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NUCLEAR REGULATORY COMMISSION

Title: MEETING WITH ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW) - PUBLIC MEETING

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

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 MEETING WITH ADVISORY COMMITTEE

5 ON NUCLEAR WASTE (ACNW)

6 ***

7 PUBLIC MEETING

8 ***

9 Nuclear Regulatory Commission

10 Commission Hearing Room

11 11555 Rockville Pike

12 Rockville, Maryland

13

14 Tuesday, May 20, 1997

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16 The Commission met in open session, pursuant to

17 notice, at 2:00 p.m., the Honorable SHIRLEY A. JACKSON,

18 Chairman of the Commission, presiding.

19 COMMISSIONERS PRESENT:

20 SHIRLEY A. JACKSON, Chairman of the Commission

21 KENNETH C. ROGERS, Member of the Commission

22 GRETA J. DICUS, Member of the Commission

23 EDWARD McGAFFIGAN, JR., Member of the Commission

24

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2 ANNETTE VIETTI-COOK, Assistant Secretary

3 KAREN D. CYR, General Counsel

4 PAUL POMEROY, Chairman, ACNW

5 B. JOHN GARRICK, Vice Chairman, ACNW

6 GEORGE HORNBERGER, ACNW

7 WILLIAM HINZE, ACNW

8 JOHN LARKINS, Executive Director, ACNW

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

2 [2:00 p.m.]

3 CHAIRMAN JACKSON: Good afternoon.

4 Today, we are meeting with the Advisory Committee
5 on Nuclear Waste to be briefed on several technical issues
6 related to management and disposal of radioactive waste.
7 The Commission looks to the ACNW, as it is called, to
8 provide it was sound technical advice to assure the safe
9 management and disposal of this country's radioactive waste.

10 Today's briefing will discuss several completed
11 projects and discuss various issues in the status of two
12 other works in progress.

13 In looking over the agenda for today's meeting, it
14 appears that we have a fairly large number of topics to
15 cover so, if my fellow commissioners don't have anything
16 further to add, I will turn it over to you, Dr. Pomeroy, and
17 we will try to restrain ourselves until we finish each part.
18 I can't totally guarantee that with this crowd, but we will
19 try that at any rate.

20 DR. POMEROY: Thank you, Madam Chairman. We do
21 have contingency plans, in case there are --

22 [Laughter.]

23 DR. POMEROY: Madam Chairman, members of the
24 Commission, it is a pleasure to be here, as always.

25 It has been essentially one year since our last

1 public discussion and, as you have noted, Madam Chairman, we
2 have several items of interest that we wish to present. Our
3 presentations will utilize, as a framework, the current ACNW
4 priorities and, if we can have the first slide, please,
5 those are listed. This is Slide Number 3 in the material
6 that you have.
7 I would like to briefly run through what our
8 priority issues are and indicate where we are going to give
9 presentations within those.
10 Regulatory framework, there will be a presentation
11 by Dr. Garrick on the Reference Biosphere and the Critical
12 Group and if there is time I will talk some about agreement
13 states issues at the end.
14 Waste containment and isolation strategy,
15 essentially we are following that particular issue very
16 closely and when our timeliness criteria is satisfied we
17 will move ahead with that. But we are currently waiting for
18 DOE's document.
19 Viability assessment and site characterization,
20 Dr. Hinze will address igneous activity. That is a work in
21 progress. We are currently in the process of writing a
22 letter. And Dr. Hornberger will address flow and
23 radionuclide transport under the site characterization
24 activity and he will discuss coupled processes under
25 repository design.

1 Low-level waste, radioactive waste disposal. As
2 noted, you know our views on that subject. We are not going
3 to discuss those here.
4 I will talk briefly about decommissioning and
5 expert judgment, perhaps, with time. Dr. Garrick will
6 address the question of risk-informed and performance-based
7 regulation. This is another item that is in progress; it
8 will be in progress through the summer of this year.
9 Uranium mill tailings fall under our timeliness criteria and
10 they are not yet a timely issue for us.
11 The interim surface storage facilities for spent
12 fuel, our initial review begins this month.
13 Moving right along, I would like to turn the
14 meeting over to Dr. Garrick and he will address risk-
15 informed performance-based regulation.
16 DR. GARRICK: Thanks, Paul.
17 As you know, most of our letters in one way or
18 another make reference to risk-informed performance-based
19 regulation and our letters certainly support that approach.
20 While we haven't written a letter explicitly on this
21 subject, given the frequent reference to it we thought it
22 would be a good idea to discuss it some and to share with
23 you some of our thinking on this subject and to address a
24 couple of specific questions which I will get to in a
25 minute.

1 As far as risk-informed performance-based
2 regulation is concerned and its use in the nuclear waste
3 field, there are a number of factors that certainly favor
4 that. Compliance demonstration is already rooted in meeting
5 performance requirements. The EPA standards or regulations
6 have a risk-based quality to them.
7 The regulatory standard, at least for high-level
8 waste, is in fact probabilistic.
9 Regulations covering high-level waste are evolving
10 with the anticipated first license application for a high-
11 level waste repository, thus the timing seems to be good for
12 us to do something constructive and useful here.
13 The PRA policy statement and the PRA
14 implementation plan sets the framework for staff uses of PA
15 and PRA.
16 As far as factors to overcome to implement RIPB
17 regulation in the nuclear waste field, you have heard a lot
18 about these. You have heard a lot about the comparisons
19 between PA and PRA and so I am not going to repeat that
20 because those presentations were very excellent in that
21 regard. I am going to give a little bit of an ACNW spin on
22 them, however, and maybe touch on a couple of items that
23 were not covered before.
24 So as far as some of the obstacles are concerned,
25 number one, risk assessment experience of NRC is principally

1 in the nuclear power field. The facility differences
2 between nuclear power plants and repositories are extensive
3 and thus there is a compromising of the relevancy of the
4 experience base.
5 Engineered systems involving active equipment and
6 hardware have been the principal target for the development
7 of the analytical methods of risk assessment, although the
8 level two, that is the containment and core response work,
9 has many aspects to it that are similar to the performance
10 assessment modeling challenges.
11 PRA started as a risk-based discipline, PA did
12 not. Probabilistic features have been evolving in PA.
13 So one way to get to this question is to pick up
14 on some of the things you have already heard a little bit
15 about, as I said, and give it our spin. So let's pose the
16 question: How can PRA approaches, methodologies and
17 techniques be brought to bear on Pas?
18 Well, as far as the basic issue is concerned of
19 what is the risk, we have to, through PA or PRA, answer the
20 same fundamental three questions. What can go wrong, how
21 likely is it and what are the consequences. So the basics
22 are the same.
23 Now, while I promise not to get too much into the
24 comparisons, I want to repeat some that you have heard about
25 and comment on them a little bit.

1 As to similarities, both PRA and PA are scenario
2 based. Now, I am speaking here more from the point of view
3 of a practitioner in PRA in many respects than I am an
4 expert on PA, which I am not. I am also speaking
5 principally from the point of view of practitioner on the
6 industry side when it comes to PRA and on the industry side,
7 there is a considerable amount of emphasis on the risk
8 assessments being scenario based.
9 The scenarios of both require definitions of
10 initial states and end states. In order to have a scenario,
11 you have to have a beginning and you have to have an end.
12 Both have ultimate risk measures that involve health effects
13 from radiation and both involve the philosophy of defense in
14 depth.
15 Now, as far as the dissimilarities of PAs and PRAs
16 are concerned, in general they are very dissimilar with
17 respect to the roles of active and passive systems. The PA
18 being principally an analysis of a system where the
19 subsystems are passive. The nuclear power and the PRA being
20 born in an environment where most of the systems are active,
21 although there are examples of passive systems.
22 There is the issue of accidents versus
23 performance. The emphasis in nuclear plant risk assessment
24 work is the analysis of rare and high-consequence accidents.
25 In fact, that was the motivation for risk assessment.

1 Versus the repository emphasis on long-term performance.

2 There are considerable differences with respect to

3 the time cycles, the time constants, the time constraints

4 involved. Generally, the time constants associated with

5 high consequence accidents in nuclear power plants is short

6 compared to the time constants associated with the

7 degradation of a repository.

8 There is the issue of safety goals for the case of

9 nuclear power plants and no safety goals for the case of

10 repositories.

11 There is the issue of unconditional risk versus

12 conditional risk. By that, I mean the reactor risk

13 assessments are, for the most part, unconditional in that

14 they are not -- the risk calculations are not under the

15 assumption of any particular initiating condition.

16 There is the issue of degradation rates versus

17 failure rates. While the repositories have a slow change in

18 their integrity, most of the accidents associated with

19 nuclear power plants involve changes that happen over short

20 periods of time, although there are the issues of aging and

21 the issues, again, of some of the passive systems where

22 there is a gradual degradation.

23 Now, what can we get from PRA that will help us in

24 doing performance assessments? And I like to call them

25 PPAs, probabilistic performance assessments.

1 Well, one of the things that we do in PRA that is
2 very helpful from a model transparency standpoint is segment
3 the problem into logical modules. In the old days, we used
4 to call the modules the plant model, the containment model
5 and the site model. The output from the plant model was a
6 series of damage states that became the input to the
7 containment model, the output of which was a series of
8 release dates that became the input to the site model. So
9 these were very logical pinch points that would allow us to
10 analyze each of these segments independent of the other once
11 we determined what these end states were.
12 The repository problem model lends itself to some
13 of this same sort of thing. I will come back to that in a
14 minute.
15 Data processing in the form of the results. In
16 the PRA arena, there has been a great deal more dependence
17 on Bayesian type methods for processing data and accounting
18 for the effect of new information and taking into account
19 the update of information as it becomes available. And the
20 data processing was, for the most part, based on information
21 quality with some of it based on modeling quality. But one
22 of the things about the repository modeling that I have
23 observed is that they are giving more attention to modeling
24 uncertainties than at a similar time was given in the case
25 of the nuclear PRAs.

1 The adoption of multiple risk measures. In the
2 case of particularly the early PRAs of nuclear power plants,
3 a full-scope, level three risk assessment involved maybe as
4 many as nine measures of risk. I sort of like to draw an
5 analogy between a skyscraper and a risk assessment that you
6 learn something by looking in one of the windows of a
7 skyscraper but not much. You learn something about the risk
8 of a nuclear power plant by looking at the core damage
9 frequency but not much. It is much more informative to have
10 multiple measures of risk and each time you learn something
11 in addition.
12 The PRA experience in the nuclear plants that has
13 been extremely beneficial and I think is a concept that has
14 been reasonably well picked up in the repository is this
15 business of importance ranking. You can rank scenarios, you
16 can rank the initiating conditions and you can rank by other
17 things that contribute to the risk.
18 So what I would like to do, and I have to
19 apologize for this diagram, it is a little complex, but it
20 helps me drive home this point of where we might look for
21 enhancements in the repository risk assessments on the basis
22 of our experience in the risk assessment of other
23 facilities.
24 What this attempts to do is to modularize the
25 performance assessment into particular segments, much like

1 the three segments that the nuclear plant is modularized.
2 As a matter of fact, you might even draw an analog between
3 the infiltration model here and the plant model and the
4 combination of the engineered barrier model and the
5 geosphere model as the containment model and then, of
6 course, the biosphere model as an analog with the
7 atmospheric dispersion or site model.
8 The modeling concept that was extremely helpful in
9 enhancing the understanding of what was going on was when
10 you did this, defining your output states from each of these
11 modules in such a way that they indeed became the input
12 states for the succeeding part of the model. So the
13 infiltration model would have output states that would be
14 defined on the basis of physical and chemical properties.
15 You may have one state define on the basis of a certain
16 temperature pressure and a certain chemical makeup of the
17 water flow and so on. And this is where there is a major
18 difference between PRA and PA in that when you do this, of
19 course, the actual scenarios that you end up with are
20 developed as a result of this process rather than doing it
21 as it is often done in the case of a repository where you
22 actually establish the scenarios in advance from end to end.
23 So this is an interesting thought that we are
24 going to examine in a working group in a couple of months as
25 to whether or not there would be any merit in structuring

1 the scenarios in this slightly different manner.

2 One other thing that I wanted to point out here is

3 the question is if I wanted to -- if I wanted to see a

4 repository analysis in a form that I would classify as risk

5 informed and performance based, what kind of measures would

6 I look for? My last exhibit there is just an attempt to

7 delineate some of those.

8 One of those measures would be the dose profile,

9 the dose rate profile, for example, the upper left-hand

10 corner. Dose rate curve as a function of time, such that I

11 have the entire profile available to me, as well as the

12 uncertainty associated with it.

13 Now, this is a little different kind of

14 presentation than normally one thinks of in a risk

15 assessment because here we are talking about dose rate, we

16 are not talking about the frequency of occurrence of an

17 event or what have you. But I like to kind of observe that

18 what I really mean by a risk assessment is not deterministic

19 versus a probabilistic but rather a deterministic plus

20 probabilistic that what you really -- what you really get

21 out of a risk assessment is another dimension. You get an

22 expression of the confidence that the analyst has in their

23 results. The issue of parameters or models, parameters of

24 the models, that is another matter.

25 The second curve in the upper right-hand corner is

1 typical of what you might get as a source term curve as a
2 function of time. Of course, you may want to look at
3 discrete points in time in terms of how the uncertainty
4 grows with time in a little more detail than would be given
5 by that curve and that is the idea of the third set of
6 probability density functions.
7 Then the fourth curve here, if I were giving this
8 as a homework assignment and wanted to really see what was
9 going on, I would ask for a risk curve on each of the
10 disruptive events because they do assume a frequency
11 character to them and therefore I can use the full arsenal
12 of all of the PRA software to help me calculate a cumulative
13 probability density distribution, complementary cumulative
14 density distribution for each of the disruptive events.
15 Now, if we choose and desire to combine these into
16 a single parameter for measuring risk, that's fine. But I
17 think one of the things we have learned in the risk
18 assessment business where it has matured some is that it
19 sometimes gives you very important insights to not convolute
20 and combine everything but to let it kind of speak for
21 itself.
22 So this is just a few thoughts on where we are and
23 what we have been thinking about.
24 CHAIRMAN JACKSON: Thank you.
25 Commissioner Rogers?

1 COMMISSIONER ROGERS: Where do you see it going
2 from here?
3 DR. GARRICK: That's a good question.
4 Well, I have been in this business a long time. I
5 have seen it go quite a way but I have never seen it go
6 anywhere without a fight; that is to say, a tremendous
7 challenge.
8 I think that I have seen an enormous amount of
9 progress in the IPA work just in the last two years in
10 embracing the notions of probability into the models so I
11 think it is moving in that direction and I think there is a
12 lot of shaking out yet to do and some of the things we are
13 talking about here are candidates for how it might shake
14 out.
15 CHAIRMAN JACKSON: Commissioner Dicus?
16 COMMISSIONER DICUS: No questions.
17 CHAIRMAN JACKSON: Commissioner McGaffigan?
18 COMMISSIONER McGAFFIGAN: No questions.
19 CHAIRMAN JACKSON: You are off the hook easy.
20 DR. GARRICK: That is much easier than I had
21 expected.
22 [Laughter.]
23 DR. POMEROY: If not, then I would like to keep
24 Dr. Garrick talking, if I may. In Tab B.2 of your book, we
25 have a presentation on the reference biosphere and the

1 critical group.

2 Dr. Garrick will carry that on.

3 DR. GARRICK: Well, this is an issue on which we

4 did write a letter. The way we have sort of approached it,

5 and this is also an issue where, of all the issues this

6 committee has addressed, I don't know that I can remember

7 one where there was greater involvement by all members of

8 the committee than on this one. So I am not on the spot

9 here; the whole committee is on the spot and I expect them

10 to speak up.

11 But we approached this from the point of view of

12 what are the real questions here and the questions that we

13 see are, first off, what's the issue and is there an

14 overarching one and what is the essence of our advice and

15 what is the basis for that advice.

16 Now, the question, as we see it, is basically the

17 exposure scenario that should form the basis for

18 demonstrating compliance at the proposed Yucca Mountain

19 high-level waste repository. This is a subject that has

20 gotten a tremendous amount of attention. It was the central

21 issue with respect to the National Academy of Sciences

22 committee that looked at the technical basis for the high-

23 level waste repository standard.

24 Embedded in this issue, as it was so clearly

25 manifested in that report, are the definitions of the

1 reference biosphere, the critical group and the previously
2 defined time of compliance. Now, we supplied you with a
3 letter on time of compliance so we are not going to say much
4 about that today.
5 As far as our advice on this issue is concerned,
6 it took the form of first trying to be generic in terms of
7 some definitions for the reference biosphere and the
8 critical group and to attempt as best we could to address
9 the whole issue as much on a scientific basis as we could
10 but recognizing that there were gaps in our scientific
11 knowledge and that those gaps would most likely have to be
12 dependent upon the establishment of policy.
13 We also gave a lot of attention and emphasis to
14 the importance of the staff taking advantage of known site
15 characteristics and repository design features to provide
16 increased focus on the questions, to provide every
17 opportunity possible to reduce the uncertainties. This was
18 an opportunity to do that. Seldom do you get in the
19 position of creating a regulatory framework for a single
20 facility. Then, finally, we offered some suggestions with
21 respect to some basic principles for calculating and
22 interpreting risk measures.
23 Now, as to the essence of our advice, we kind of
24 came to the conclusion that what we meant by the reference
25 biosphere was the environment in which the biota and the

1 critical group comes in contact with radionuclides. As far
2 as the critical group is concerned, we indicated that that
3 is the population group that forms the basis for calculating
4 the radiation risk to the public and including but is not
5 limited to the person or the individual at greatest risk.
6 As far as the policy requirement is concerned, the
7 area where there was clearly some scientific gaps was the
8 basis for defining demographics and behavior of populations
9 that are at risk from the repository over the time period of
10 compliance.
11 Site specificity, again, we urged the use of known
12 site and design characteristics to generate regulations and
13 guidance that will reduce technical uncertainties and
14 increase confidence in the assessment of the safety and
15 overall performance. Now, we talked about risk assessment
16 principles, made reference to the issue of consistency of
17 application of risk-based methods and what we meant by that
18 was primarily that if you are, for example, examining a
19 scenario it is wise, we think, if you are taking a risk-
20 based approach to do that throughout the entire scenario
21 rather than applying it in some modules and not in other
22 modules. But it is something that we put quite a bit of
23 emphasis on.
24 Now, the basis for our advice and the theme of our
25 letter was that the whole issue of the reference biosphere,

1 the critical group, should be as much scientifically based
2 as it possibly can be and we should push that to the limit.
3 Whatever we come up with as science is developed that
4 reduces the dependence on policy, we should be able to take
5 advantage of that science.
6 So policies only where there are scientific gaps.
7 We also, as we have in most of our advisory letters of late,
8 emphasized the need for the adoption of a risk-informed and
9 performance-based approach and, as I said, we also pushed
10 the notion of consistency of application.
11 CHAIRMAN JACKSON: How easy do you think it would
12 be to come to real unanimous or near unanimous agreement on
13 what items would constitute scientific gaps?
14 DR. GARRICK: Well, I think that there is fairly
15 good agreement as to where we are lacking sufficient
16 scientific information to put forth what we would call a
17 scientific basis and I think we have identified that. I
18 think that one of the things I have been encouraged by in
19 the repository work as I have gotten more involved in it is
20 that the well designed research program, well orchestrated
21 analysis program can provide a lot more information than I
22 suspect many of us thought would be possible.
23 So the only area that I think we are uncomfortable
24 with, with respect to a scientific gap, is the area having
25 to do with the demographics of the future and the human

1 behavior in the future.

2 DR. HINZE: Not to be flippant, but it is going to
3 be a lot easier to determine what the gaps are than to
4 arrive at a policy. I think that is clear as one looks at
5 the problem.

6 DR. POMEROY: And I think there is another aspect
7 that I would like to emphasize and that is that the policy
8 decision is going to be very, very serious in certain of
9 these areas. The location of the critical group, which may
10 be specified by the EPA, may be specified by the NRC or it
11 may be specified in some ways and offered to you at the
12 staff level.

13 That choice alone can determine the acceptability
14 or nonacceptability of a given repository in a generic sense
15 and we have examples of that that we could discuss.

16 DR. GARRICK: I think there is another point that
17 is important, since there has been a lot of discussion about
18 uncertainty. If one adopts the notion of the science of
19 uncertainty, that is to say accepts the fact that if some
20 parameters are going to involve considerable uncertainty, as
21 long as you represent that uncertainty in your modeling and,
22 as some of us like to call it, tell the truth, it is
23 possible to stretch the scientific basis considerably beyond
24 what you might otherwise think is possible.

25 One of the things I think we have an illusion

1 about is that when we are working with a point estimate that
2 we are working with truth or that we are working with
3 complete knowledge. Seldom in the kind of work that I have
4 been involved with, at least, has that luxury really
5 existed.
6 So I think that we are not in as bad a shape there
7 as we might and if there was any kind of information that
8 developed that would allow us to represent even future
9 demographics in terms of some parameters, albeit they would
10 have large uncertainty bands, that would, at least, even
11 there be a step toward bringing science into that process
12 and we should certainly, in whatever regulations we evolve,
13 accommodate that possibility.
14 CHAIRMAN JACKSON: Commissioner Rogers?
15 COMMISSIONER ROGERS: No, I think the questions so
16 far were what I had.
17 CHAIRMAN JACKSON: Commissioner Dicus?
18 COMMISSIONER DICUS: Let me try to clarify
19 something to be sure I understand it and this is on the
20 scientific gaps and clearly you identified at least one area
21 where policy requirement might come in on the demographics
22 and the behavior of populations. And I wasn't clear as to
23 whether or not that is the only place you have identified or
24 you have identified others already or you think there will
25 be other gaps.

1 DR. GARRICK: Well, there are others that are
2 often talked about as bordering on scientific gaps. One of
3 those activities that we have already mentioned is the issue
4 of disruptive events and the role of disruptive events.
5 Clearly, there is considerable uncertainty in the
6 frequency and severity, that is to say the hazard curve,
7 associated with the large earthquakes, large magnitude
8 earthquakes. Similarly, you could say the same thing with
9 respect to igneous events and you could say the same thing
10 with respect to other things that --
11 DR. HINZE: Human intrusion.
12 DR. GARRICK: Yes, human intrusion, meteorites,
13 whatever. So those are all candidates for scientific gaps.
14 On the other hand, I think that we have made a considerable
15 progress in how to at least include them in our modeling.
16 It is like the whole arena of the risk business. We first
17 learn how to model active systems and then we started
18 working on so-called external threats, such as earthquakes
19 and storms. But we know how to do this active system
20 modeling better than we know how to do external events,
21 better than we know how to do human response, better than we
22 know how to do organizational performance and so on.
23 So it is a gradual encroachment on these things
24 that all contribute to the risk in bringing them into the
25 technical arena and making them less subjective and more a

1 part of the analysis based on some sort of evidence. And if
2 your modeling activity accommodates the treatment of
3 parameters that have high uncertainty in them, there are
4 quite a few things that you can do that you otherwise
5 couldn't.
6 DR. HORNBERGER: Could I interject something to
7 disagree just a little bit with John, which I'm fond of
8 doing?
9 DR. GARRICK: They all are.
10 [Laughter.]
11 DR. HORNBERGER: Scientific gaps doesn't quite
12 capture what we have in mind because scientists, as a
13 scientist, we are fond of talking about gaps in science
14 where we need more research dollars to close the gaps and I
15 don't think that is primarily what we are talking about.
16 Earthquake frequency, there is some chance that
17 science will get us better and better answers in the future.
18 I don't think that we are going to get better and better
19 answers from science on human intrusion scenarios. And they
20 are the kind of things that I believe that we, the ACNW, was
21 focusing on where policy was really needed.
22 DR. HINZE: If I might interject, one of the
23 problems there is the location of the critical group. That
24 is something where we can have some scientific input but,
25 yet, it is going to be a policy decision. There is

1 scientific information regarding the depth of the water
2 table, for example, and how the water table may vary with
3 climate and thus the economics of the critical group. But
4 this really fades into the policy area.
5 As much as possible, our message is use science as
6 much as possible and then your best judgment in terms of
7 policy from there on.
8 CHAIRMAN JACKSON: Commissioner McGaffigan?
9 COMMISSIONER McGAFFIGAN: Could I ask on the
10 question of policy issues, both bills currently pending
11 before the Congress try to settle at least some of these
12 issues, assuming that is in their view the best way to
13 settle it. Have you looked at the bills and seen whether --
14 human intrusion, for example, is dealt with in both
15 bills -- and reached any conclusions as to whether they are
16 dealing with these policy issues, these scientific gaps as
17 the term was previously used?
18 DR. GARRICK: I am generally familiar with the
19 bills and, yes, they would have a major impact in my
20 opinion, because they address both the standard question,
21 the issue of the dose levels and they also address the
22 interim storage. The interim storage has an impact on the
23 repository because it gives you an opportunity to do things
24 with the feed material to the repository that you wouldn't
25 otherwise be able to do. So, no question in my mind, that

1 these bills are going to have a major impact if they are
2 approved. At least that's my view.
3 COMMISSIONER McGAFFIGAN: But have you looked at
4 whether there are additional policy issues that, in your
5 view, need to be resolved? That was one of the questions
6 that I believe our staff received from both houses was, are
7 the policy issues that need to be settled being settled in
8 this bill or are there gaps that we should think about
9 settling?
10 DR. GARRICK: Well, I think the policy issue that
11 prevails is the same one that we have been talking about.
12 COMMISSIONER McGAFFIGAN: Human intrusion?
13 DR. GARRICK: Right.
14 DR. POMEROY: There are certainly, however, going
15 to be significant issues that arise in any interim storage
16 facility with regard to the infrequent events, particularly
17 seismology and volcanology.
18 With your permission then, we would like to turn
19 next to a presentation on flow and radionuclide transport
20 and coupled processes by Dr. Hornberger.
21 DR. HORNBERGER: Given my profession, I am not
22 sure how coherent a presentation I can give without a
23 chalkboard behind me and a piece of chalk in my hand.
24 COMMISSIONER DICUS: We can arrange that.
25 CHAIRMAN JACKSON: I made the migration.

1 [Laughter.]

2 DR. HORNBERGER: The issue of radionuclide
3 transport and coupled processes, these two issues, I think
4 are clearly recognized not only by our committee as
5 important but quite broadly by people in the business. They
6 are key elements in the evaluation of Yucca Mountain as a
7 potential repository site. Both the transport of
8 radionuclides through the vadose zone and through the
9 groundwater pathways in the saturated zone and the
10 interaction of radionuclides with the rocks themselves and
11 recognizing this importance of radionuclide transport, we
12 held a working group meeting in September of 1996 where we
13 heard presentations by a variety of groups on these issues.

14 I wanted to cover just a bit about the significant
15 issues that came up at our meeting in Las Vegas. One of
16 these, I am sure that you heard probably repeatedly about
17 was the measurement of bomb-pulse chlorine 36 in the ESF.
18 These values are, the elevated values of chlorine 36 are
19 obviously attributed to or can only be interpreted as caused
20 by the flow of water to the level of the repository horizon
21 within the past 50 years, roughly. This is very rapid for
22 flow in the vadose zone at Yucca Mountain and indicates that
23 there is flow and transport in an interconnected series of
24 fractures and faults at Yucca Mountain.

25 This, of course, really is a significant issue for

1 evaluation at Yucca Mountain because it is a difficult -- it
2 is difficult to measure, it is difficult to model, all of
3 the things that have to be done.
4 CHAIRMAN JACKSON: When Mr. Barrett from
5 DOE -- I'm sorry to interrupt you -- briefed the Commission
6 last week, he seemed to think that these were things that
7 could be engineered around. Has the committee come to any
8 conclusions?
9 DR. HORNBERGER: The preliminary data we have
10 seen, there is a graph, if you can put up the chlorine 36,
11 on the graph on page 16 in your handout, you can see that
12 these open squares, the ones that are high -- by the way,
13 the background, the dotted line at the bottom is the current
14 background. But, in the past, because of changing
15 conditions there had been elevated levels of chlorine 36 so
16 that really anything below about 1,500 on that left-hand
17 scale can be ruled out as not being bomb-pulse. So it is
18 really these higher values that are important.
19 The open squares indicate data that were collected
20 on what DOE refers to as a feature basis. That is, they
21 went along and they identified fault zones and that is where
22 they took the samples. And you can see, for the most part,
23 the elevated values of chlorine 36 are associated with these
24 features. That is the basis, I think, of Lake Barrett's
25 conclusion, if we stay away from major fault zones, we may

1 be able to avoid these fast flow paths.

2 Now, having said that, I don't think that the
3 final story has yet been written. There are a variety of
4 isotopes that have to be looked at and we have to hear a lot
5 more about the distances from these fault features where the
6 chlorine 36 has been identified. I think at first blush it
7 looks like an engineering solution might be feasible but it
8 is a little too early for me to say that with any degree of
9 conviction.

10 I think what the chlorine 36 data touch on as
11 well, or in coordination with another significant issue that
12 came up at the meeting, is that the infiltration flux
13 through the repository horizon is a really important
14 parameter in determining the performance assessment. DOE
15 had originally speculated that the infiltration rates were
16 very low, the fluxes were very low. From a host of
17 different lines of evidence, this number has been revised
18 and best estimates now are probably that the flux is between
19 one and 10 millimeters per year whereas earlier estimates
20 had placed it at less than one millimeter per year.

21 This then has significant implications for, as I
22 say, the repository performance, the evaluation of the
23 repository performance. And there is a significant issue as
24 to how much information we have and how much more
25 information we need. I am using the "we" generically. DOE

1 needs to actually evaluate repository performance. There is
2 precious little actual data on the hydrological
3 characteristics of fractures and faults at Yucca Mountain.
4 Some other issues that came up at our working
5 group meeting have to do with the chemical state at the
6 repository. It was unclear to us from the presentations we
7 heard to what extent DOE and their contractors were dealing
8 in an integrated way with what we might term the near field
9 chemistry, the fact that there were going to be large
10 quantities of iron, steel, concrete in the repository and
11 actually trying to come to grips with how these materials
12 might buffer the chemistry, the dissolution of the waste
13 forms, the waste packages themselves.
14 Furthermore, it turns out that with the higher
15 fluxes now being looked at, higher infiltration fluxes
16 through the repository horizon, the importance of the
17 interaction between the radionuclides and the geological
18 materials, the zeolites, the absorption, the geochemical
19 interaction may in fact become more important than
20 previously thought. This is an issue that may assume
21 greater importance in the future.
22 Finally, we heard some material on colloid
23 transport and we were not convinced that this issue had been
24 resolved, the effect of colloids.
25 Concerns and advice? Well, in addition to some of

1 the other concerns that I hinted at, we had a fairly
2 significant concern that DOE and the contractors were
3 developing some very nice what we might call inverted,
4 scientific models. But clearly to go to performance
5 assessment, TSPA, their TSPA, they are going to have to do
6 abstractions. They are going to have to use
7 simplifications. We were concerned about the transparency
8 of that simplification process. In fact, our advice to NRC
9 staff was that the staff really needed to remain aware of
10 both the expert elicitation process and the TSPA abstraction
11 workshops to make sure that they kept tabs on how DOE was
12 doing this so that they would understand the simplifications
13 that had gone on.
14 The ACNW is concerned about the limitations that
15 had to be placed on the issues related to radionuclide
16 transport at the center. We recognize, really along with
17 the NRC staff, we do understand how these decisions come to
18 be made. But, again, I think you heard from Margaret
19 Federline the ongoing analysis may in fact lead staff to
20 have to revisit this issue and perhaps revive some of the
21 work that had been put on hold regarding radionuclide
22 transport.
23 We also had thought that the NRC had supported
24 work at the Apache Lead Research Site at the University of
25 Arizona for many years and we saw a chance that some of

1 these issues related to colloid transport in particular
2 might be effectively dealt with by additional work at the
3 ALRS.
4 Finally, I have just a few words to say on coupled
5 processes. You might say I have been talking about coupled
6 processes, hydrology and geochemistry, and that is true.
7 There are other coupled processes that are of some
8 importance.
9 In particular, the focus on the near field having
10 to do with thermal load in particular, the ACNW sees -- we
11 anticipate that there will be increased use of PA to
12 prioritize emphasis on coupled processes and really to do
13 scoping studies as to really what new data may need to be
14 collected. We see in the letter report that we sent
15 forward, we see this as an area that is "data starved." We
16 have more models than we have data and we think that more
17 data are going to be necessary.
18 As I mentioned earlier, we see a need for greater
19 emphasis on near field chemistry and also we see a need to
20 keep tabs on the repository design in terms of the thermal
21 load. This has not been set and a linkage between the
22 thermal load and the hydrological response is likely to be a
23 key issue.
24 That is all I have to say.
25 CHAIRMAN JACKSON: Zero sum game budgeting can

1 result in the support of one area of research resulting in
2 eliminating another. So is there an issue under review by
3 the center, the CNWRA, that you would propose being replaced
4 by the work on flow and radionuclide transport and the
5 coupled chemical and hydrologic transport models?
6 DR. HORNBERGER: You saved the tough question for
7 me, didn't you?
8 CHAIRMAN JACKSON: I warm up as I go along.
9 [Laughter.]
10 DR. HORNBERGER: Obviously, I would have to be
11 very careful in terms of we haven't done a very -- I haven't
12 done a very full analysis of the total center program so I
13 will just give you my own opinion. This is not an ACNW
14 opinion.
15 I think that, for example, we heard --
16 CHAIRMAN JACKSON: Commissioner Dicus is giving me
17 a look.
18 DR. HORNBERGER: Okay.
19 [Laughter.]
20 DR. HORNBERGER: We heard about the KTI and
21 igneous activity at our last meeting and we actually, I
22 think, there is room for an orderly closeout, for example,
23 on that issue. I don't know what kind of resources that
24 would save. I don't know whether that would really lead to
25 an improvement of the situation with regard to radionuclide

1 transport or not but in a zero sum game there aren't any
2 easy choices.
3 CHAIRMAN JACKSON: Thank you.
4 Commissioner Rogers?
5 COMMISSIONER ROGERS: Is there any work going on
6 elsewhere in the world that we might be able to tap into,
7 particularly on these more general questions of coupled
8 processes and colloid chemistry effects?
9 DR. HORNBERGER: Yes. Colloids and coupled
10 processes have been an emphasis internationally. The
11 difficult bit is, for example, with colloid transport is, to
12 my knowledge, all of the other countries in the world are
13 looking at saturated repositories. So we can learn some
14 things.
15 It turns out, however, that colloids have a
16 propensity to get hung up on air/water interfaces and you
17 don't have very many air/water interfaces in a saturated
18 granite. So there are some limitations.
19 So the short answer is, yes, there is a lot to
20 learn. We should definitely keep abreast of what is going
21 on internationally. But there are also some very special
22 things going on a Yucca Mountain.
23 COMMISSIONER ROGERS: Do you think there are any
24 mechanisms that ought to be put in place to tap these
25 international efforts that are not presently available?

1 DR. HINZE: One of the things we stated in our
2 coupled process letter is that INTERVAL, the second phase of
3 INTERVAL has a lot of merit and a lot to tell the NRC and
4 the center in our work. One of our recommendations was
5 there seemed to be a lot of bang for the buck, if you will
6 permit me, a lot of things that could be achieved with
7 relatively minor investment. That would also, of course,
8 give the NRC a certain amount of leverage in terms of
9 directing that into those areas that would be of most
10 interest and most concern to a tuff-related repository.
11 CHAIRMAN JACKSON: Commissioner Dicus?
12 COMMISSIONER DICUS: Yes, you have pointed and
13 spoken to the importance of the transport and the findings
14 with chlorine 36 and I think in response to the Chairman's
15 question regarding engineering features to perhaps address
16 or resolve the issue. My question goes to more of a shorter
17 term. Would you care to make a comment on what these
18 findings, what might their implications be with the
19 viability assessment?
20 DR. HORNBERGER: I think that these
21 provide -- these are data that everyone has to take into
22 account. There are two issues, of course. The presence of
23 chlorine 36, of course, indicates there is new water but it
24 doesn't tell us how much new water. Now, the suspicion from
25 the range of other investigations is that the flux is very

1 small so we are not necessarily talking about a leaking
2 sieve so I think that DOE will certainly have to bound the
3 uncertainties and they will have to investigate this in
4 their viability assessment. But I don't think that this one
5 bit of evidence says, all bets are off, it has to be purely
6 engineering that we rely on.
7 CHAIRMAN JACKSON: Commissioner McGaffigan?
8 COMMISSIONER McGAFFIGAN: Just on the issue of
9 funding, when we had Mrs. Federline in a few weeks ago,
10 radionuclide transport was an area where she identified some
11 extra money might be needed. The Chairman has -- I forget
12 whether it is vapors or fumes -- has said our program is
13 working on in a few areas and we clearly hope that we will
14 get some support from the Congress this year to get the full
15 $17 million request and get -- my sense is even if we can
16 close out, if that is appropriate, the igneous activity,
17 KTI, we still have lots of things where new issues are
18 coming up that we could usefully put some resources into,
19 totally leaving aside an interim storage site if that ever
20 were to emerge. We are totally working on fumes at the
21 moment or darn close to it.
22 So I just wanted -- the Commission has made it
23 very clear and in testimony, the Chairman's testimony, even
24 at $17 million, we have a very, very, very tightly
25 constrained program.

1 That's more a statement than a question.

2 DR. HINZE: I would like to interject something

3 about coupled processes in relationship to that. One of the

4 reasons that we looked at coupled processes is the committee

5 was concerned that there was not a KTI on coupled processes

6 because we think that is a very important item. The Staff

7 folded this into the technical integration, KTI.

8 But our concern here was that we don't lose the

9 coupled processes because this is potentially extremely

10 important and that the resources, as you were alluding to,

11 are a problem there too. But at least coupled processes are

12 being worked upon in that technical integration. It is a

13 matter of emphasis.

14 CHAIRMAN JACKSON: Dr. Pomeroy.

15 DR. POMEROY: We will move right along.

16 The next item on our agenda has to do with igneous

17 activity and Dr. Hinze will make that presentation. That is

18 under Tab C.1.

19 DR. HINZE: Since the bottom line has already been

20 given on this --

21 [Laughter.]

22 DR. HINZE: Thanks George.

23 As I think we are all aware, the potential risk

24 from igneous activity has been identified as an important

25 site characterization issue and is appropriately a KTI and

1 that is because Yucca Mountain lies within what is known as
2 an active volcanic field. Anyone that travels, as you have,
3 to the site sees Lathrop Wells, which has an age date of
4 100,000 years and perhaps even some less, activity that is
5 less, that is only 15 kilometers away. And we see some of
6 the one-million-year-old activity of Crater Flat, just five
7 miles, eight kilometers away from the site.
8 Obviously, this makes the likelihood of activity,
9 the probability, extremely important. That, together with
10 the possible entrainment of waste in an eruption could bring
11 waste to the surface and that brings us to the consequences,
12 the other half of the risk ingredient. Additionally, there
13 could be some igneous effect, igneous activity effects that
14 would be indirect and these are part of the coupled process
15 routine as well.
16 I am sure the Commission is very well aware that
17 historically this is a contentious issue which has reached
18 the popular as well as the scientific press. The major
19 players in this, the three major players, DOE, NRC, as well
20 as the state of Nevada, have all had somewhat differing
21 views which seem to be approaching some kind of commonality.
22 Not exactly commonality, though.
23 It is important to understand that the reason for
24 this is that the science of prediction of volcanic activity
25 or igneous activity, especially in terms of thousands or

1 tens of thousands of years, is really very much in its
2 infancy. It is a difficult problem. And as a result of
3 this limited experience in prediction and also the very low
4 number of igneous events, it works at you both ways there.
5 There are a lot number of igneous events and, as a result,
6 the Yucca Mountain -- the approach to Yucca Mountain igneous
7 activity problem requires that we approach this
8 statistically, look at probability and be very much
9 concerned about the range of uncertainty.
10 In the next slide, we mentioned a few things
11 regarding our activities. We have been long supporters of a
12 strong NRC program on this topic for confirmatory purposes
13 and have continued to monitor it. And, as mentioned
14 previously, we did hold a meeting, at are last meeting in
15 April, to examine the status of the igneous activity KTI
16 because we are at really a critical stage in that whole
17 process. We were joined by several international experts in
18 volcanology who gave us advice.
19 The bottom line to all of this is that we believe
20 that the ACNW should -- we conclude that the work on this
21 topic of igneous activity is very much nearing completion
22 and should be brought to an orderly closure within roughly a
23 year. We do have some recommendations for that program and
24 we will -- we are in the process of preparing that in the
25 form of a letter to you which hopefully we will have out at

1 this meeting.

2 In terms of the status of the igneous activity and
3 in terms of probability specifically, DOE has closed out its
4 site characterization program with the probabilistic
5 volcanic hazard expert elicitation which, incidentally, came
6 up with about the same mean probability value that the DOE
7 program did. They have also closed out their work on the
8 consequence, the other half, the consequence study.

9 We don't know very much about that. They have not
10 made presentations to us on their work on this but the
11 synthesis report that they are preparing and will be out at
12 the end of the fiscal year, we are told, will provide us
13 with that kind of information.

14 Now, DOE and NRC and practically every individual
15 scientist because of the infancy of this "science" have
16 different approaches to estimating the probability. But
17 peer reviewed literature indicates that these are -- that
18 these may all be viable approaches but they are different.
19 And DOE and the NRC don't reach the precise probability
20 value.

21 The significance of this is important to all of us
22 but it is going to have to wait for follow-on PA work both
23 by DOE and by NRC to put it into the risk RIPB, to the risk-
24 informed, performance-based approach.

25 The NRC has performed preliminary consequence

1 estimates. These are excellent preliminary work. The DOE
2 is in the planning stages on this and will be taking this up
3 as part of their TSPA and, as we understand from them, they
4 will be using basically the same codes that the NRC is using
5 in their calculation of risk and those consequence and thus
6 risk.
7 The NRC continues to fine-tune their work and
8 appropriately they are conducting and should for a short
9 time here should conduct limited -- in our view should
10 conduct limited field work and they are conducting modeling
11 studies to decrease that uncertainty and to test the
12 conceptual models. That is true in both the probability and
13 consequence areas.
14 I am sure you have heard from DOE and from your
15 own staff the results. Let's just touch on those again.
16 The tentative estimates, and these are still tentative
17 estimates because they are not completely documented and
18 finalized. But the probability is that there -- from the
19 multiple models of the staff and the center have a range of
20 probability of 10 E-7 to 10 E-8 events per year. And what
21 the NRC staff needs to do, in our view, is that they need to
22 finalize this and they also need to develop their range of
23 uncertainty of that value from their studies, from their
24 studies of the models.
25 Consequences have been performed leading to 500

1 millirems per year at 20 kilometers at Amargosa Valley.
2 This is from a particular model that deals with waste
3 entrained in an ash-forming eruption. This is -- they have
4 used relatively conservative values in their calculation of
5 this.
6 The net result, when you look at the risk here for
7 a period of 10,000 years, you end up with a risk that gives
8 you that warm, fuzzy feeling of half a millirem per year
9 over a 10,000-year period of time.
10 The DOE has estimated as a result of their PVHA a
11 mean probability of 1.5 times E-8 with a bounding range of
12 10 E-7 to 10 E-10. The PVH estimate and the DOE estimates
13 are something less than an order of magnitude difference.
14 My own personal feeling, and this is my personal feeling, is
15 that considering the fact that the risk is only half a
16 millirem per year based upon the 10 E-7 value, which the
17 staff terms a reasonably conservative upper bound, that the
18 difference here between the PVHA value and the work of your
19 staff is not remarkably different and not terribly
20 significant.
21 In terms of our conclusions, this is not just the
22 perfunctory congratulatory but we do believe that the NRC
23 has had a very strong program that provides excellent
24 confirmatory expertise. This is a new area and their chaps
25 have really bitten into this and done an excellent job, peer

1 reviewed articles, et cetera, that have been very well
2 received.
3 The probability and consequence activities of the
4 NRC need to be prioritized. The work needs to be conducted
5 with dispatch and leading to an orderly closure within a
6 year and that should include complete documentation. We
7 need more documentation.
8 In order to have some robustness to these results
9 and to have confidence in them, it is important that the
10 probability studies be scrutinized with sensitivity studies
11 and there is a need, potentially a need for the igneous
12 event sites that have been recognized in the immediate Yucca
13 Mountain area, and particularly in Jackass Flats immediately
14 to the east of the repository, these need to be checked out
15 to determine if we have the presence of unrecognized
16 volcanic igneous activity events. This is the one
17 possibility of having a major change, bringing about a major
18 change in the probability. This is not calling for a great
19 deal of work and it would make the results much more robust
20 in the licensing procedure.
21 Consequence studies are preliminary. We need to
22 have a little more complete range of the scenarios. We
23 don't mean ad infinitum but there needs to be a look at
24 broader scope of the scenarios, particularly the spatial
25 gradient, the study of the spatial gradient of the dose in

1 an ash eruption type of eruption. And any study of any
2 vagaries in the distribution of the ash by wind, for
3 example, we all see the sand dunes in Amargosa Valley and we
4 must be certain that the distribution by winds, for example,
5 may not complicate the situation.
6 We don't mean to be harping but greater reliance
7 on PA is needed to prioritize the activities in the igneous
8 activity and it still is possible to do that and make that
9 more worthwhile. And also we need some guidance on this
10 particular KTI, on closure of it. What uncertainties are
11 going to be permissible for closure of this KTI?
12 We do want to pass on the recommendation that
13 there is a need to maintain expertise in igneous activity,
14 to monitor and evaluate the continuing scientific progress
15 in predicting igneous events. This is a very dynamic area,
16 one in which the science is changing at a very steep -- on a
17 very steep gradient and it is possible, I don't know about
18 probable, but certainly it is possible that in this
19 prelicensing period we are going to see some significant
20 changes in the ability to predict igneous events.
21 So it is important that we maintain an expertise
22 to follow that, to evaluate that and to also be involved in
23 the monitoring of the TSPA-VA of the Department of Energy as
24 well as handling the NRC's own performance assessment work.
25 We will hopefully be providing you with comments

1 and discussion about these individual items, but would be
2 happy to try to answer any questions.
3 CHAIRMAN JACKSON: Commissioner Rogers?
4 COMMISSIONER ROGERS: I have no additional
5 questions.
6 CHAIRMAN JACKSON: Commissioner Dicus?
7 COMMISSIONER DICUS: No questions.
8 CHAIRMAN JACKSON: Commissioner McGaffigan?
9 COMMISSIONER McGAFFIGAN: Again, a comment.
10 Another reason we may need to maintain expertise is when we
11 ever get a license application in this area we need someone
12 who remembers why we closed it out the way we did in 1998.
13 DR. HINZE: Yes, sir. And I think my colleagues
14 said that I should say "documentation" at least five times
15 during my presentation. I don't know whether I made five
16 times but I wanted to.
17 CHAIRMAN JACKSON: So that in the year 2040, we
18 can --
19 [Laughter.]
20 DR. HINZE: Well, we won't see it.
21 Thank you very much.
22 CHAIRMAN JACKSON: Thank you.
23 Dr. Pomeroy?
24 DR. POMEROY: I would only like to reemphasize one
25 point that Bill made. That, again, the spatial distribution

1 and the sensitivity studies in the igneous activity area are
2 extremely important and those certainly should be carried
3 out. We are looking forward eagerly to getting the results
4 of those to evaluate what potential effect, for example, as
5 I talked before, the location of the critical group might
6 make on that.
7 The last item on our agenda, for which we have
8 about five minutes, is myself. I would like to talk very
9 briefly about some selected topics from our priority issues.
10 I would like to talk about issues that -- some of
11 these issues fall somewhat peripherally within our framework
12 and have a lesser relationship to the main body of the work
13 that we carry out.
14 I would like to call your attention to the
15 comments regarding agreement states issues on page 5 and
16 page 6. I would like not to read them to you. I think we
17 can all read.
18 These are things that keep coming up in our
19 discussions, areas where we find that there is a lack of
20 evidence for a given problem and we continue to maintain
21 them on our list of potential topics for the future.
22 What I would like to talk about very briefly is
23 the expert judgment slide, slide number 7. Namely, I
24 believe and we are seeing evidence of this, that expert
25 judgment continues to play an important role in the

1 decisionmaking process. You heard Bill discuss the
2 probabilistic volcanic hazard assessment.
3 There are concerns within the probabilistic
4 volcanic hazard assessment that are perhaps broader than
5 simply that one assessment, mainly the question of
6 incorporation of new data. As Dr. Garrick has pointed out,
7 there are methodologies for handling the incorporation of
8 new data into an expert elicitation. Those are
9 methodologies that are available, they have been exercised
10 in the PVHA program. It is more difficult to incorporate a
11 paradigm shift conceptual model but, even there, there are
12 helps that may come from the PRA field with regard to that.
13 The point I would like to stress here is the
14 question of communications between the DOE and the NRC
15 staff. We have seen improvements in the communications
16 between those two entities but we believe there is a great
17 deal of improvement that still could be made.
18 Specifically, I personally find what I see is a
19 talking past each other phenomenon that is common with
20 younger persons in general.
21 [Laughter.]
22 COMMISSIONER ROGERS: Does that include us?
23 DR. POMEROY: No.
24 COMMISSIONER ROGERS: I thought that was a
25 technique that developed with age.

1 DR. POMEROY: I don't want to comment on the DOE's
2 half of this game but I do feel there is a need for the NRC
3 to evaluate elicitations that it does receive. I feel there
4 is a need to respond and to comment on any DOE initiatives
5 that are undertaken as a result of requests from the NRC. I
6 feel very strongly that there should be clear statements of
7 the criteria that are going to be used for closure of a
8 given issue and I have to say that, in spite of our working
9 group meeting and in spite of attending the technical
10 exchange, I would still need a statement of the "official"
11 NRC position. I am unable to determine that at this time.
12 CHAIRMAN JACKSON: The official NRC position on?
13 DR. POMEROY: On igneous activity, on the closure
14 of igneous activity, what their actual numbers are. These
15 are often presented by members of the center staff who, of
16 course, do not speak for the NRC staff and a clear statement
17 of the NRC position was one of the objectives that we had
18 for our working group session. We hope the improvement that
19 we have seen in communications will result in further
20 communication in the future.
21 CHAIRMAN JACKSON: Thank you.
22 DR. POMEROY: I believe that is all I would like
23 to say, except to say I hope you can discern out of what we
24 have presented here today two themes. One is that we
25 strongly support risk-informed performance-based regulation

1 and, secondly, that we support the use of scientific and
2 technical data to the maximum extent possible in formulating
3 all of our responses and regulations.
4 I think that is all we have.
5 CHAIRMAN JACKSON: Further questions?
6 COMMISSIONER ROGERS: Just on this expert judgment
7 topic which has, I think, always been an interesting and
8 challenging one as to how to use it, I wonder if you could
9 say anything more about the use of expert judgment in those
10 areas where there might be some kind of scientific
11 disagreements. It looks as if this has worked pretty well,
12 particularly in the igneous area, as far as I can learn. I
13 know you touched on the issue of human intrusion as not
14 being a scientific question and I am not introducing the
15 notion that expert judgment could help very much in that
16 one. I mean, I have set that one aside, I don't know.
17 But in other areas, it seems to me there is a
18 gradation from a lot of knowledge and a lot of data to a
19 little data and a lot of experience in some ways but not
20 necessarily that much data. And the issue of, is it
21 possible to collect more data to pin things down versus
22 coming to a decision that is probably very difficult to get
23 more data although, if one waited, you know, another hundred
24 years or so you could get more data.
25 I wonder if you have any thoughts as to how one

1 might structure the use of expert judgment in coming to -- I
2 hate to use the word "closure" because closure has certain
3 connotations here. But at least coming to a common
4 assessment that at this particular time nothing more in
5 required. Let's call it whatever you want to call it, but I
6 wouldn't call it closure because closure really seems to
7 connote that it really is a settled issue with NRC and
8 nothing is settled until everything gets looked at together,
9 you know, as we have said many times.
10 So I wonder if you have any thoughts on how to
11 perhaps adopt a little more structured approach to the use
12 of expert judgment that would help in somehow or other
13 deciding we have come to the point that nothing more is
14 required right now?
15 DR. POMEROY: Let me offer a few comments. I am
16 not sure I can answer that question completely but let me
17 say first there are, of course, as you are well aware, other
18 assessments or elicitations going on at the present time.
19 The probabilistic siting hazard assessment and a number of
20 assessments in association with the abstraction process of
21 TSPA and also simply an elicitation of experts in various
22 areas like the unsaturated zone hydrology.
23 In the unsaturated zone hydrology workshop, the
24 experts themselves were given the question. Do you see the
25 need for additional data and, if so, what additional data do

1 you see? They got some very positive responses that there
2 was a need for additional data and so that feedback occurred
3 within the expert elicitation process.
4 We have long discussed among ourselves the
5 question of how expert elicitation is going to be accepted
6 in the legal or adversarial, at least, environment that we
7 will eventually be functioning in and at one point we felt
8 very strongly and I think I personally still do that we
9 should attempt to try to formulate a rulemaking process, in
10 fact, that we feel at that point that guidance was not
11 sufficient.
12 There are questions, some legitimate questions
13 that the staff has raised with regard to PVHA that aren't
14 easily decidable in terms of how do you select experts, how
15 do you ensure that there is a full spread that the people
16 who are involved in the process can provide you the full
17 range of uncertainty in the given process that you are
18 looking at.
19 Some of those could be answered by a more
20 formalized structure for the use of expert judgment. I
21 believe that there are discussions within the NRC staff
22 itself as to the relative -- still, as to the relative value
23 of the expert judgment elicitation, formal elicitation
24 process. That is a good thing to have. But we need at some
25 point to reach some consensus on those in terms of moving

1 the process forward.

2 I think if you have looked at Dr. Brocoum's slides

3 from a recent management meeting, those are -- those

4 indicate clearly that there is a problem between what DOE

5 sees as the value of the expert judgment elicitations and

6 what he perceives as the NRC response to those questions.

7 I think there is still room for improvement here

8 and we need to work still with the various groups to see

9 whether we can't formulate some of that.

10 DR. GARRICK: I think I would like to make one

11 comment on the whole issue of expert judgment. One of the

12 things that I have observed as that as we work harder to

13 develop a schema for expert elicitation, it seems that one

14 of the fallouts of that is that we discover new ways of

15 finding information.

16 I am thinking, for example, of a non-NRC facility

17 where, in its early days of analysis, namely the Waste

18 Isolation Pilot Plant, there was heavy dependence upon

19 expert elicitation. And what happened was as the expert

20 elicitation took place and was highly criticized in most

21 cases, especially that having to do with future societies,

22 it did sharpen the wits and the creativity of the

23 investigators on how to find data to at least narrow the

24 issues that -- on which they would have to do expert

25 elicitations.

1 So it has had an interesting side effect of
2 sharpening up the ability to scope issues such that maybe
3 there is more information than one thought. You know, a
4 simple analogy would be if you are asked to analyze a first-
5 of-a-kind system for which there is no data, you don't know
6 quite where to start. But if, on the other hand, you start
7 looking at that system and breaking it apart and you find at
8 the subsystem and component level there is lots of
9 information, then it becomes a matter of how well you can
10 aggregate that into the total system and I think there is
11 some of that kind of benefit that has come from the expert
12 elicitation exercises.
13 CHAIRMAN JACKSON: Commissioner Dicus?
14 COMMISSIONER DICUS: No, thank you.
15 CHAIRMAN JACKSON: Commissioner McGaffigan?
16 COMMISSIONER McGAFFIGAN: I would like to go to a
17 slide that you skipped past under B.1, number 6, on
18 decommissioning nonreactor facilities. I want to precede
19 this by thanking you for the letter that you sent last month
20 with regard to the decommissioning rule and the
21 appropriateness of the 25 millirem per year all pathways
22 standard that is proposed by the staff and not having a
23 separate groundwater standard.
24 But this first bullet on that page, the notion
25 that we as a government may need to think about getting all

1 of this waste activity into a single home is one that I
2 haven't seen before but, given what I know now, it rings
3 true to me. NORM, the NORM issue which you cite in your
4 parentheses there, there are lots of NORM sites around this
5 country that are at least as dirty as anything that we are
6 going to try to clean up under the rule that you commented
7 on last month. Yet they are unregulated at the moment,
8 effectively. We argue about what NORM is and
9 technologically enhanced NORM and the various fossil
10 industries come in and say, you know, not us. And we even
11 have a letter on record from the American Petroleum
12 Institute saying, you know, please don't ever apply that
13 standard to us, the 25 millirem per year all pathways.
14 Have you gone any further? Is there anything
15 behind this bullet other than a plea for rationality?
16 DR. POMEROY: The simple answer to that is, not a
17 great deal. It is a statement of rationality that we came
18 to in the process of looking at the low-level waste program
19 which we responded to earlier.
20 When we began to look at that in an examination of
21 many of the other activities that we have looked at in the
22 past, one comes to the immediate conclusion that there needs
23 to be a rational order placed on this and it seems
24 intuitively obvious to us, perhaps, that such a thing should
25 happen, that the NRC should be responsible for all

1 radiological wastes and that there should be a single entity
2 governing that.
3 COMMISSIONER McGAFFIGAN: But that would require
4 an amendment to the Atomic Energy Act.
5 DR. POMEROY: That's certainly true. We recognize
6 that.
7 [Laughter.]
8 DR. POMEROY: The laugher means that's impossible?
9 CHAIRMAN JACKSON: No, no. A private joke here.
10 On behalf of the Commission let me thank you and
11 commend you for a very high-quality briefing. The
12 committee's deliberations and advice will be of tremendous
13 benefit to us as we grapple with the issues particularly
14 related to licensing of a high-level waste repository. So
15 the Commission greatly appreciates all of your efforts in
16 those areas as well as the others and that was a
17 particularly nice walk through from the perspective of the
18 committee's views on risk-informed performance-based
19 regulation, which is always a favorite topic.
20 So, unless there are further comments, we are
21 adjourned.
22 [Whereupon, at 3:32 p.m., the meeting was
23 adjourned.]
24
25

CERTIFICATE

This is to certify that the attached description of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: MEETING WITH ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW) - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Tuesday, May 20, 1997

was held as herein appears, is a true and accurate record of the meeting, and that this is the original transcript thereof taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company

Transcriber: Christopher Cutchall

Reporter: Christopher Cutchall