

1 UNITED STATES OF AMERICA
 2 NUCLEAR REGULATORY COMMISSION
 3 ***
 4 MEETING WITH ADVISORY COMMITTEE
 5 ON NUCLEAR WASTE (ACNW)
 6 ***
 7 PUBLIC MEETING
 8 ***

9
 10 Nuclear Regulatory Commission
 11 Commission Hearing Room
 12 11555 Rockville Pike
 13 Rockville, Maryland
 14
 15 Thursday, December 18, 1997

16
 17 The Commission met in open session, pursuant to
 18 notice, at 10:07 a.m., the Honorable SHIRLEY A. JACKSON,
 19 Chairman of the Commission, presiding.

- 20
 21 COMMISSIONERS PRESENT:
 22 SHIRLEY A. JACKSON, Chairman of the Commission
 23 GRETA J. DICUS, Member of the Commission
 24 NILS J. DIAZ, Member of the Commission
 25 EDWARD McGAFFIGAN, JR., Member of the Commission

ANN RILEY & ASSOCIATES, LTD.
 Court Reporters
 1250 I Street, N.W., Suite 300
 Washington, D.C. 20005
 (202) 842-0034

- 1 STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:
 2 JOHN C. HOYLE, Secretary
 3 KAREN D. CYR, General Counsel
 4 DR. B. JOHN GARRICK, Chairman, ACNW
 5 DR. CHARLES HORNBERGER, Vice Chairman, ACNW
 6 DR. CHARLES FAIRHURST, Member, ACNW
 7 DR. RAYMOND WYMER, Member, ACNW
 8 DR. JOHN T. LARKINS, Executive Director, ACNW

9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 ANN RILEY & ASSOCIATES, LTD.
 Court Reporters
 1250 I Street, N.W., Suite 300
 Washington, D.C. 20005
 (202) 842-0034

[10:07 a.m.]

CHAIRMAN JACKSON: Good morning, ladies and gentlemen. Today the Commission will be briefed by the Advisory Committee on Nuclear Waste on several technical issues related to the management and disposal of radioactive waste.

The Commission always looks forward to the ACNW to provide it with its technical advice to assure the safe management and disposal of this country's radioactive waste.

Today's briefing by the ACNW will include discussions on three technical issues that are of great interest to the Commission. These topics include the application of probabilistic risk assessment or PRA to performance assessment in the NRC High Level Waste Program, performance assessment capability in the NRC itself in the NRC High Level Waste Program, and the implementation of a defense-in-depth concept in High Level Waste.

In addition to these technical discussions, the Commission will also discuss its priorities for the next year. The Commission looks forward to your presentation and unless any of my fellow Commissioners have opening comments, Dr. Garrick, Please proceed.

DR. GARRICK: Thank you. Perhaps before we start, Chairman Jackson, I would like to recognize two new members ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

4

of the Committee -- Dr. Raymond Wymer and Dr. Charles Fairhurst, and we're delighted to have them and put them to work as quickly as possible.

We have taken the liberty to restructure the agenda a little bit from what you described, and in particular, in order to establish a framework within which we can identify the relevance of the issues we are going to talk to you about, we are planning to talk a little bit about the priorities first.

CHAIRMAN JACKSON: Sounds good.

DR. GARRICK: And I think that one of the things that we have attempted to do with the presentation is to create somewhat of a theme, starting with the priorities or starting with the Strategic Plan as a proposed structure within which we operate, and getting into the performance assessment issue as a discipline and our comments regarding that, and then moving from there to, well, what capabilities exist within the NRC to deal with this subject, and then somewhat in the context of an example address the issue of defense-in-depth.

We hope that that theme is logical and appeals to you, so with that I will lead off the discussion, talking about the Strategic Plan.

What we have done here is pick up on your leadership for developing a Strategic Plan for the Agency ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

5

and root our plan in that plan and ask ourselves along the way about its relevancy to the overall plan of the Nuclear

3 Regulatory Commission -- so we hope that that occurs. We
4 hope also that this can become a benchmark, if you wish,
5 with which we can measure our performance, and of course we
6 expect to do this each year.

7 So if I could, I would like to proceed to the
8 Plan. We have chosen to take a top-down approach just as
9 the NRC Plan did, and to get into the whole arena of
10 mission, vision, goals, objectives, and then finally the
11 product that we want out of the Plan was priorities.

12 Our first exhibit here is what is the mission of
13 the ACNW. Our characterization of that mission is that we
14 are to provide independent and timely technical advice on
15 waste management issues to support the NRC in conducting an
16 efficient regulatory program that enables the nation to
17 safely use nuclear materials.

18 Now with respect to our vision, the Advisory
19 Committee on Nuclear Waste strives to provide advice and
20 recommend solutions that are forward-looking, that are based
21 upon the best available science and technology, and that can
22 be implemented and reflect the needs and balance risk,
23 benefit and cost to society to enable the safe use of
24 nuclear materials.

25 As far as goals are concerned, we have identified
ANN RILEY & ASSOCIATES, LTD.

 Court Reporters
1250 I Street, N.W., Suite 300
 Washington, D.C. 20005
 (202) 842-0034

6

1 several goals. One of the goals of course is to position
2 ourselves to be effective in our response to change and the
3 attendant uncertainty that surrounds us in the management of
4 nuclear waste, to provide assurance to the Commission that
5 the best science is being employed in resolving key safety
6 issues, and of course when we talk about that science we are
7 talking about consistent with the constraints that we all
8 have to work under; to provide advice to the NRC on how to
9 increase its reliance on risk as a basis for
10 decision-making, including risk assessment methods for
11 waste, radioactive waste management; to support and assist
12 the NRC in improving public involvement; and to optimize the
13 effectiveness and efficiency of the ACNW operations.

14 CHAIRMAN JACKSON: Yes, please.

15 COMMISSIONER DICUS: On the fourth bullet, in
16 assisting and improving public involvement, what are some of
17 your ideas that you would be doing to help us improve public
18 involvement that we are not already doing?

19 DR. GARRICK: All right. Well, I am not
20 suggesting that we aren't doing some of these things, but a
21 couple of things that come to our mind and that we have
22 talked about a little bit is that we could probably be a
23 little more deliberate in our outreaching for public
24 involvement, in giving ourselves confidence that the public
25 is well-represented on key issues.

ANN RILEY & ASSOCIATES, LTD.
 Court Reporters
1250 I Street, N.W., Suite 300
 Washington, D.C. 20005
 (202) 842-0034

7

1 We are in a position of anticipating these issues
2 much further in advance than the announcement accommodates,
3 and so I think that one aspect of this that we have been

4 thinking about is perhaps there are some things we can do in
5 the sense, in the context of an outreach program.

6 The other thing that I think is very fundamental
7 to the whole notion of a transition towards a risk-informed
8 regulation is that many of us believe very strongly that one
9 of the most important mechanisms, one of the most important
10 tools for reaching to the public is to have a framework
11 within which issues are consistently and systematically
12 addressed, including issues, comments, or input that might
13 come from the public -- so those are a couple of thoughts.

14 COMMISSIONER DICUS: That's good. Thank you.

15 DR. GARRICK: Criteria -- obviously if you are
16 going to have as an end goal of a strategic plan and
17 development of priorities you need some sort of process that
18 gives you some confidence that these priorities are properly
19 connected to our vision and our mission.

20 The priorities that we have listed here are very
21 consistent with the priorities that we have seen in the Plan
22 for the Agency.

23 It's clearly protection of public health, workers,
24 and the environment. We want certainly to be responsive to
25 issues that the Commission is most interested in.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

8

1 Timeliness is always a matter that is important in
2 the effectiveness of any advisory effort.

3 We have also tried to measure the relationship of
4 the issues to the Strategic Plan of the Agency, the
5 potential for an issue to pose undue risk or surprises or
6 things that would affect the reasonableness of the solution
7 to that issue -- such as cost; issues arising from
8 strategies and activities of licensees -- it seems that if
9 you are going to be an effective advisor you need to
10 understand the depth and breadth of the issues as viewed by
11 the people that you are trying to regulate; and finally
12 issues arising from technical basis for safety assessments.

13 So what this all led to was a set of priorities.
14 We chose to divide these priorities into two categories, one
15 that we chose to call the First Tier priorities, and of
16 course a major consideration in something being First Tier
17 is that it is something that needs to be addressed now,
18 1998.

19 We have also tried to cut these at a level where
20 they convey some sort of an image that is less than generic
21 that people in our business in the Agency identify something
22 with, and so we have been rather sensitive to the labels
23 here.

24 So the priorities, not necessarily in order of
25 priority, that we have listed under the First Tier are the

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

9

1 viability assessment. We realize that this is not an
2 official Nuclear Regulatory Commission requirement, but we
3 also realize that as the Agency moves and positions itself
4 to be increasingly effective in the licensing of repository
5 for high level waste that this is an important opportunity

6 for us to get involved, to see issues, to get a sense of
7 what the licensee or the applicant is doing, and so we view
8 this as a very important activity.

9 Risk-informed performance-based regulation -- I
10 don't think we need to elaborate much on that. It's
11 becoming an across-the-board issue of considerable
12 importance to the Agency. We will be addressing it some
13 more in our subsequent presentations.

14 We all know also that as the Site Characterization
15 Program proceeds with respect to Yucca Mountain and as we
16 learn more about the characteristics and the properties of
17 that site, we learn a great deal more about what we are
18 going to have to do in the way of modifying that site to
19 give us confidence that it can comply with the standards and
20 the regulations that are to follow.

21 One of those issues that has surfaced that is
22 becoming increasingly important is that there is
23 considerable evidence that perhaps there is going to have to
24 be a greater dependence on engineered systems than maybe the
25 way we were thinking a few years ago, and so we have moved

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

10

1 that up as a high priority.

2 Decommissioning is judged to be also a First Tier
3 priority and it crosses a lot of activities and disciplines
4 in the whole arena of waste management.

5 Then, of course, research -- this is an issue that
6 has increased in importance for a few reasons. One is that
7 this is a function that was handled to some extent by the
8 previous Nuclear Safety Research Review Committee and the
9 activities of that committee are having to be spared by the
10 Advisory Committee on Reactor Safeguards and the Advisory
11 Committee on Nuclear Waste and we want to be darn sure that
12 we are forward-looking with respect to this research.

13 CHAIRMAN JACKSON: I think Commissioner McGaffigan
14 has a question for you.

15 COMMISSIONER MCGAFFIGAN: This may be more a
16 statement than a question.

17 I just want you to be aware on the risk-informed,
18 performance-based regulation, we had a meeting yesterday
19 where we talked in reactor space about how far we can push,
20 how rapidly we can push towards risk-informed regulation in
21 that context and I believe the Strategic Plan says that
22 risk-informed and as appropriate performance-based. We are
23 still trying to define when it is appropriate and I think in
24 the waste area I think we believe it is appropriate but we
25 don't have a lot of guidance at the moment as to when it is

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

11

1 appropriate to use a performance-based rule as opposed to a
2 more prescriptive rule, and I think we are still struggling
3 to come up with the criteria for when one does that, so it
4 is an ongoing -- we have made a commitment to try to make a
5 transition to more risk-informed and to more
6 performance-based or less prescriptive, but the words in the

7 Strategic Plan were struggled over, and so I just point out
8 the nuances to you.

9 DR. GARRICK: Yes.

10 CHAIRMAN JACKSON: I actually believe that that is
11 in fact an opportunity.

12 DR. GARRICK: Yes.

13 CHAIRMAN JACKSON: For our advisory committees.

14 DR. GARRICK: Yes -- and we agree with that.

15 As far as the Second Tier --

16 CHAIRMAN JACKSON: Excuse me --

17 DR. GARRICK: Oh, excuse me.

18 CHAIRMAN JACKSON: Commissioner?

19 COMMISSIONER DICUS: Well, this could be for First
20 Tier or Second Tier questions or slides rather. Have you
21 within your First Tier -- did I hear you say you haven't
22 really prioritized within the First Tier priorities. Is it
23 as the issue comes up or as you may to discuss it?

24 DR. GARRICK: Well, we have not really fine-tuned
25 it that much. I think each member of the committee has

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

12

1 their own preferences as to which is the top priority.

2 I suspect that the events will determine that as
3 we proceed in 1998 and they take on a little different
4 context because some of these issues will continue for sure
5 way beyond 1998. Others are going to be much more
6 short-lived.

7 COMMISSIONER DICUS: I don't know whether I should
8 ask this question or not, but I guess I will. Even just
9 looking at the First Tier priorities that you read, some of
10 the items in the Second Tier priorities, it is a lot of work
11 for a relatively small group.

12 That's more a statement than a question.

13 DR. GARRICK: You're absolutely correct,
14 Commissioner Dicus --

15 CHAIRMAN JACKSON: Don't set him up to ask for
16 more --

17 [Laughter.]

18 COMMISSIONER DICUS: When I asked the question, I
19 thought I know I am going to get in trouble with this
20 question.

21 CHAIRMAN JACKSON: You are.

22 [Laughter.]

23 DR. GARRICK: The only answer I can give is yes.

24 CHAIRMAN JACKSON: Thank you. Very good answer.

25 DR. HORNBERGER: I think in part, if I could just

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

13

1 interject, it's clear that we are not going to exhaustively
2 approach all of these topics and the viability assessment we
3 will do what we can when the products come through later in
4 the year.

5 CHAIRMAN JACKSON: It's a triage, yes.

6 DR. GARRICK: Triage, yes. I think we are short
7 of time and I don't think I want to dwell much on the Second
8 Tier except to recognize them and to indicate that these not

9 only reflect the application of our criteria but have
10 involved a number of reviews of meetings we have had.

11 Commissioner Dicus made a major contribution to
12 this when she attended part of our retreat.

13 We have received a lot of information from the
14 NMSS as to what they believe are the priorities, so this is
15 something that has come from a wide band of resource bases.

16 COMMISSIONER MCGAFFIGAN: A question about just
17 how the Advisory Committee with limits compared to ACRS
18 operates.

19 We involved ACRS quite often in lots of Staff
20 proposals, generic letters, whatever. We have in this long
21 list of priorities items that come up.

22 One that comes to mind at the moment we and the
23 State of Washington are struggling with is the Trojan
24 reactor vessel with internals intact and whether it should
25 be disposed of at Richland.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

14

1 Do you see a role for yourself in advising the
2 Staff and the Commission on these cases? I guess it's more
3 casework. The ACRS I think does more casework.

4 You have thus far stayed at a higher policy level.

5 How do you see that in your committee's work?

6 DR. GARRICK: Well, I guess I would say first that
7 we are here principally to respond to issues raised by the
8 Commission, and if the Commission sees us as having an
9 effective role in that arena we would, I think the committee
10 would be delighted to do so.

11 I don't think that we see ourselves as fenced in
12 on any particular way of operation. I would hope that we
13 would have the flexibility to do that.

14 COMMISSIONER MCGAFFIGAN: And this gets back to a
15 fundamental question. I have noticed reading Nucleonics
16 Week and other publications recently that there is a
17 movement afoot or in France for example to question whether
18 repositories are the appropriate role or if there may be a
19 technology out there and some sort of interim approach, and
20 then some technology comes along in 100 years, and that
21 obviously -- my old Los Alamos sometimes -- cells
22 accelerated transmutation of waste -- is that technology
23 that may come along.

24 I know there is a big Academy report on that
25 subject, but is there a role for you all in continuing to

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

15

1 inform us as to -- I know on the viability of the repository
2 approach but on these alternatives that occasionally get
3 talked about, whether they are indeed viable in your view?

4 DR. GARRICK: Well, Commissioner McGaffigan, I
5 surely hope there is. Speaking for myself, this is what
6 makes this job interesting is to be in a position to address
7 broader issues than maybe we see in trying to set up our
8 agendas and what have you.

9 I think that it is clear in our conversations

10 among the committee that we have a very deep interest in
11 alternatives, in interim solutions, in methods of timeliness
12 with respect to when we get to a particular type of
13 solution, and in the technologies that are involved, so I
14 think that we would be very interested in that kind of
15 involvement.

16 CHAIRMAN JACKSON: Actually, that leads to two
17 comments.

18 One is that having recently been in France, I
19 think the issue for the French is not rejecting the idea
20 because I actually had a meeting with all of the nuclear
21 players. It's not rejecting per se the idea of a repository
22 but having a repository built in a way where it can either
23 be permanently sealed or what is put into it being
24 retrievable if a technology is developed that allows for
25 disposition of the high level waste by some alternative

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

16

1 mechanism, and so we want to be careful in terms of how it
2 is reported versus what the players are really saying.

3 DR. GARRICK: Yes. As a matter of fact, when we
4 put the priority repository design on here, we were thinking
5 of just those kinds of issues and the retrievability issue
6 is a particularly important one that we sometimes think is
7 not adequately addressed, and from a reality standpoint from
8 an operational standpoint, and that is a very good example.

9 CHAIRMAN JACKSON: Go ahead, please.

10 COMMISSIONER DICUS: So it would cover, if I can
11 change the terminology a little bit, the closed repository
12 designs as well as maybe an open repository design?

13 DR. GARRICK: Yes. It's no question that our
14 focus has been on a closed repository and post-closure but
15 there is strong interest in alternatives and some of those
16 alternatives involve modifications of -- interface that goes
17 from open to closed.

18 CHAIRMAN JACKSON: Right. Exactly.

19 COMMISSIONER DICUS: How does your Strategic Plan
20 track with the Agency's Strategic Plan?

21 DR. GARRICK: Well, I think -- and one of the
22 things we are going to do is send you a copy of it -- and we
23 have agreed on a letter to do that and you will be receiving
24 that within the next few days. I think the attachment to
25 our letter will be very apparent with respect to its

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

17

1 connection with the NRC Plan.

2 I would like to move on to the next topic,
3 application of probabilistic risk assessment methods to
4 performance assessment in the NRC High Level Waste Program,
5 and

6 You have received a letter on this. As you
7 observed from our letter, the primary issues that we
8 identified had to do with the committee feeling very
9 strongly that the true spirit and intent of the concept and
10 the philosophy of risk assessment be sustained. Whenever we
11 use it and apply it that it is a technology, a discipline

12 that was sought out as an alternative to simplified
13 calculations, to bounding calculations, to worst case
14 analysis. It was intended to provide us more insight into
15 the reality of what was going on with the system that we
16 were interested in.

17 The issue here is that the committee wants to have
18 a high degree of confidence that that quality is preserved
19 in its application so this is more in the context of a
20 caution and a consciousness, a concern than anything in
21 particular.

22 The approach to performance assessment should
23 clearly allow an exposure or a manifestation of those things
24 that are driving the risk because that is what gives you the
25 information you need to implement any kind of sensible risk

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

18

1 management program.

2 CHAIRMAN JACKSON: Yes, Commissioner.

3 COMMISSIONER MCGAFFIGAN: On the first caution,
4 you said there is nothing specific there, but is the fear
5 that bounding calculations and worst case calculations have
6 a way of creeping into so-called realistic --

7 DR. GARRICK: Yes.

8 COMMISSIONER MCGAFFIGAN: -- models?

9 DR. GARRICK: Yes, that's true, and the fear that
10 we are really doing a disservice to the public because in
11 the way they are presented sometimes the public interprets
12 them as being the real world and the real analysis and I
13 think we need to be very cautious about that.

14 CHAIRMAN JACKSON: Yes?

15 COMMISSIONER DICUS: Maybe you are going to
16 address this in the other slides, but given the fact that
17 what we are doing is to review what DOE is doing, how would
18 something like this track with what DOE is doing?

19 DR. GARRICK: Yes, I realize the roles are
20 different.

21 I realize that the purpose of the Agency with
22 respect to performance assessment is, first, to gain an
23 understanding and increase knowledge about the facility or
24 the site that they are trying to evaluate, and then second,
25 to use it as a mechanism for giving them an independent

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

19

1 perspective, the independent ability to review what DOE
2 does, so I think the point is well-taken and it is important
3 to realize that our interest, the Nuclear Regulatory
4 Commission's interest in the performance assessment is a
5 different one than the licensee, and I think those are the
6 two primary differences.

7 One of the things that we were briefed on last
8 summer was the progress that the Commission has made with
9 respect to performance assessment, the tools that have been
10 developed, and we were very pleased to see that a great deal
11 of progress has been made.

12 Revised NRC total performance assessment code

13 Version 3.1 in our judgment represents a major step forward.
14 We are very aware that it has been a longstanding
15 effort on the part of the Staff to collect the evidence to
16 package the information that supports any analysis in an
17 effective manner and that the Staff has continued to be
18 interested in trying to gain this understanding that I spoke
19 to of the processes that affect repository performance.

20 We think they have made a lot of progress in that
21 regard.

22 CHAIRMAN JACKSON: I think Commissioner McGaffigan
23 has a question.

24 COMMISSIONER MCGAFFIGAN: Well, it really relates
25 to -- you are praising on this page but on the page you are
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

20

1 going to suggest that --

2 DR. GARRICK: The good news and the bad news.
3 [Laughter.]

4 COMMISSIONER MCGAFFIGAN: That there may be a need
5 for TPA 3.2, which would get rid of what you call
6 unrealistic results that arise from bounding calculations
7 embedded in the code.

8 Is that in fact -- it's a pivotal effort but it
9 isn't quite there yet, if I try to put these two thoughts
10 together?

11 DR. GARRICK: Yes. I think that obviously we in
12 our briefings and in the documentation we received don't
13 always have a full view of everything that is going on, and
14 we recognize that, and as a matter of fact, between the
15 briefing in July and this meeting, we have had things
16 brought to our attention that illuminate some of the issues
17 that we were concerned about and in fact there is less
18 concern, but one of the things that we were triggered on a
19 little bit during our meeting and the basis for this letter
20 was that it was the impression of some of the committee
21 members that maybe not as much attention to detail was being
22 given as could be with respect to some critical assumptions.

23 I think that we were especially focused in that
24 meeting on the engineered barriers -- that was sort of a
25 theme of that meeting -- and so we were looking very

ANN RILEY & ASSOCIATES, LTD.
Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

21

1 strongly at a component of the repository design that
2 perhaps the TPA 3.1 in its evolution had not quite caught up
3 with in terms of its importance.

4 So, yes, we made some judgments that perhaps there
5 were some assumptions having to do with the representation
6 of the degradation of the waste package that were more
7 conservative than we would have liked to have seen, but
8 still in the context of my opening comment here, the
9 approach we were taking was one of caution more than one of
10 necessarily being unduly critical and reminding ourselves of
11 what this discipline can do for us and what its underlying
12 capability is.

13 DR. HORNBERGER: I would point out too that I
14 don't think it is inconsistent with the Staff's position.

15 That is, I don't believe that they see this as a fixed
16 immutable instrument -- that they really do want to test
17 things out and improve it in areas where they see
18 improvement is needed, whether it is called 3.2 or just a
19 revision of TPA 3.

20 CHAIRMAN JACKSON: Let me ask you this question.
21 In terms of trying to get at what you called some
22 of the ultra-conservative model assumptions --

23 DR. GARRICK: That word --
24 [Laughter.]

25 CHAIRMAN JACKSON: How much is this related to a
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

22

1 conservatism that is cultural versus a conservatism that is
2 based on lack of information?

3 DR. GARRICK: Yes. Well, I guess the way -- I
4 know what you are saying. I guess a way that I would like
5 to address that is that I think as technical people, and we
6 certainly have to be sensitive to cultural conditions, but
7 as technical people I think it is very important for us when
8 we are talking about a parameter or a performance measure to
9 do the best job we can of characterizing the full range of
10 values of that measure.

11 Now by that we are not suggesting that we ought
12 not to be conservative. On the contrary, the committee has
13 been outspoken on that issue. We should be conservative,
14 but if you do the former and you do it systematically and
15 visibly, then the opportunity exists when you have decided
16 to regulate on the basis of a value, the opportunity exists
17 to see what the context is of that value based on reality,
18 so that is the thought here.

19 CHAIRMAN JACKSON: But that is a key phrase you
20 just used. You said based on reality, and that gets to my
21 question about the informational base that is being drawn
22 on.

23 DR. GARRICK: Yes.

24 CHAIRMAN JACKSON: And so if you could answer the
25 question in that context, in terms of how can the Staff or
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

23

1 what needs to happen to have the models become more
2 realistic?

3 DR. GARRICK: I think the one thing that is very
4 important to do just what you are talking about is to make
5 sure that when you present a calculation or a distribution
6 that the evidence supporting that is very clear.

7 One of the things we also recommended strongly in
8 that letter is that a lot of attention be given to packaging
9 the supporting information such that one could make a
10 connection between the values and the information base, and
11 it reflects a philosophy I think that it's maybe not so
12 important what the analyst does as it is what the analyst
13 does on what basis -- what is the evidence, what is the
14 information base that the analyst uses.

15 So what we have tried to do is put a little focus

16 and emphasis on the source material, on the evidence base
17 for the calculations.

18 CHAIRMAN JACKSON: Yes, Commissioner Diaz.

19 COMMISSIONER DIAZ: Just following up on the same
20 issue, do you think it might be possible in some period of
21 time to define what conservative means?

22 DR. GARRICK: Well, Commissioner Diaz. I am not
23 sure, but I do -- this is one of the great attractions that
24 the probabilistic thought process has to me is namely
25 context, namely perspective, namely the full range of values

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

24

1 that you might associate with a particular analysis.

2 The key is whether or not you have sufficient
3 supporting evidence to make that a reality.

4 There is always going to be uncertainty.

5 COMMISSIONER DIAZ: I understand, but in old-time
6 engineering we used to take these safety factors and
7 sometimes a safety factor of two was fine and sometimes a
8 safety factor of four was fine.

9 DR. GARRICK: Right.

10 COMMISSIONER DIAZ: You know, at one point we have
11 to maybe decide is it a factor of 10 what being conservative
12 is.

13 DR. GARRICK: Yes.

14 CHAIRMAN JACKSON: Commissioner McGaffigan. You
15 had a question?

16 [No response.]

17 DR. GARRICK: So I am going to move to the
18 interpretation of results.

19 I think we have been talking about -- and I am not
20 going to say much about that because key similarities of PRA
21 and PA we did discuss at the last Commission meeting.

22 They have a great deal of similarity. They both
23 can be scenario-based. If you talk about a scenario-based
24 approach, you are talking about initial conditions and end
25 conditions.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

25

1 In the reactor game we talk about initiating
2 events. In our game we talk about initial conditions,
3 end-states.

4 We have an advantage in the waste field in that
5 the end states that are the most likely going to be defined,
6 and we are looking forward to EPA doing that, is a health
7 standard of some sort, a dose standard, and so we don't have
8 to have a surrogate for health effect, we can calculate it,
9 so it lends itself very nicely to a risk-based approach.

10 There are some dissimilarities.

11 One of the things we talked about in this letter
12 is the need for a mechanism, a tool for analyzing the
13 results, for being able to take the results and take
14 advantage of how those results were assembled and unravel
15 them in such a way that one can see the effect of
16 intermediate results on the bottom lines.

17 We know Staff is working on that. We are going to

18 continue to push for that because we think that that is
19 absolutely key to making this process an acceptable process.

20 We talked about specific methods that are employed
21 to do this. We mentioned the event tree. We are not
22 religious about that. There are other methods and we are
23 open to those kinds of suggestions, so our conclusions
24 relative to probabilistic performance assessment, we do
25 believe that sustaining the properties of risk analysis, of
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

26

1 doing realistic analysis is important.

2 We want to make a contribution to having that be a
3 conscious thing on the part of the people doing the work,
4 and we are suggesting that, in conclusion, that the Staff
5 look very hard at some sort of a post-processor that makes
6 this whole issue of interpreting the results of the PA a
7 more manageable one, and we are convinced, especially
8 following our meeting, that they are working on this.

9 CHAIRMAN JACKSON: Thank you. Commissioner?

10 COMMISSIONER DICUS: A couple of questions.

11 One, on the use of the post-processor, you said
12 the Staff is working on this, that they seem to be agreeable
13 to do this, that this is the right direction to go?

14 DR. GARRICK: Yes, they are agreeable.

15 I think that as most of the problems in life are
16 communication problems, everybody has their own language as
17 to -- in this field when they practice this, and they become
18 strongly identified with that language and the images that
19 come out of that, and I am certainly no exception to that
20 and the committee is no exception to that, so we have had a
21 little bit of difficulty understanding each other on how we
22 are doing this and I think we need a lot more briefings and
23 interaction, especially with respect to developing a more
24 in-depth understanding of TPA 3.1 before we can really say
25 we are getting together on this.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

27

1 So I think there is work to be done, but I suspect
2 a lot of that work is understanding each other.

3 COMMISSIONER DICUS: What about, again thinking
4 about DOE, is DOE doing anything like this, are you aware?
5 I don't know if we know.

6 DR. GARRICK: DOE needs this. There is no
7 question in our mind that they need it. We understand that
8 they are doing some things. We don't know for sure what
9 they are.

10 They attended the same meeting where this was
11 discussed. They did comment at the end of that meeting they
12 thought they were doing most of what we were talking about.

13 Based on what we have seen, what we have heard, we
14 are not convinced of that, and also down the road in the
15 licensing process it's going to take a lot more interaction.

16 CHAIRMAN JACKSON: Is this being done within a
17 laboratory, DOE laboratory, or is it done by other DOE --
18 you know, staff?

19 DR. GARRICK: The team that is doing the TSPA, the
20 Total Systems Performance Assessment, is made up of -- that
21 is one of the things that concerns us.

22 There's a lot of laboratories, universities, M&O;
23 contractors, DOE staff that are involved. I think that one
24 of the biggest challenges they have is the integration of
25 the inputs that they are --

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

28

1 CHAIRMAN JACKSON: Well, you know, I told them
2 that two years ago.

3 DR. GARRICK: Yes. Well, you were right on.

4 CHAIRMAN JACKSON: Yes, actually -- I mean it was
5 clear then in terms of how the work was tracking and who
6 was, you know, who was pulling it all together.

7 COMMISSIONER DICUS: And one more just quick
8 question. Making these shifts a little bit with the staff
9 and more realistic models and all, have you thought about
10 resource implications for the Commission?

11 DR. GARRICK: Yes. Yes, and we know --

12 COMMISSIONER DICUS: Do you have them?

13 DR. GARRICK: There are resource problems. The
14 NRC Staff clearly does not have the resources that DOE has
15 to work on performance assessment and so they have to be
16 much more selective in what they do, and it is a constraint.
17 No question.

18 COMMISSIONER DICUS: Thank you.

19 CHAIRMAN JACKSON: Part of the reason I asked the
20 question also had to do with -- about information bases --
21 is the input to this process from the Center, the Nuclear
22 Waste Regulatory Analysis.

23 Do you have a sense of how the work that that
24 center is doing is being integrated into --

25 DR. GARRICK: I am not sure we completely

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

29

1 understand that.

2 I know one thing that the committee is in
3 agreement on is that the Center has a very important rule
4 and that we feel that their involvement is extremely
5 important and there's some integration problem there too.
6 It's a little simpler.

7 CHAIRMAN JACKSON: Right.

8 DR. GARRICK: Than DOE's.

9 CHAIRMAN JACKSON: Commissioner?

10 COMMISSIONER DIAZ: Yes. Going back to something
11 you said a while ago and to this you said that when you do
12 your PA analysis it's different than reactor because your
13 end point is better known.

14 What is the implication of the recent, you know,
15 Chairman of ICRB suggesting that we go to a 30 millirem per
16 year and back off collective dose if that -- what I am
17 asking is would that knowledge make the process of analyzing
18 these things, if you really know what dose you are going to,
19 easier and less resource intensive?

20 DR. GARRICK: Commissioner, you have just touched

21 on a subject that will take us 10 meetings.
22 [Laughter.]
23 DR. GARRICK: There is no questions that some
24 decisions on collective dose and thresholds would have a
25 major impact on end states and how we deal with them.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

30

1 This is a very critical issue. If I had to guess
2 an issue that might find itself on the top tier next year,
3 it would be that one. It would be the whole issue of
4 thresholds and --

5 COMMISSIONER DIAZ: And so would you recommend
6 some time that the Commission makes this an issue that needs
7 to be resolved with whatever means we have to address it?

8 DR. GARRICK: Yes, I would. Very much so.

9 All right. What I would like to do now is move
10 into our third presentation actually -- Dr. Wymer.

11 DR. WYMER: Thank you. We have passed over into
12 some of my areas in some of these questions and responses.

13 I would like to take just a minute to put this in
14 context a little bit and to explain some of what I will say,
15 which may differ somewhat from the viewgraphs in a few minor
16 ways.

17 We have prepared three letters on this subject of
18 performance assessments spaced roughly at three year
19 intervals. I think the pace will quicken as we get closer
20 and closer to the repository licensing action and I will
21 add, too, what we are embarked on here in the performance
22 assessment for the Yucca Mountain Repository is very large,
23 very costly, and probably more importantly from the point of
24 view of our considerations is in many ways unique with
25 respect to the knowledge base required and with respect to

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

31

1 what the input to the performance assessment has to be.

2 That to a large extent has set the stage for much
3 of what the NRC has had to do.

4 So with that little introduction, I would like to
5 get into it. Now since we wrote the letter to the
6 Commission on the eighth of October and subsequent to that,
7 toward the latter end of November, we got a very detailed
8 response from the Executive Director of Operations that
9 dealt with a lot of our suggestions and in fact pointed out
10 that not only had they been considering these suggestions
11 that we made, we'd like to think it's based on our previous
12 communications and discussions, but also largely to their
13 own initiative, and had in fact planned to deal with many of
14 these issues that we have raised, which is very gratifying,
15 and in some cases had actually acted on them.

16 So with that little background, I'll move on to
17 the first viewgraph.

18 We thought we would start off on a positive note
19 and -- and it will stay pretty positive -- and point out the
20 accomplishments that the NRC Staff with the support of the
21 Center have achieved.

22 One of the things we were particularly concerned
23 about was in light of budget cuts and reduction and the
24 ability to carry out some of the support for the key
25 technical issues, of which 10 have been identified, whether
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

32

1 or not the NRC would be able to go ahead and do what it
2 needed to do in a timely enough way to meet the needs for
3 the review of the total system performance assessment
4 viability assessment and the license application and what we
5 have learned is that in fact the Staff has been very clever
6 and has managed to reassign some of the key parts of some of
7 the key technical issues to other, better supported key
8 technical issues in order to keep things alive and make sure
9 that the essential things are moving, so that has happened.

10 Now as you know, the key technical issues and the
11 Issue Resolution Status Reports are the mechanism by which
12 this whole process is carried forward. As the key technical
13 issues are addressed and the technical requirements are
14 established, the input then is fed into the performance
15 assessment people and there is a necessity for a close
16 symbiosis there and that is well-integrated as far as we can
17 see and takes place quite well.

18 I have the next list of accomplishments here.

19 With respect to the total system performance
20 assessment viability assessments, there have been a number
21 of communications between the NRC Staff and the Department
22 of Energy staff on the code development and on the
23 resolution of issues and on the convergence of what the key
24 technical issues in fact are.

25 That has been very important in leading toward

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

33

1 preparing for this review. We don't expect, based on what
2 we have heard, that the Department of Energy will receive
3 any great surprises downstream, that in fact there will have
4 been enough discourse that while there may be a
5 disagreement, there may not be any surprises -- or certainly
6 not many. I think that is a very positive thing the Staff
7 has accomplished.

8 With respect to the code, which is in many senses
9 the proof of the pudding, it is the tool that will be used
10 in assessing DOE's license application and capabilities, one
11 of the most important tools, we have been gratified to see,
12 and this came up in the previous comments, that the code has
13 been upgraded.

14 It's recognized as a living document, something
15 that will be continually upgraded as sensitivity studies are
16 made and shortcomings in it or deficiencies in it are
17 unearthed.

18 It's my understanding that the code was completed
19 in September and right now there have been some sensitivity
20 tests performed on modules of this code and there will be a
21 user's manual.

22 This gets to the point that was raised of what is
23 the backup information, what is the documentation, how do

24 you know really what the code has in it and what it will do,
25 how well-based, how well-founded it is. There will be a
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

34

1 user's manual we understand, produced in early 1998, which
2 will detail what the input is, what the assumptions are,
3 what in fact the code consists of, and we are looking
4 forward to seeing that just to see how well it does meet
5 this advertised goal.

6 We'll move on to the next viewgraph then. One of
7 the things that we have sort of honed in on is the issue of
8 the engineered barriers. What we have observed is that as
9 time goes on, DOE has more and more come to recognize that
10 geology alone is not going to be the whole answer or not
11 enough will be known for that to be the whole answer, and in
12 complying with the response to the defense-in-depth concept
13 which they are obliged to correspond to, that they are
14 getting closer and closer to the waste package with respect
15 to doing analyses of retention of radionuclides and what
16 this means to the final dose.

17 So that gets into the issue, the whole question of
18 engineered barriers as it relates to the defense-in-depth
19 concept, which George Hornberger will address here next.

20 CHAIRMAN JACKSON: Let me ask you a question here.

21 You mentioned the reduction of the Center's
22 efforts on the KTIs related to engineered barriers and
23 radionuclide transport.

24 The question is, are you suggesting that the KTIs
25 need to be reprioritized in some way?

ANN RILEY & ASSOCIATES, LTD.
Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

35

1 DR. WYMER: No. What in fact has happened is
2 since we wrote our letter we have learned that there has
3 been a few additional people brought on to deal with these
4 specific areas, in the areas that we have suggested,
5 specifically, and there has been an increased level of
6 funding associated with the KTI on radionuclide transport
7 and particularly near-field.

8 CHAIRMAN JACKSON: And when you talk about the
9 specific needs in engineering analysis, material science,
10 and chemistry, are you saying that the staffing level in
11 inadequate or that there is an absence of these disciplines?

12 DR. WYMER: It depends. I think more staffing
13 could be used to advantage.

14 There is not a total absence in any of these
15 areas, but because of the increased stress and emphasis on
16 engineered barriers, enhancement would certainly be
17 desirable.

18 CHAIRMAN JACKSON: I see.

19 DR. GARRICK: I think that when we heard the
20 presentations in July, one of the senses of the committee
21 was that if there was an area where we had not seen as much
22 capability and expertise as perhaps we would like, it was
23 the area of analyzing the containment capability integrity
24 of the engineered systems, so I think that this was a

25 particular point that we were focusing on in view of what
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

36

1 has happened at DOE in their TSPA over the last two years
2 and the growing dependence on engineered systems to
3 demonstrate the kind of performance they want to achieve.

4 So we were really suggesting that it is not to say
5 the NRC doesn't have that kind of capability. It was only
6 to say that we hadn't seen it.

7 It was not as visible in the presentation and in
8 the documentation. As we learn more about TPA 3.1, we are
9 seeing more and more.

10 CHAIRMAN JACKSON: I see. Commissioner
11 McGaffigan, did you have a question?

12 COMMISSIONER MCGAFFIGAN: No.

13 DR. WYMER: Okay. We have attached enough
14 importance to this whole issue of engineered barriers that
15 we are in fact going to convene a workshop on this subject
16 we hope in March or no later than April of this coming year.

17 CHAIRMAN JACKSON: Will it be a workshop to which
18 you will invite international participants?

19 DR. WYMER: We will do our best to invite the best
20 people. There is a lot of work going on.

21 CHAIRMAN JACKSON: That's right.

22 DR. WYMER: That's right.

23 International -- there's a recent meeting that's
24 directed in part toward this topic, and there are some very
25 good people working in the field outside of this country,

ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

37

1 and we hope that the outcome of the workshop will be a
2 focusing of attention on this area and a highlighting of
3 some of the needs which perhaps haven't really emerged as
4 clearly as they should up to this point.

5 DR. GARRICK: Just a quick observation on that,
6 because I think it's an important point, namely the
7 international.

8 The committee is fortunate that Dr. Fairhurst is
9 on the committee, because he has been extremely active in
10 the international community and probably knows every
11 rock-hound --

12 [Laughter.]

13 DR. GARRICK: -- in Europe and other places on
14 this topic, so we take that question very seriously.

15 Can we go to the next viewgraph?

16 This is -- this is not meant to do any more than
17 -- it is not meant to do any more than to give you an idea
18 of what the near-field looks like in one of the -- or will
19 look like in one of the drifts in the Yucca Mountain
20 Repository.

21 And the point I wanted to make on this viewgraph
22 is that it is an extraordinary complex system, starting in
23 the middle with the fuel, which has its own barriers to
24 release, and inside the canister there could be additional
25 barriers provided if that were found to make a positive

ANN RILEY & ASSOCIATES, LTD.

1 benefit. And then's there the cask itself which provides
2 not only containment, but a potentially chemically reducing
3 environment, which further complicates the issue maybe with
4 respect to transport of thing like technetium and neptunium,
5 which move rapidly in their common valent states, but which,
6 if reduced, might behave very differently.

7 And then that shows a drip shield which is another
8 -- another engineered barrier feature. And then surrounding
9 the entire thing, but within the concrete liner, wall liner,
10 there can be another filler material which can either be
11 chemically reactive or not, depending on the value of
12 providing that kind of reactivity.

13 So the general point I wanted to make is that,
14 just within that drift, we have an extraordinarily
15 complicated system that requires analysis and it remains to
16 be seen how important each one of the features, or changes
17 in those features inside that drift can be to the ultimate
18 retention of radionuclides and whether or not it is
19 effective in the 10-year, 100-year, or 1,000-year time
20 frame. These are things which need to be ferreted out, and
21 that's all I wanted to do with that.

22 CHAIRMAN JACKSON: Yes.

23 COMMISSIONER MCGAFFIGAN: Just on the picture, is
24 the idea at DOE that they will add these barriers over time?
25 The issue we talked about earlier, retrieveability for 100
ANN RILEY & ASSOCIATES, LTD.

1 years, or whatever.

2 DR. WYMER: Yes.

3 COMMISSIONER MCGAFFIGAN: If you have backfilled
4 with a lot of rock, that may or may not be chemically
5 active, it looked like it would be pretty hard to take --

6 DR. WYMER: It's kind of hard, yeah. What we
7 understand is that they plan to not backfill for about 50
8 years. In order to give time to see how things play out.
9 And then if things look pretty good, and there is no real
10 problems and no objections, then they would -- then they
11 would go in and backfill, and then it does get difficult to
12 do anything after that. But they -- they see it 50-year,
13 give or take.

14 DR. HORNBERGER: Our understanding is that most of
15 the things on that diagram are not part of DOE's reference
16 design.

17 DR. WYMER: Well, the things that aren't -- if we
18 could have it up there again. Are the things that are in
19 yellow. Like ceramic coating is not. They are not taking
20 credit for the cladding and the backfill is not in the
21 reference design. But this is the design, I was told by
22 Jack Bailey, the man in charge of this, that they are in
23 fact working to, even though it is not their, quote,
24 "reference design."

25 DR. GARRICK: Well, the reference design for the
ANN RILEY & ASSOCIATES, LTD.

1 viability assessment is this minus --
2 DR. WYMER: Minus what is in yellow.
3 DR. GARRICK: Minus the thing that is in yellow.
4 Yes.
5 DR. WYMER: That's right. That's correct.
6 These other things in yellow are things that could
7 conceivably add to the integrity of the system.
8 CHAIRMAN JACKSON: Well, this is a clear case
9 where the technical decisions are policies.
10 DR. WYMER: Yes. That is absolutely right.
11 I wanted to, in the interest of time, to pass on
12 the next viewgraph called Requirements of Realistic
13 Performance because a lot of that has been covered one way
14 or another already. And go on the conclusions. Our
15 conclusions by and large are favorable. We think that there
16 has been substantial and good work done on the EPA 3 Code.
17 We have a few concerns. We would like to see the
18 code verified and benchmarked. So far what has been done is
19 has been measured against DOE's corresponding code. DOE's
20 is much more complex because they have the burden of
21 providing a license application. The NRC has the burden
22 only of checking them and making sure that we agree with
23 what they say on whether it is right.
24 We do think that it would be good to get the code
25 out for peer review as soon and as thoroughly as possible.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

1 The unique aspects of the situation do mean that
2 benchmarking is difficult because it can't -- there is
3 nothing to benchmark it against in some cases, although
4 certain modules can be benchmarked.
5 And, quite important, we think this whole thing of
6 maintaining computer -- adequate computer capability is
7 central, because the code is central, and the code is a
8 computer code. Therefore, you must be able to have the
9 resources at hand to run the thing, and to adequately carry
10 out the calculations in a timely manner.
11 COMMISSIONER DICUS: Excuse me.
12 CHAIRMAN JACKSON: Yes, Commissioner. Go ahead.
13 COMMISSIONER DICUS: Yes. We may have the same
14 question.
15 CHAIRMAN JACKSON: Well, go ahead, Commissioner
16 Dicus.
17 COMMISSIONER DICUS: We are talking about the
18 computer capability. I think I heard you say resources. So
19 are you talking about expertise, or are you talking about
20 software and hardware, and expertise?
21 DR. WYMER: To a large -- hardware is sort of
22 central. I think that the -- there could be more manpower
23 put on it for analyzing the code and doing the sensitivity
24 analyses, those are very important. And, as a matter of
25 fact, I could mention, I guess, to a certain extent, the

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300
Washington, D.C. 20005

1 information is not available, and in other ways, it is not
2 sought for doing the actual probabilistic risk assessment,
3 or the code, but rather their sensitivity analyses are done
4 on individual modules, which in fact cover a range and allow
5 you to establish what the -- what the swings are in
6 performance under various parameters, and so.

7 COMMISSIONER MCGAFFIGAN: To follow up, what is
8 the hardware capability at the moment that you are finding
9 locking or potentially locking? Do we not have powerful
10 enough hardware either here or at the Center to run the
11 codes as they develop?

12 DR. WYMER: Well, I am little bit like Roy Rogers,
13 all I know is what I read in the newspapers. All we know is
14 what the -- what the staff tell us. I, personally, do not
15 have the capability, the background to evaluate it. But we
16 are -- we are told that they would like to somewhat increase
17 their capability and it might be that some sort of a
18 separate presentation on that specific point might be
19 desirable.

20 DR. HORNBERGER: There was a concern they would be
21 unable to maintain the current capability in terms of
22 hardware. And so the first worry is not take a step
23 backward.

24 COMMISSIONER MCGAFFIGAN: The other question that
25 really follows -- you have talked about most of the other
ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

1 suggestions previously. The thrust of these is to add,
2 although the staff has clearly responded on the KTIs with
3 regard to engineered barriers and radionuclide transport,
4 but are there any areas that the staff is working on at the
5 moment that perhaps we could scale back the effort in order
6 to make room for some of these things that you are
7 suggesting we work more on?

8 DR. WYMER: That is hooked directly to the KTIs,
9 and in some of those, like the vulcanism and tectonic areas,
10 they are farther along than they are in others. And so
11 there probably is some grounds for discussion of how near
12 complete they are and what the relative importance of these
13 are, but we have been told and there are pieces of paper
14 that support the feeling that some of these areas are
15 nearing completion.

16 CHAIRMAN JACKSON: Do you have a sense that the
17 staff has a plan, a migratory plan to go from a focus in
18 some of these areas to the areas that need more focus?

19 DR. WYMER: She's looking at you.

20 DR. GARRICK: Well, --

21 CHAIRMAN JACKSON: When I, this is only way I know
22 to communicate.

23 DR. GARRICK: We are assured that they do. But at
24 the risk of getting in a little trouble, to answer Mr.
25 McGaffigan's question, I think that some of us would

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

1 certainly want the Commission to look at, if they are
 2 resource-constrained, the tradeoff of some of the earth
 3 science capability for more engineering capability. Because
 4 the whole industry has -- is transitioned from an earth
 5 science dominated issue to more and more engineering
 6 involvement. So, as a general statement, I think -- and if
 7 I were -- had an organization such as they have, that is
 8 probably where I would begin to look. And I had no more
 9 FTEs that I could add -- that is a term I have learned about
 10 since coming here. So --

11 CHAIRMAN JACKSON: Okay. Earth sciences versus
 12 engineering.

13 DR. GARRICK: Yes.

14 CHAIRMAN JACKSON: One E for another. All right.

15 DR. WYMER: One final point I wanted to make is
 16 that we would like to see an enlargement of the -- of the
 17 scientific basis for treatment of the near-field
 18 radionuclide mobilization. And there's a lot of information
 19 available. It has not been developed in the context of this
 20 problem, but it certainly is directly relevant to this
 21 problem. An enormous information base can be tapped. It
 22 probably should be done more systematically and in more
 23 detail than it has been, and I think to this point it hasn't
 24 been just because there hasn't been a recognition of the
 25 importance of the near-field like there is now, and the

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

1 resources are -- are bounded.

2 CHAIRMAN JACKSON: Right. Okay. Yes?

3 COMMISSIONER McGAFFIGAN: Is that an additional
 4 KTI or is that something that would need to be done within
 5 the context of the existing KTIs?

6 DR. WYMER: That is a subissue under the KTIs,
 7 yes.

8 COMMISSIONER McGAFFIGAN: Okay.

9 CHAIRMAN JACKSON: I think we had better on.

10 COMMISSIONER McGAFFIGAN: Yes.

11 CHAIRMAN JACKSON: Because we are running out of
 12 time here.

13 DR. GARRICK: Dr. Hornberger will talk about
 14 defense-in-depth and the letter you have received on that
 15 subject.

16 DR. HORNBERGER: Yes. I see we are running out of
 17 time. They tried to kid me that I was batting clean-up.
 18 But we all knew.

19 I have some comments that I would like to make on
 20 the letter than we sent you on October 31st, 1997. And,
 21 clearly, the whole issue is the revision of 10 CFR 60, the
 22 site-specific revision that is to follow on the heels of the
 23 EPA site-specific regulation for or standard for Yucca
 24 Mountain.

25 Just a bit of history. I guess it was last spring

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

1 Janet Kotra gave us a wonderful presentation sort of

2 illuminating for us the thought process that went -- that
3 people went through to come to the current 10 CFR 60. And
4 Jack Sorenson, this summer, wrote a nice paper for us in
5 which he did a lot of research on where defense-in-depth
6 crops up in the regulations in NRC. And it is quite
7 interesting that defense-in-depth is something that we all
8 adhere to but --

9 CHAIRMAN JACKSON: Don't know what it is.

10 DR. HORNBERGER: Right.

11 [Laughter.]

12 DR. HORNBERGER: It is a nice picture, but it is a
13 little fuzzy.

14 CHAIRMAN JACKSON: We are comfortable with that
15 that we have used for 30 years.

16 DR. HORNBERGER: That's right.

17 CHAIRMAN JACKSON: We don't know anything more
18 about it than the concepts, which we may not know about
19 either.

20 DR. HORNBERGER: And it is good. And then Charles
21 Fairhurst yesterday showed me the French, the "Defense en
22 Profondeux" -- I apologize to anyone who actually speaks
23 French. But the French concept is also quite different from
24 ours.

25 So, at any rate, the first thing that we did is

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

47

1 we, for ourselves, we said that defense-in-depth, when we
2 talk about it, was going to refer to methods of design,
3 construction and operation of a geological repository in
4 ways that ensure safety in the face of considerable
5 uncertainty. And given that still kind of soft definition
6 of defense-in-depth, we came to the conclusions that this
7 was an opportunity for us to look at our risk-informed
8 approach to -- to the regulation. And, in fact, we
9 concluded that the specific re- -- subsystem requirements,
10 prescriptive requirements in terms of the rule, really were
11 unnecessary. There's more -- this is sort of the bottom
12 line of the whole letter.

13 We think that an overall performance-based
14 standard is a superior tool.

15 The next slide, in terms of background, I think,
16 again, perhaps a more logical way, I would go to the second
17 bullet for -- first. We certainly endorse -- I think
18 everybody in the whole business, worldwide, endorses the
19 concept of defense-in-depth, and we recognize this need for
20 the dependence on diverse barriers. We certainly support
21 the concept in 10 CFR 60 that both the engineered system and
22 the geological system should make contributions to safety.

23 What we -- the conclusion we came to, what we do
24 not support at this time is the furthering of rule-based
25 prescriptive subsystem requirements in the Yucca Mountain

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

48

1 site-specific standard.

2 I threw in --

3 CHAIRMAN JACKSON: Let me make sure I understand
4 what you said.
5 DR. HORNBERGER: Sure.
6 CHAIRMAN JACKSON: So you are rationalizing
7 defense-in-depth with the risk-informed in the following
8 way. If you want to look at some net system performance
9 that involves both the engineered piece and the natural
10 piece, and that you recognize that each one makes a
11 contribution, as you have said, and you can optimize that,
12 but you don't to separately, and within each one, propose
13 specific requirements, because you are saying in the end you
14 may not have optimized. Is that your point?

15 DR. HORNBERGER: That is correct. Maybe we should
16 write that down.

17 [Laughter.]

18 CHAIRMAN JACKSON: The transcript will show it.

19 DR. HORNBERGER: I put in the next slide of the
20 Matruschka because this is -- it is an image that is used
21 quite a bit in radioactive waste.

22 CHAIRMAN JACKSON: That's cute.

23 DR. GARRICK: We were going to bring you each one.
24 We decided that was pushing it a little.

25 CHAIRMAN JACKSON: I think that's --

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

49

1 DR. HORNBERGER: Charles McCombie sent me a nice
2 video that the Europeans did. Perhaps you have all sent it.
3 Which is a public information video in which extensive use
4 is made of this metaphor of the Russian doll. And I think
5 for public education, it serves a very useful purpose. It
6 has some limitations carried to the technical extreme,
7 however, and the next slide also comes from -- from Neil
8 Chapman's book. And we begin to see that -- how we can
9 somehow use this metaphor to say, yes, we have these diverse
10 barriers, each playing a role.

11 The problem is that we shouldn't get too caught up
12 in the notion that while if one of the -- one component
13 breaks, then we are going to be saved by the next shell in
14 this Russian doll. And so I just wanted to point out that
15 we went through this and had long discussions and -- I
16 shouldn't say that. We didn't discuss -- we discuss the
17 Russian doll.

18 COMMISSIONER DICUS: How do you address, and
19 without getting, carrying on too long, an event that would
20 challenge several systems? I mean how do you -- you have to
21 take that into account.

22 DR. HORNBERGER: Yes.

23 COMMISSIONER DICUS: A paving machine can run over
24 this doll and it is gone.

25 DR. HORNBERGER: And then -- and then it is gone.

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

50

1 Right.

2 COMMISSIONER McGAFFIGAN: This doll.

3 [Laughter.]

4 COMMISSIONER DICUS: And with -- dealing with the

5 public, that's, I mean --

6 DR. HORNBERGER: Yes.

7 COMMISSIONER DICUS: -- that's, as a member, if I
8 were a member of the public and this was brought as a way
9 to, you know, these protective barriers, I would say, well,
10 I can run over that with a steamroller and I don't have any
11 protective orders. So you just have to be careful.

12 DR. HORNBERGER: Yeah. No, that is correct. And
13 I mean even in the repository context, obviously, if one has
14 a volcano --

15 CHAIRMAN JACKSON: A cataclysmic event.

16 COMMISSIONER DICUS: Right. Exactly.

17 DR. FAIRHURST: It is perhaps a little more
18 appropriate to react to context where there is an external
19 environment that is immediately accessible, where there is
20 an underground geological environment that has got its
21 limitations.

22 DR. HORNBERGER: Okay. Let me go to the
23 recommendations that were part of our letter, because,
24 again, the whole letter has been summarized very nicely for
25 us. Our recommendation is to use performance assessment to
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

51

1 quantify the effectiveness of individual barriers. Again,
2 as John said, our whole approach, the way we think about
3 risk-informed decisions is that if we can get in front of us
4 what are our expectation is for the behavior of the system,
5 we can then make informed decisions.

6 DR. GARRICK: I think an important point on this
7 is that we are -- because it can be misinterpreted, is we
8 are saying put more emphasis on the individual barriers.
9 Put enough emphasis on the individual barriers that you do a
10 better job of quantifying their role in various scenarios,
11 including cataclysmic events or volcanic events, as long as
12 you carry with that the likelihood of the event.

13 DR. HORNBERGER: Right. In fact, the second
14 recommendation is that we really think that DOE should, or
15 any license application in the future should be required to
16 demonstrate the contributions, quantitative, including the
17 uncertainties that come out of a PA. And we also think that
18 the -- that guidance can be given implementing the DID
19 concept in a revised 10 CFR 60. In our mind, that feeds
20 back really to the first recommendation, that this guidance
21 would probably take the form of how one would expose the
22 contributions in a rigorous way using a PA effectively.

23 CHAIRMAN JACKSON: Go ahead.

24 COMMISSIONER DICUS: Just, I had this note on his
25 questions. I almost hate to ask, but this last bullet, "NRC
ANN RILEY & ASSOCIATES, LTD.

Court Reporters
1250 I Street, N.W., Suite 300
Washington, D.C. 20005
(202) 842-0034

52

1 should set forth sound principles." Give us an example of a
2 sound principle. I mean -- what you mean or define the term
3 a little bit.

4 CHAIRMAN JACKSON: We are back to these
5 adjectives.

6 DR. HORNBERGER: Yeah, the adjectives. Yeah. I
7 wish we had taken that out, right.

8 [Laughter.]

9 DR. HORNBERGER: No. The -- it is very difficult
10 for me, of course, to -- to give very precise -- a very
11 precise answer. And perhaps the wording is a little
12 awkward. But we think that guidance in terms of the
13 performance to be expected can be given, and should be
14 given. We don't think that subsystem requirements are
15 appropriate in a rule. But certainly through guidance, one
16 can set forth ideas on how one would actually go forward in
17 a performance assessment to do what we say in the first
18 bullet there, to expose the contributions.

19 DR. GARRICK: I think this is clearly an issue we
20 expect to deal with a lot more.

21 DR. HORNBERGER: Yeah.

22 DR. GARRICK: We expect to interact with the
23 staff, but you have just received a letter, for example,
24 from the ACRS on the characterization of parameters, point
25 values versus uncertainty, where that is a specific example

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

53

1 of the kind of guidance you might want to give in how you
2 characterize the performance of an individual barrier.

3 CHAIRMAN JACKSON: I understand.

4 DR. HORNBERGER: Let's see, I put in the next
5 slide. This is a draft from the staff as to how they
6 envision the -- well, the structure framework for a total
7 system performance, and I think that it just illustrates
8 that there are points at which you could interrogate the
9 analysis to actually get at the contribution of these
10 various processes or the -- and the importance of key
11 technical issues in the staff's framework for how they are
12 going to deal with that.

13 So the conclusion, we think that the approach that
14 we recommend allows to take advantage -- one to take
15 advantage of site- and design-specific properties and
16 features, that it clarifies the degree of dependence of the
17 overall performance of individual barriers, and exemplifies
18 risk-informed performance-based regulation.

19 CHAIRMAN JACKSON: Thank you.

20 Any further questions?

21 I had one question for you, Dr Larkins. You know,
22 as I look back at the Committee's outline on its strategic
23 plan, and it laid out its goals and its criteria, for
24 instance, to select the priorities, leaving aside the
25 specific priorities, how much concurrence is there between

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

54

1 the ACRS -- does it have a plan and --

2 DR. LARKINS: Yes.

3 CHAIRMAN JACKSON: -- do its goals and criteria
4 track with those of the ACNW?

5 DR. LARKINS: Fairly closely. Both Committees are
6 revising their operating plans right now to reflect the new
7 priorities that are being developed. They track pretty

8 closely with the Agency's operating plans and I think they
9 are -- there is consistency between the two.

10 CHAIRMAN JACKSON: Okay. Thank you.

11 DR. LARKINS: I can't quantify it. I mean there's
12 differences, obviously.

13 CHAIRMAN JACKSON: The Commission would like to
14 thank of all you for a very informative briefing. Obviously,
15 you know, even though we are being very careful, we have a
16 keen interest in the use of PRA in the regulation of nuclear
17 facilities and activities, including waste disposal. In
18 fact, as part of the PRA implementation plan, as you know,
19 Margaret Federline has a piece of that relates to looking at
20 the use of PRA and those kinds of approaches in the context
21 of waste management.

22 It, you know, it does seem that it can provide
23 useful insights into the performance of a repository, and we
24 encourage you, as well as the staff, to continue your
25 explorations along these lines. Your views are very

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034

55

1 important to the Commission on these matters because you
2 have the broad-based expertise and the opportunity to stand
3 back and look at these things from a more reasoned point of
4 view.

5 I am intrigued about the idea of the International
6 Conference. And so the Committees are to be commended for
7 the high quality of today's briefing. And I really
8 appreciate it and the Commission appreciates it a great
9 deal.

10 So unless there are any further comments, we are
11 adjourned.

12 [Whereupon, at 11:26 a.m., the meeting was
13 concluded.]

14
15
16
17
18
19
20
21
22
23
24
25

ANN RILEY & ASSOCIATES, LTD.

Court Reporters

1250 I Street, N.W., Suite 300

Washington, D.C. 20005

(202) 842-0034