and we're defining the unlikely FEPs
5 as that value between 10^{-5} and 10^{-8} per year,
6 essentially a 10 percent chance of occurring at the
7 high end, down to the .01 percent chance which is
8 really the 1 in 10,000 over 10,000 years at that for
9 the very unlikely.

10 We think that upper bound of 10 percent
11 for unlikely seems to be a prudent range for defining
12 the unlikely events in the context of these two
13 calculations. Once again, it's not intended as a
14 precedent for other applications where the term
15 unlikely might be used in NRC regulations. At the
16 beginning of this exercise of writing the amendment,
17 we looked at the word unlikely, where is it used? It
18 appears in all kinds of places, other regulations. It
19 really is the context and for this particular
20 application it's appropriate. There are many other
21 uses of the word unlikely and we are not setting
22 precedent for that.

23 Where are we at? Right now, we anticipate
24 that we will get an SRM shortly and the amendment will
25 be published this month, 75-day comment period. We

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1 anticipate that we would have a final amendment some
2 time in the summer to early fall. And once again, I
3 would like to reiterate that I think during the public
4 comment period, as we get some of the comments in,
5 there could be an appropriate time, maybe more than
6 one time, to come back to the Committee and discuss
7 the comments we've gotten and where we think we're
8 headed with this amendment.

9 And with that, if there are any questions,
10 I'd be happy to try to answer them.

11 MEMBER GARRICK: Thanks, Tim. Milt,
12 microphone.

13 MEMBER LEVENSON: You did what is fairly
14 easy to do which is to confuse me, Tim. After you've
15 defined that you're going to talk about three things,
16 very unlikely, unlikely and likely, you then ring in
17 a new one which is very likely. Is that intended to
18 be a different category?

19 MR. McCARTIN: No, no. It was just -- the
20 10^{-4} in terms of -- I guess we could have -- well, we
21 were looking for the lower bound for unlikely or the
22 -- the lower bound for likely and --

23 CHAIRMAN HORNBERGER: Just take the "very"
24 off and you solve the problem.

25 MR. McCARTIN: The reason "very" is there,

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1 that in terms of -- it's too likely to be considered
2 the lower bound for likely.

3 (Laughter.)

4 MR. BAHADUR: Is 10^{-5} likely?

5 MR. McCARTIN: That's the -- yes, the
6 lower bound for likely. That's what our proposal is.
7 The lower bound for likely, the upper bound for
8 unlikely. You've got three categories. Obviously,
9 there's that.

10 MEMBER LEVENSON: Okay, one other
11 question. From a standpoint of risk informed and I
12 know maybe probably it isn't possible for this, but
13 I'd like your comment on the idea of defining these
14 independent of consequences when they're a basis for
15 screening out things. You're not -- there's nothing
16 in here that allows you to throw something out because
17 even if it's likely, the consequences are unimportant.
18 There's a whole separate set of things, right?

19 MR. McCARTIN: Right. It does not look --

20 MEMBER LEVENSON: You still have the other
21 screen, even if something is very likely, but has
22 extremely low consequences, still have the ability to
23 throw it out?

24 MR. McCARTIN: Oh, absolutely. I mean the
25 regulation allows for something that does not have a

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1 significant effect and that would be certainly based
2 on low enough consequences or low enough risk.

3 CHAIRMAN HORNBERGER: That would occur in
4 screening the FEPs, is that right?

5 MR. McCARTIN: That's one area you could
6 do it. You could actually have a FEP come in. You do
7 the analysis you see that the consequences and/or risk
8 is low enough that we -- it does not have a
9 significant effect on the time or the magnitude of the
10 dose. I can eliminate it. And that's really the --
11 in the rule, it does say that. Things that don't have
12 a significant effect on the timing and magnitude of
13 the dose, do not have to be included in the analysis.

14 MEMBER GARRICK: Ray?

15 VICE CHAIRMAN WYMER: Once these
16 categories are defined, then you get down to the
17 really tough question of how do you determine
18 probabilities. Where in the regulations is there
19 criteria for doing that?

20 MR. McCARTIN: Well, the only thing -- the
21 one thing we have said is that we, along the lines I
22 know Dr. Garrick mentioned that could there be
23 mischief by defining things a particular way merely to
24 get it a low enough probability to get it out of the
25 analysis and we have said that in general for events,

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1 categories of events and we're expecting a broad
2 definition of the event, rather than a very narrow
3 definition and maybe a simple example could be that if
4 you have seismicity, seismicity as an event occurs.

5 If you wanted to define maybe a very
6 narrow range of magnitude of the seismic event, you
7 could get down to a very small probability and we're
8 not looking at -- we're not expecting a narrow
9 definition. It tends to be more of a broader
10 definition, but other than that, there's nothing
11 that's part of the NRC review. It would be looking at
12 how a particular event was defined that potentially
13 led it to be screened from the analysis.

14 VICE CHAIRMAN WYMER: So you take somebody
15 else's calculation of probability and evaluate it?

16 MR. McCARTIN: Yes.

17 VICE CHAIRMAN WYMER: Okay.

18 MEMBER GARRICK: George?

19 CHAIRMAN HORNBERGER: Tim, let's see, how
20 can I phrase this question? One of the things that I
21 found a little confusing is this notion that you
22 presented that should we have a probability range or
23 a single number. At first I thought well, a single
24 number can't be what Tim means because that doesn't
25 make any sense. You're not going to pick the square

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1 root of 2 times 10^{-6} , the single number for an
2 unlikely event. So that isn't what you mean.

3 So what I don't understand is then what
4 the distinction is between saying okay, I'm going to
5 pick the single number, less than 10^{-5} . How is that
6 different from defining a range?

7 MR. McCARTIN: I don't believe it is.

8 CHAIRMAN HORNBERGER: Okay.

9 MR. McCARTIN: But --

10 CHAIRMAN HORNBERGER: So in terms of plain
11 language, don't you think that you might be doing
12 violence to understanding by raising this as a big
13 issue?

14 MR. McCARTIN: Well, what it does is --
15 the reason we use the range, we also have that lower
16 end cutoff, that unlikely doesn't proceed on to zero,
17 if you will, but it stops at the 10^{-8} and from that
18 point on it's very unlikely and it's really just
19 creating that here's the range for unlikely and then
20 here is likely. But you're right, it's just --

21 CHAIRMAN HORNBERGER: In the presentation,
22 you can add confusion by saying well, we're not
23 picking a single value. We're picking a range when --
24 obviously, that's what you're doing.

25 MR. McCARTIN: Well, yes. Maybe a better

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1 way to say it is it's less than 10^{-5} and therein is
2 less than 10^{-8} . That might --

3 CHAIRMAN HORNBERGER: I think you
4 mentioned this. It is important to highlight that
5 this decision, as Ray indicated well how do you decide
6 on these probabilities. These would only be the
7 unlikely events or event sequences or the whole -- I'm
8 using event the same way you said you were going to
9 use it. It's only for the stylized analyses for human
10 intrusion and well, basically igneous activity.

11 MR. McCARTIN: Groundwater.

12 CHAIRMAN HORNBERGER: Or groundwater
13 protection. So they're not screened out over the all
14 pathways dose at all?

15 MR. McCARTIN: No, no. The individual
16 protection would have the unlikely events, yeah.
17 Obviously, very unlikely is excluded from everything.

18 CHAIRMAN HORNBERGER: Right.

19 MR. McCARTIN: But the unlikely is
20 included in the individual pathway.

21 CHAIRMAN HORNBERGER: Thanks. That's all
22 I have.

23 MEMBER GARRICK: Tim, how would you
24 correlate FEPs with scenarios?

25 MR. McCARTIN: I would say that to me it's

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1 easier to think of the events and an event is like a
2 scenario class. I think they're similar.

3 A scenario class would have some
4 collection of FEPs within it.

5 MEMBER GARRICK: Yeah, yeah. FEPs also
6 contains the word process.

7 MR. McCARTIN: Yes.

8 MEMBER GARRICK: So it's not impossible
9 for a process to be characterized as a scenario.

10 MR. McCARTIN: Yes, right. Generally, to
11 date, probabilities, explicit probabilities have been
12 assigned primarily to events. The DOE and ourselves
13 have not tried to assign a probability to a feature or
14 a process. It could be done, but to date it generally
15 is looking more at the events.

16 MEMBER GARRICK: Now I guess the other
17 question I would want to ask is why are we doing this?
18 Why aren't we just focusing on the risk of not meeting
19 the standards and just calculate that risk? Why do we
20 want these thresholds?

21 MR. McCARTIN: Probably as much for
22 practicality purposes, I think. Certainly, the 10^{-8}
23 cutoff for very unlikely, I think you come to a point
24 where how low do I want to try to go to estimating
25 what might happen? And I think 10^{-8} in part, is due

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1 to practicality of how far I want to go in probability
2 space. 10^{-10} , 10^{-12} . I mean you get to some pretty
3 outlandish kinds of things and a lot of speculation,
4 depending on how far you go down. I think 10^{-8} is
5 there, as much for practicality in that it seems to be
6 a reasonably low level. We don't want to go lower.

7 The unlikely events, in my opinion, is
8 recognizing that we have two very special calculations
9 here, human intrusion and groundwater protection and
10 you're trying to get more -- you don't want to go to
11 as extreme events as you've considered in the
12 individual all pathway. But you're looking at, in a
13 general sense, what's likely to occur. And it's one
14 also of for these calculations will do a simpler kind
15 of calculation. I would say it's one of practicality,
16 once again and -- but I don't know, from a risk
17 standpoint should you look at a 10^{-10} event that has a
18 consequence --

19 MEMBER GARRICK: Well, we've run into this
20 problem in the large scope risk assessments of nuclear
21 power plants and the reason I ask the question about
22 scenarios is that you can look upon a risk assessment
23 as a structured set of scenarios. And the question
24 was if you impose screening levels, you need to be
25 careful to not get in the position that there's 10^{-4}

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1 events and so what we did was stored all of the events
2 that were screened and included them in the aggregate
3 calculation of the final risk measure which could be
4 something like an off-site dose or a release category
5 or a core damage frequency or what have you.

6 But that, at least, protected us against
7 any accumulated effect that might come from a class of
8 scenarios that met the cutoff criteria, but we didn't
9 throw them out. We kept them in the bottom line
10 calculation. Do you anticipate a similar approach
11 here?

12 MR. McCARTIN: To date, we have not been
13 as worried about the completeness argument.

14 MEMBER GARRICK: Right.

15 MR. McCARTIN: That -- which is what I
16 think you're getting at. Could we throw away enough
17 things that indeed we're really not representing the
18 risk of the facility any longer.

19 MEMBER GARRICK: Right.

20 MR. McCARTIN: And I believe in the rule
21 where we talk about we're expecting the events in
22 these types of things to be defined in a broad sense,
23 that we have not seen an effect that would, that is
24 throwing out big chunks of risk, if you will. I look
25 at say volcanism, seismicity.

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1 I mean these things are in and they're in
2 a broad sense, they're not things -- we have not seen
3 things being tossed out that the cumulative effect
4 would be that now we have 10 percent of the risk and
5 90 percent of the risk was tossed out. Certainly, the
6 desire was when we said that we were expecting a broad
7 definition was trying to get at that fact. I think
8 our review would have to look at it. We have to look
9 at what gets thrown out, etcetera.

10 As you know, the rule also talks to not
11 the amendment, but final 63 talks about we want to see
12 DOE's basis for what they threw out and I think we
13 would have to be sensitive and be able to answer that
14 question. Have we thrown out more risk than we've
15 kept in, but right now I think because the categories
16 tend to be broad --

17 MEMBER GARRICK: Of course, another
18 opportunity for accountability here would be the
19 uncertainties, the uncertainties could be impacted by
20 the impact that is judged from the FEPs that have been
21 screened out.

22 In principle, I like the idea of a range
23 versus a value, although as George says, the threshold
24 is a value. But the range is an interesting concept
25 and I think a step in the direction of accounting for

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1 uncertainty.

2 In the decision to do that did you
3 consider going the next step of actually imposing a
4 distribution function? I can imagine a p0 function,
5 a probability frequency function that would
6 characterize this parameter, this range even more
7 fully in a risk sense.

8 Did you consider that at all?

9 MR. McCARTIN: No.

10 MEMBER GARRICK: Rather than a limit line
11 as in the Reg Farmer limit line idea, you would have
12 a limit distribution and that way --

13 CHAIRMAN HORNBERGER: Does that mean that
14 you would partially include the analysis in the human
15 intrusion?

16 MEMBER GARRICK: No, what I'm talking
17 about is that if you do a calculation of the frequency
18 of occurrence event and you characterize that
19 calculation as a probability density function, does
20 that function -- is that compatible with the criteria
21 and the criteria could be a PDF. That's all I'm
22 saying.

23 CHAIRMAN HORNBERGER: I guess I don't
24 follow that. It seems to me that what Tim is
25 describing is a way to conform to what is stated in

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1 the EPA rule which is to define when an event sequence
2 or whatever, however we want to call it gets included
3 in, for example, a human intrusion stylized analysis.

4 MEMBER GARRICK: Yes, I understand. But
5 all I'm suggesting is that --

6 CHAIRMAN HORNBERGER: That requires a yes
7 or no answer is what I'm saying.

8 MEMBER GARRICK: Yes. But I think that if
9 you're starting to talk about criteria of what
10 constitutes an acceptable value, you could do it in
11 the context of distribution functions as well as you
12 could do it in the context of ranges, as well as you
13 could do it in the context of specific numbers.
14 That's all I'm saying.

15 CHAIRMAN HORNBERGER: Not to define a
16 likely event.

17 MEMBER LEVENSON: Well, in essence, it's
18 the same thing. The EPA cutoff says that you run
19 hundreds of analyses --

20 CHAIRMAN HORNBERGER: No, no. I
21 understand the rule, but it has nothing to do with --

22 MEMBER GARRICK: George, all I'm saying is
23 that you can represent likelihood in a number of
24 different ways. One way you can represent it is with
25 the frequency without regard to uncertainty. Another

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1 way you can represent it is with the probability and
2 inherent in your probability would be an uncertainty.
3 But another way you could represent it is in the
4 probability of frequency and you could have the notion
5 of frequency and you could say there's uncertainty in
6 that frequency and I characterize that certainty in
7 the form of a probability distribution.

8 And so all I'm suggesting is was there any
9 thought --

10 CHAIRMAN HORNBERGER: But still, it
11 strikes me -- suppose you now identify an events
12 sequence and you say well, there's a probability
13 distribution associated with it and with central
14 tendency as 10^{-6} or 5 times 10^{-6} per year and some
15 dispersion parameter around it. Is that event likely,
16 unlikely or very unlikely?

17 MEMBER GARRICK: Oh, I would, I guess I
18 left out a part. I would -- this is how I would go
19 possibly instead of the concept of likely and unlikely
20 and very unlikely.

21 CHAIRMAN HORNBERGER: Okay.

22 MEMBER GARRICK: To me, the concept of
23 likely,
24 very unlikely, etcetera, is an intermediate step 2
25 that kind of -- that PDF kind of characterization.

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1 CHAIRMAN HORNBERGER: I understand that
2 now. But what I'm saying is that it strikes me that
3 what Tim is faced with doing is conforming with the
4 existing EPA regulation which doesn't permit that.

5 MR. McCARTIN: I guess I would prefer the
6 -- in the regulation it be fairly rigid in terms of
7 less than 10^{-5} , greater than 10^{-8} , but in terms of
8 application and I don't know if this would get to some
9 of your desires, would be when I'm looking at
10 assigning a probability to a particular FEP, could I
11 use a distribution for the probability of that FEP and
12 I think the answer is yes.

13 Now the issue would be one of well, is it
14 in or is it out? If I get a little bit over here and
15 I think the intent of the rule where you're looking at
16 mean kind of behavior, I would say if you use a
17 distribution which is characterizing the uncertainty
18 in your probability estimate, if the mean of that
19 distribution would be -- you would use the mean to
20 decide whether you're in or out. That's something
21 that I think we probably will be looking at, possibly,
22 in the context of the review plan.

23 VICE CHAIRMAN WYMER: But the real problem
24 is going to occur when you come up with an event which
25 is neither very likely nor very unlikely, but likely.

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1 Then you're on pretty shifting ground.

2 CHAIRMAN HORNBERGER: No, then it's in.

3 MEMBER GARRICK: Then it's in, yeah.

4 VICE CHAIRMAN WYMER: But then you're
5 going to apply a judgment.

6 CHAIRMAN HORNBERGER: No, no, no. Then
7 it's in the analysis. Then it has to be considered in
8 the groundwater protection analysis and in the human
9 intrusion, stylized human intrusion.

10 VICE CHAIRMAN WYMER: Okay, I see what you
11 mean.

12 MEMBER GARRICK: One other comment, Tim,
13 here. You describe these as qualitative evaluation
14 guidelines. In order to establish compliance, you're
15 really imposing a very quantitative requirement on the
16 part of the analyst, right?

17 MR. McCARTIN: Absolutely, yeah.

18 MEMBER GARRICK: Because these thresholds
19 are pretty definite.

20 MR. McCARTIN: Well, you are right and the
21 qualitative was more in terms of the preamble in the
22 EPA standard. This is a qualitative word. Here are
23 some of the things they said in a qualitative sense to
24 give you an indication of what the intent was and by
25 that, if you look at qualitatively the words, they

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1 were intending to have expected conditions, likely
2 conditions and so when I look at -- I've got this
3 qualitative word unlikely and the intent as the way we
4 read it is to get to likely expected conditions and
5 that is what allows -- we then went okay,
6 quantitatively, you're absolutely right.

7 We want a very sharp, clear indication of
8 how we will implement that and that's why we're --
9 there is no doubt there. I mean we're proposing 10^{-5}
10 as the one end and 10^{-8} at the other and likewise for
11 very unlikely, 10^{-8} is very sharp. There is no
12 qualitative nature to that.

13 MEMBER GARRICK: I think the thing that
14 you have to be very much alert to is that the analysts
15 don't get so involved in these evaluation guidelines
16 that they compromise the real issue here which is
17 calculation of the risk of meeting the standard and
18 that's -- no, that's the thing that a lot of these
19 kind of bottom up considerations tend to do.

20 There is something people can get hold of
21 and they run with them and it's one of the reasons why
22 we, for example, were against subsystem requirements
23 was we want the focus to be the measure of its been
24 identified by law, in this case the three standards,
25 15 milirem, 15 milirem and 4 milirem. That's the

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1 context. And that's something I think you'd want to
2 be very careful with in this.

3 MEMBER LEVENSON: So is the total thrust
4 of this as George just implied a minute ago, to these
5 categories, to decide whether or not you do an
6 analysis, whether or not it's in the --

7 MR. McCARTIN: Well, the analysis will be
8 done. The question is what kinds of FEPs do I include
9 in the analysis and in reality I mean you can look at
10 -- and I'll talk to both cutoffs. The 10^{-8} cutoff, as
11 you know, I think on the plus side, you can -- do you
12 consider all the important things at Yucca Mountain.
13 I mean you have volcanism in that calculation.

14 We can't think of many things below 10^{-8} ,
15 I mean there's things that people --

16 CHAIRMAN HORNBERGER: A Bolide impact.

17 MR. McCARTIN: Which?

18 CHAIRMAN HORNBERGER: A Bolide impact.

19 MR. McCARTIN: Oh. Tsunamis. There's
20 things --

21 CHAIRMAN HORNBERGER: No, no, no. A
22 Tsunami isn't very likely to come over the Sierra, but
23 if you look at a probability of a Bolide impact, it's
24 not -- it's less than 10^{-8} , but it's certainly not
25 zero.

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1 There are craters in Arizona.

2 MR. McCARTIN: Yes, yes. But I think one
3 is sufficient enough to disrupt the repository 300
4 meters down, I think has been characterized as less
5 likely than --

6 CHAIRMAN HORNBERGER: I was agreeing with
7 you. It's less than 10^{-8} if you're screening it out.
8 Potentially bit impact.

9 MR. McCARTIN: Yes. So I think you've got
10 those kinds of things in there. When you get to what
11 should we include in human intrusion and groundwater
12 protection, certainly igneous activity at 10^{-5} falls
13 out certainly and then you've got things like rock
14 fall seismicity will still be in to some extent. At
15 least qualitatively that's how we see the
16 calculations. What is the impact of this particular
17 amendment, that really is the primary effect and we
18 think the calculations will be done. It's just a
19 matter of what gets included.

20 CHAIRMAN HORNBERGER: Tim, it strikes me,
21 this is just a follow-up on John's last comment that
22 you already have, I think, good experience to draw on
23 that goes to two of the things that John mentioned,
24 first of all, a distribution of frequencies and second
25 of all, what happens, how you make logical decisions

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1 about whether something is screened and that is you
2 look at igneous activity and DOE's analysis as I
3 recall right below 10^{-8} , but with a broad distribution
4 and so it doesn't get screened out even though the
5 mean or the median of the distribution is below 10^{-8} .
6 I think that you don't throw out good judgment when
7 you draw these lines and I think that you have good
8 experience with that already.

9 MR. McCARTIN: Right. I believe DOE's
10 latest numbers have it slightly greater than 10^{-8} , but
11 it's on that edge, but that's one of the things,
12 clearly, that we would be reviewing and looking at,
13 things that are screened out that are near that
14 boundary, be it the 10^{-8} or 10^{-5} and what's the basis.
15 So yeah.

16 MEMBER GARRICK: How important do you
17 think these categorizations will become in the
18 analysis, the unlikely, very unlikely and likely?

19 MR. McCARTIN: The understanding we have
20 to date would say that it's not very important. With
21 the simple -- with one simple caveat that there are
22 some things that the calculation will be somewhat
23 easier to do without and the -- not having to include
24 igneous activity in the groundwater protection
25 calculation and the human intrusion calculation. It's

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1 one less thing to have to include there. The
2 calculations we've done to date would say that isn't -
3 - wouldn't have made a difference.

4 MEMBER GARRICK: In the nuclear weapons
5 field they have a similar categorization and they have
6 a very unlikely, well, they have unlikely, very
7 unlikely and extremely unlikely. Was there any
8 discussion or interaction with them on this whole
9 process and how it has worked? They've been doing
10 this for a number of years.

11 MR. McCARTIN: No. I can tell you when we
12 first started on this amendment, we talked to a number
13 of people in the Agency both within NMSS and NRR and
14 the Office of Research in terms of give us some
15 insights on the unlikely, very unlikely, etcetera.

16 MEMBER GARRICK: Right.

17 MR. McCARTIN: And the overall response I
18 got from everyone was that it really depends on the
19 exact nature of the calculation you're doing and the
20 consequences and they said -- everyone was somewhat
21 unwilling to do much without knowing more about the
22 impact and what the application is. And so I think
23 for now, I think we're comfortable defining it in the
24 context of Yucca Mountain, in the context of the
25 10,000 year compliance period, in the context of human

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1 intrusion, groundwater -- it's a very specialized
2 application and for here, I think it makes sense.

3 There aren't many other people that deal
4 with the 10,000 year compliance period in terms of
5 looking at consequences and so we didn't get a lot of
6 information from the people we contacted, but we did
7 not go outside the Agency, I will say that.

8 MEMBER GARRICK: Any other questions?

9 MEMBER LEVENSON: It seems to me an
10 important factor here, John, and that is that it looks
11 like they no longer have to consider human intrusion
12 occurring during a volcano eruption.

13 (Laughter.)

14 MEMBER GARRICK: We used to call those
15 combined loads.

16 (Laughter.)

17 Yes, Latif?

18 MR. HAMDAN: Yes. Tim, do you have
19 anywhere in the rule some basis for the 10^{-5} , why it's
20 not 10^{-6} or 10^{-4} , for example?

21 MR. McCARTIN: Well, that's what the
22 amendment is doing is proposing 10^{-5} . In the
23 amendment, we certainly talk to the other three
24 values, 10^{-4} , 10^{-6} and give our rationale for it, but
25 this is the proposal. And once again, when we -- I'll

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1 say we go up before the Commission and even though
2 OGC, the legal arm of NRC, for a proposal for
3 rulemaking it's just that. Is this a reasonable
4 proposal? That's not to say it's going to end up here
5 at 10^{-5} , but it seems and I think people agreed that
6 it seemed a reasonable value to go out for public
7 comment.

8 Will it end up there? We've given our
9 basis why. We'll see what the public comment says and
10 likewise, I think for the Committee and once again,
11 this will be the third time, but I still want to say
12 we apologize for not coming early on, but I think this
13 will give you a longer time to think through this.
14 It's our first cut. That's why we go out for public
15 comment and maybe 10^{-5} , maybe there's a more
16 appropriate number, but we'll see what happens during
17 the public comment period.

18 MEMBER GARRICK: Any other comments from
19 audience or staff or anybody?

20 Okay, I think that satisfies us. Thank
21 you, Tim.

22 MR. McCARTIN: Sure.

23 CHAIRMAN HORNBERGER: Thanks very much,
24 Tim. Anything that anybody wants to bring up that we
25 could accomplish in 10 minutes or should we break for

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1 lunch adn reconvene?

2 So because John and I have a meeting with
3 Commissioner Merrifield at 1 o'clock, what I would
4 suggest is that Ray and Milt could get us started --
5 I don't know if either of you have read this yellow
6 letter, I haven't yet. But there are questions. The
7 big thing is to look through this research report and
8 try to come up with the key things that we need to say
9 in our research report. So my suggestion is you
10 should go ahead and have a read through that adn the
11 two of you could discuss it. That one and this white
12 one that Dick Savio handed around, research.

13 MR. SINGH: I haven't passed out the
14 research report yet.

15 CHAIRMAN HORNBERGER: Oh okay, so it's not
16 around.

17 MR. SINGH: But I have copies.

18 CHAIRMAN HORNBERGER: Okay, so what I
19 suggest is Dick, why don't you give copies to Ray and
20 Milt and --

21 MEMBER LEVENSON: When will you be back?

22 CHAIRMAN HORNBERGER: Probably around
23 1:30. Okay? So we'll start our letter writing
24 session around 1:30 and we don't need to be on the
25 record at all this afternoon? Is that right?

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1 So this will end the record keeping.

2 Adjourned.

3 (Whereupon, at 11:54 a.m., the proceedings
4 were concluded.)

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Pippa Antonio
Official Reporter
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