

**UNITED STATES OF AMERICA**  
**NUCLEAR REGULATORY COMMISSION**

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

**Location:**       **Rockville, Maryland**

**Date:**           **Tuesday, July 21, 1998**

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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MEETING WITH  
ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW)

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PUBLIC MEETING

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Nuclear Regulatory Commission  
Room 1F-16  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland

Tuesday, July 21, 1998

The Commission met in open session, pursuant to  
notice, at 1:33 p.m., the Honorable SHIRLEY A. JACKSON,  
Chairman, presiding.

COMMISSIONERS PRESENT:

SHIRLEY A. JACKSON, Chairman of the Commission  
NILS J. DIAZ, Member of the Commission  
EDWARD MCGAFFIGAN, JR., Member of the Commission

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1 STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:

2 B. JOHN GARRICK, Chairman, ACNW

3 CHARLES FAIRHURST, Member, ACNW

4 GEORGE HORNBERGER, Member, ACNW

5 R.G. WYMER, Member ACNW

6 JOHN LARKINS

7 JOHN C. HOYLE, Secretary

8 KAREN D. CYR, General Counsel

9 ANNETTE C. VIETTI-COOK, Assistant Secretary

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

[1:33 p.m.]

CHAIRMAN JACKSON: Good afternoon, ladies and gentlemen. Commissioner Diaz is running a little late and he asked that we begin.

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 looks to the ACNW, as it is called, to provide it with technical advice to ensure the safe management and disposal of this country's radioactive waste.

The Commission was last briefed by the ACNW on December 18th of last year. We seem to have a long time period between these briefings.

Today's briefing will include discussions on four topics that are of great interest to the Commission. These include, first, the ACNW's views on risk-informed, performance-based regulation. Second, the interim guidance in support of the final rule on radiological criteria for license termination. Third, the NRC's waste-related research program. And, fourth, the near-field environment and performance of engineered barriers in a high-level waste geologic repository.

In addition to these discussions, the ACNW will also address its plans, priorities and accomplishments for

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1 fiscal year 1998 and its plans and priorities for fiscal  
2 year 1999. The Commission looks forward to interacting with  
3 you on all of these topics.

4 And unless my colleague has any comments, please  
5 begin, Dr. Garrick.

6 DR. GARRICK: Thank you. I agree with you it has  
7 been a little bit too long since we have had a chance to  
8 meet, and I think the resources in here are adequate to do  
9 something about that, so we will try to do that.

10 We are going to first talk to you, as you  
11 indicated, about the positions of the Advisory Committee on  
12 risk-informed, performance-based regulation, and we have  
13 been pretty direct and outspoken on those positions in a  
14 number of letters.

15 CHAIRMAN JACKSON: Good.

16 DR. GARRICK: And what I want to do is just kind  
17 of reiterate our views on some of the key points having to  
18 do with this approach. So in my first exhibit, I point out  
19 that we as a Committee strongly support whatever we can do  
20 to enhance the language of this discipline, and important to  
21 that is moving towards a common terminology. And we have  
22 been very encouraged by the Commission's view on wanting to  
23 do that as well. So I think that will help the process a  
24 lot.

25 We have also expressed our position several times

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1 that we believe that as we move towards a risk-informed,  
2 performance-based method of operation, that it will give us  
3 a basis for making our regulations more efficient and moving  
4 in the direction of some form of optimization of the  
5 regulations.

6 As we have said on a number of occasions, and as  
7 you have also said, it is very important that if the agency  
8 is going to move in this direction, that we do it in such a  
9 way that the language applies to everything essentially that  
10 the agency does. So even though this activity had its birth  
11 in and has emerged primarily from the reactor business, the  
12 underlying principles are sufficiently basic that they can  
13 apply to, we believe at least, all of the activities of the  
14 agency.

15 CHAIRMAN JACKSON: Please.

16 DR. GARRICK: Yes.

17 COMMISSIONER MCGAFFIGAN: Dr. Garrick, we had a  
18 stakeholders meeting last week, and I don't know -- I saw  
19 some ACRS members there. I am not sure whether you all were  
20 there. But we asked about risk-informing Part 50, and I  
21 think the answer that we got was that there are some --  
22 let's finish what we are doing now, get these various Reg.  
23 Guides out and working. Dr. Remick said there may be an  
24 opportunity in Appendix B to strip some stuff out that the  
25 maintenance rule may be now adequately dealing with.

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1 But there wasn't a lot of enthusiasm for a  
2 comprehensive rewrite. And it strikes me that what I am  
3 learning, and you said earlier that it came out of the  
4 reactor side, but in some sense, the waste side has gotten  
5 ahead of that reactor side because it is a new area.

6 DR. GARRICK: Yes.

7 COMMISSIONER McGAFFIGAN: It is easier to bring  
8 this new framework into an area where you are starting from  
9 scratch than it is where you have a large body of work  
10 already there and the stability of the regulatory framework,  
11 however deterministic and prescriptive, and whatever it may  
12 be. Better the devil you know than the devil you don't  
13 tends to become a counter-weight.

14 Do you have any thoughts about that? As I say,  
15 you'll have to take my word that that was the general  
16 consensus of some of the industry folks. And you might not  
17 have concurred in it if you had been present, but whatever.

18 DR. GARRICK: Well, I think that you are correct  
19 in that the waste field has some advantage, particularly on  
20 the performance side, because the standards are basically  
21 performance-based, and the primary activity has been in the  
22 high-level waste arena and that is where most of the  
23 attention has been given with respect to establishing a  
24 performance-based standard. So I think there is an  
25 advantage.



1           On the probabilistic side, I think that the waste  
2 side has had some catching up to do, and I believe they have  
3 done a very good job of that. And I think they have been  
4 sometimes frustrated by not being able to capture as much of  
5 the methods that come out of the reactor business and  
6 transfer those to the waste business, as some would like.  
7 But, certainly, some of the fundamental principles, they  
8 have been able to do that.

9           As far as the question of how fast we should move,  
10 I think that it is very difficult when you have got a system  
11 that seems to be working, that people are well-skilled in,  
12 trained. It is difficult to talk about change, and I think  
13 there will be a natural resistance to that. On the other  
14 hand, you would certainly expect that from me.

15           I think the change is justified. The benefits for  
16 doing so are there. I think we are in a time of metrics and  
17 measurements. I think the risk-based process gives us a  
18 much better basis for measuring our performance and being  
19 focused in terms of having reasonable confidence that we are  
20 dealing with the right priorities. So I expect that. I  
21 expect there will be a resistance and people saying that  
22 maybe we shouldn't go make substantial change.

23           And I think we have to be very selective where we  
24 make the change and what-have-you. And I would hope that  
25 one of the areas where there would be rather quick change

1 would be in the analysis activities that are ongoing. There  
2 is no reason that all of our analysis activities shouldn't  
3 be risk-informed right now, regardless of the regulations.  
4 I would like to think that a comprehensive, risk-oriented  
5 analysis contains within it all that is required for the  
6 existing regulations.

7 But I hope, as you will see in a moment, that we  
8 move in a direction where maybe some of the existing  
9 regulations can either be simplified or even eliminated.

10 CHAIRMAN JACKSON: So let me make sure I  
11 understand your point. There are really two. One is that  
12 you believe that even within the existing framework, that  
13 essentially all of the analysis can be made risk-informed.

14 DR. GARRICK: Yes.

15 CHAIRMAN JACKSON: And that the second point you  
16 make is that there are some selected regulations that should  
17 be or could be made risk-informed.

18 DR. GARRICK: Yes.

19 CHAIRMAN JACKSON: Even if we don't do a  
20 comprehensive rewrite of Part 50.

21 DR. GARRICK: Right.

22 CHAIRMAN JACKSON: Could you speak to where you  
23 think some of the opportunities are?

24 DR. GARRICK: Well, certainly, we heard a lot on  
25 that reactor side about Part 50 and about trying to embrace



1 the safety goals more directly into the regulatory process.  
2 There has been lots of talk and discussion, and even work  
3 towards elevation of the core damage frequency as a  
4 surrogate of risk, and all of that is related in one way or  
5 another to Part 50.

6 In the waste side, I think the differences that  
7 are probably going to manifest themselves between the  
8 existing Part 60, for example, and what we expect in the new  
9 regulation, Part 63. Some of those are clearly going to be  
10 driven by risk-informed interests and performance-based.

11 I think the idea of moving away from the  
12 allocation of performance requirements to subsystem levels  
13 is another direct indicator that we are moving in the  
14 direction of a more performance-based and risk-informed  
15 approach. So I think we are beginning to see things happen  
16 and those are a couple of the regulations that I think would  
17 be most -- most directly impacted.

18 CHAIRMAN JACKSON: You also speak to the fact that  
19 you feel that the concepts need to be sufficiently general  
20 to accommodate all NRC activities. Do you feel that, and I  
21 know you have had some interaction at an earlier  
22 incarnation, but do you believe that the concepts and  
23 definitions embodied in now the staff white paper on the  
24 risk-informed, do you think they are general enough to  
25 accommodate those?

1 DR. GARRICK: I think -- yes, I think that is very  
2 much in the right direction. The version that I have seen,  
3 I am very encouraged. I think it clearly has a stronger  
4 orientation to risk than -- and performance than any similar  
5 paper that I have seen.

6 CHAIRMAN JACKSON: And the last question, we did  
7 have a Commission meeting a couple of weeks ago on PRA and  
8 the propagation of it into materials-related areas in  
9 particular, waste management areas. Do you agree that -- or  
10 do you believe that the staff has a comprehensive plan or a  
11 comprehensive framework for using risk-informed approaches  
12 to optimize our regulations and regulatory approaches,  
13 including analyses, in these areas?

14 DR. GARRICK: Well, being sometimes accused of  
15 being a zealot in this discipline, obviously, I am never  
16 satisfied. And I think that, you know, there is a desire  
17 always to see progress and more progress. But I have  
18 followed what has been going on, and both facilities, the  
19 nuclear waste facility side and then the reactor side, and  
20 have been very encouraged that -- with most of what is being  
21 done.

22 I have also been encouraged by the fact that, for  
23 example, the ACRS has capability in this arena that they  
24 haven't had in the past, and I think that is very, very  
25 helpful.



1           So I think there is a lot of work to be done, but  
2 I see some of the fundamental building blocks being put in  
3 place, and the white paper is clearly one of those.

4           COMMISSIONER McGAFFIGAN: One of the points you  
5 made a few minutes ago was that you think there could be a  
6 quick change in the ongoing analysis activities of the  
7 agency regardless of the regs. We are dealing with one at  
8 the moment, 50.59, where if you have any ideas as to how to  
9 make that quick change, they would be welcome, because we  
10 are having a heck of a time. We have this design basis  
11 analysis that is the fundamental --

12          DR. GARRICK: Right.

13          COMMISSIONER McGAFFIGAN: -- sort of stylized  
14 analysis that underlies that and the whole -- the whole of  
15 Part 50, really. And the Commission, sort of naively, in  
16 its SRM said, well, you might be able to look at some of the  
17 work you did on Reg. Guide 1.174 and try to define --

18          CHAIRMAN JACKSON: Right. Go forth and do good.

19          COMMISSIONER McGAFFIGAN: Define minimal and sort  
20 of the same sort of notion you just threw out, and we are  
21 not there yet.

22          DR. GARRICK: Yes.

23          COMMISSIONER McGAFFIGAN: Dr. Aposotolakis in the  
24 ACRS has thrown something across the transom that may help,  
25 but we are struggling with how you build in, even in our

1 analysis, a risk-informed analysis to deterministic  
2 prescriptive regulations.

3 DR. GARRICK: Yes.

4 COMMISSIONER McGAFFIGAN: And the design basis  
5 accident analysis.

6 DR. GARRICK: Well, I have to live my colleagues  
7 here, and for me to really get into 5059, --

8 COMMISSIONER McGAFFIGAN: I know.

9 DR. GARRICK: -- I might spend the rest of the  
10 day. But I think -- I am a great believer in the top-down  
11 approach. I think if we come to grips with some  
12 fundamentals and some policy issues, and some methods, and  
13 the staff begins to embrace those and get trained in them,  
14 that, you know, we will see solutions that we didn't see  
15 before.

16 Now, I will comment on a couple of things that you  
17 mentioned as I go along here. Fortunately, the questions  
18 you have asked has allowed me to cover most of what I have  
19 just covered. So I think we are in pretty good shape.

20 So let me return to the exhibit on risk and risk  
21 assessment. I am a great believer that in any science if  
22 the science is to move forward, you have to have some way of  
23 measuring and risk is no different than that, and the more  
24 the measurements can be in terms of fundamental principles,  
25 first principles, the more broadly it will apply to systems

1 that we have to worry about, so I think the encouragement  
2 here is to not get locked into a single measurement  
3 necessarily that constitutes what we mean by risk, because  
4 it usually does not quite do the job.

5 One fundamental that we have seen work very well  
6 in the applications arena is something we call the triplet  
7 definition of risk. Whether we have been analyzing the risk  
8 of importing agricultural animals and the implications that  
9 has on disease rate or whether we are analyzing the space  
10 shuttle or a chemical refinery or a nuclear power plant, the  
11 triplet definition of risk has applied and been a very  
12 constructive framework within which to ask the important  
13 detailed questions -- what can go wrong, how likely, what  
14 are the consequences approach in practice has seemed to work  
15 very well.

16 Given that that is kind of what one might assume  
17 is a definition of risk, I also like to look upon it as  
18 containing the definition of deterministic safety analysis.  
19 Even in the old days when we were doing safety analysis of  
20 nuclear power plants, long before PRA, we used to ask the  
21 doublet question -- what can go wrong and what are the  
22 consequences? -- so in the context of the triplet, what we  
23 like to say is it's not a question of deterministic versus  
24 probabilistic. It is a question of whether or not you want  
25 to deal with the question of uncertainty and likelihood of a



1 safety analysis and if you do a safety analysis becomes a  
2 risk analysis -- so that is an example of a general kind of  
3 fundamental notion.

4 CHAIRMAN JACKSON: Go ahead.

5 COMMISSIONER McGAFFIGAN: Before you leave the  
6 slide, the triplet definition of risk, if we adopt -- I  
7 remember being taught risk is probability times consequences  
8 for an individual event. It's the same thing -- what can go  
9 wrong --

10 DR. GARRICK: Yes.

11 COMMISSIONER McGAFFIGAN: But how important is it  
12 that we develop a common definition across agencies, health  
13 agencies, FDA, FAA, EPA, et cetera so that we are not  
14 speaking past each other?

15 There is this report I think Gil Olman put out a  
16 year or two ago --

17 DR. GARRICK: Yes.

18 COMMISSIONER McGAFFIGAN: -- about risk and I  
19 think it talked about some of this stuff, but we are -- are  
20 you suggesting we just go ahead or do we try to foster a  
21 common language or how do we do what we do in the context of  
22 what everything else is doing?

23 DR. GARRICK: I don't know that I would suggest  
24 that we force anything. I think that it is a concept that  
25 has worked well and generally concepts that work well are

1 adopted and spread and become standards.

2 I have never been to one to think that there was  
3 so much wisdom as to be able to know what the ultimate  
4 definition ought to be, so I would think that if the agency  
5 has lots of success with this way of thinking, this kind of  
6 definition, that it would be adopted by others.

7 As a matter of fact, the definition I am finding  
8 is finding its way into a number of other arenas, including  
9 defense and NATO -- I have seen it in NATO documents --  
10 chemical and so forth, so I think that there is enough  
11 evidence out there that the idea has enough confidence  
12 behind it or it wouldn't be suggested, that its acceptance  
13 is not taking anybody out on a limb very far, but my  
14 preference would be that the language would be standardized.  
15 At least we would move in that direction.

16 COMMISSIONER DIAZ: Yes. Besides the definition  
17 of risk, of the triplet, in your set of fundamental  
18 principles is there anything else you could put on the table  
19 that would be more specific what you mean by fundamental set  
20 of principles?

21 DR. GARRICK: Yes -- well --

22 COMMISSIONER DIAZ: Measures needed to be  
23 interpreted in terms of --

24 DR. GARRICK: Well, yes. One thing that I'd put  
25 out on the table in the risk business is that I am very much

1 a believer in evidence-based risk assessment. I think that  
2 what we want to do is to have our risk assessments be  
3 impersonal, not be dependent upon opinions and politics,  
4 religion, or anything except the supporting evidence, so I  
5 think the evidence has to speak for itself.

6 I think that in order to do that you can very  
7 often enhance that process by the tools you select to  
8 process that evidence, and they need to be transparent and  
9 that not only means transparent with respect to the specific  
10 exercises that you go through, but transparent with respect  
11 to the logic that you employ.

12 You know, this is the thing that sets risk  
13 assessment apart from a lot of the other analyses that have  
14 risk principles in them, and that is that usually in the  
15 risk field we are trying to calculate something about which  
16 we have very little or no information, and so what we have  
17 to do is map that requirement, that number or that outcome  
18 that we want down to where we have some information, and it  
19 is that mapping that needs to be visible and if the logic is  
20 visible and the information is clear, then of course you  
21 move in the direction of transparency.

22 CHAIRMAN JACKSON: Let me ask you two questions.  
23 I mean I think I understand what you are trying to say.

24 One theoretically could say that superficially  
25 there seems to be an inconsistency between, say, using PRA



1 to complement our traditional deterministic approaches,  
2 which is what we talk about sometimes, and secondly, using  
3 what you say is treating deterministic approaches or  
4 analyses as a subset of risk analysis --

5 DR. GARRICK: Right.

6 CHAIRMAN JACKSON: -- and it seems that the  
7 resolution of that apparent inconsistency is in your triplet  
8 definition, namely that you are basically arguing that a  
9 deterministic analysis or approach answers the first and the  
10 third question and that PRA answers or attempts to answer  
11 all three.

12 DR. GARRICK: Right.

13 CHAIRMAN JACKSON: So it is in that sense that the  
14 deterministic analysis is the subset --

15 DR. GARRICK: Yes.

16 CHAIRMAN JACKSON: -- but it's also in that sense  
17 that PRA is the complement that allows you to add in an  
18 answer to the third --

19 DR. GARRICK: Right.

20 CHAIRMAN JACKSON: -- to the second question, is  
21 that right?

22 DR. GARRICK: Yes. That's right.

23 CHAIRMAN JACKSON: Okay. Then the second question  
24 I wanted to ask you is you spoke about evidence-based risk  
25 assessment and of course one could raise the question of the

1 use of expert panels and expert judgment, and is the point  
2 you are making that this mapping needing to be made visible  
3 and therefore the transparency of the logic, as you call  
4 it --

5 DR. GARRICK: Right.

6 CHAIRMAN JACKSON: -- is that the way that one  
7 justifies and makes the best use of expert judgment?

8 DR. GARRICK: That's part of it, and you will  
9 notice I did not use the word "data" because data conjures  
10 up certain specific things in people's minds, and data is a  
11 piece of evidence, but it is not the totality of evidence.

12 The laws of physics are evidence, logic is  
13 evidence and expert elicitation outcome is evidence --

14 CHAIRMAN JACKSON: Okay.

15 DR. GARRICK: -- so I think that is what I was  
16 referring to.

17 CHAIRMAN JACKSON: Okay.

18 DR. GARRICK: All right. Let's go to risk  
19 assessment and defense-in-depth.

20 We have written to you much about those topics.

21 One of the things that we see as an advantage of a  
22 risk-informed approach is the opportunity to add clarity to  
23 the concept of defense-in-depth, the opportunity to move in  
24 the direction of quantifying the contribution to performance  
25 of all lines of defense.

1           Of course, when we talk about quantification we  
2 are really not talking about necessarily a property of the  
3 real world so much as we are about the knowledge of the  
4 individual or individuals and their ability to express that  
5 knowledge, and in order to express knowledge about rare  
6 events you have got to have a mechanism and a form to do  
7 that that captures the fact that there's lots of things you  
8 don't know or the fact that there are uncertainties, so  
9 quantification doesn't necessarily mean a number. It means  
10 capturing the information in a form that conveys what you do  
11 know as well as what you don't know, and some of the lines  
12 of defense you are going to know a lot less than others, and  
13 if you have a way of communicating that, then you have a  
14 real heads-up on the notion of defense-in-depth.

15           On risk-informed, performance-based terms, the  
16 committee is very much in agreement with the positions we  
17 have seen articulated by the Commission on the fact that a  
18 risk analysis is not necessarily decision analysis. Many  
19 more things often go into a decision.

20           In risk there is always the opportunity to define  
21 your risk parameters in such a way that they embrace issues  
22 of cost and issues of schedule. That kind of activity has  
23 carried with it a whole new field called performance risk  
24 analysis or programmatic risk analysis, but one has to be  
25 very careful about using risk in decision-making and making



1 sure that it is in its proper context.

2 Performance-based -- there are major differences  
3 between materials and reactor licenses in the case of  
4 performance-based regulations. I think we spoke to that at  
5 the opening, that there's things that have been established  
6 by tradition through the reactor field that have to be dealt  
7 with in probably an evolutionary manner to move to the  
8 risk-based way of thinking.

9 I think one of the primary compromises, if you  
10 wish, of the doublet view of safety analysis is that  
11 interpretation of design basis. I think if we had not come  
12 up with the concept of a design basis accident, I think the  
13 coupling between safety analysis and risk analysis would  
14 have been much easier to see.

15 Regulatory burden -- I think that most people who  
16 are mature about this discipline and practice it look to  
17 relief in regulatory burden. They certainly don't look to a  
18 relief understanding what the safety is, on the contrary  
19 convinced that there will be much more knowledge about the  
20 safety, but that eventually there needs to be some  
21 efficiencies as a direct result of risk-informed practices  
22 and those efficiencies need to take the form of changes in  
23 the regulations.

24 So as to my closing comments, I think that we have  
25 indicated a number of times that we think the risk view is

1 essential to judge the overall safety of a repository. It  
2 provides us the perspective we need.

3 I think one of the things that is sometimes  
4 underestimated is the experience base in the waste field.  
5 While the use of probabilistic methods in the waste field  
6 has come relatively late, the amount of activity has been  
7 intense and the expenditure of effort, resources in the last  
8 10 years, primarily through two projects -- the Waste  
9 Isolation Pilot Plan and the Yucca Mountain, proposed Yucca  
10 Mountain repository.

11 As a result of those activities we have learned an  
12 enormous amount about how to apply these methods to a  
13 geologic system, and as we said, one of the things that is  
14 very important in evolving and transitioning to a risk way  
15 of thinking is to not prescribe yourselves out of the  
16 business. We need to retain a certain amount of  
17 flexibility.

18 As to the details, even though we have been  
19 arguing in my whole discussion here about the importance of  
20 fixing some principles and the way we do some of the  
21 analyses and the details of some of the methods -- that  
22 aspect of it needs to be flexible.

23 I think that's all I want to say about the subject  
24 and I am certain available for questions.

25 CHAIRMAN JACKSON: Okay.

1 COMMISSIONER MCGAFFIGAN: I am not sure you ever  
2 answered the Chairman's question about where the low-lying  
3 fruit are in reactor space, but maybe your answer was that  
4 your colleagues would get mad if you took all afternoon on  
5 the subject, so --

6 DR. GARRICK: I think one of the areas is to --  
7 okay, I will answer that.

8 I think the design basis accident philosophy  
9 approach to regulation is sometimes a barrier to the  
10 introduction of a risk-informed approach, and I think that  
11 is a specific that you started to look at the regulations in  
12 the context of design basis that you would maybe appreciate  
13 that this is the one activity, this is the one analysis,  
14 effort that has compromised, if you wish, an otherwise  
15 doublet approach to safety analysis, and I know why it came  
16 about and how it came about and that it was useful but it  
17 created partitions that were artificial.

18 We got into class 9 accidents, severe accidents  
19 and what have you, and these sort of artificial interfaces  
20 that don't really exist in nature. And that we started  
21 regulating against a design basis accident as if we did that  
22 we would never have a severe accident. And we of course  
23 learned that that's just not the case. So that's one major  
24 issue that I would love to work with you on.

25 CHAIRMAN JACKSON: Well, would you -- we'll give



1 your colleagues plenty of time. Would you care to speak to  
2 50.59?

3 DR. GARRICK: Well, I think that what you're  
4 trying to do, namely it's like somebody has said if somebody  
5 comes in for a change, even though we are not under a  
6 risk-based regulatory process right now, such changes cannot  
7 be realized anymore without some level of a risk analysis.  
8 And I would like to see the 50.59 activities move more  
9 aggressively in that direction to where there was increased  
10 dependence on that, and I think also there would be great  
11 signals sent out to the licensees if with that came a real  
12 examination of 50.59 in terms of its deterministic, in terms  
13 of its traditional requirements.

14 I think that one of the things that is causing  
15 quite a bit of anxiety, and I'm sorry I wasn't to the  
16 meeting last week, is that many people are discouraged about  
17 risk on a couple of counts. One is this whole idea of  
18 keeping a comprehensive risk assessment current is viewed as  
19 an extensive burden, and, two, and this involves the NRC,  
20 it's not clear to a lot of licensees just what the benefit  
21 is, that if they have to go ahead and comply with all of the  
22 so-called deterministic requirements, they're not so sure,  
23 given the maturity of the industry, that they want to engage  
24 themselves in a research-oriented kind of activity just for  
25 the sake of building confidence in a risk-based approach to

1 regulatory practice.

2 So my view on this is that probably the pilot  
3 programs you have are useful. They provide a lot of  
4 insights and problems learning about the application of risk  
5 to a whole family of issues, everything from hydrogen  
6 recombiners and their necessity to the utility of a graded  
7 quality assurance program. But I think that the thing that  
8 would really advance the cause would be some rather  
9 significant backoff, if you wish, or modification if you  
10 wish of a regulation that is a heavy burden, on the basis  
11 that you're now confident that what was being sought as a  
12 result of that regulation is more than offset by the new  
13 methods and the new practices.

14 CHAIRMAN JACKSON: Okay. Thank you.

15 Dr. Fairhurst.

16 DR. FAIRHURST: Thank you very much.

17 What I'm going to address is clearly a restatement  
18 of material communicated in a letter in April. That was  
19 based on a presentation in March from the Office of Nuclear  
20 Regulatory Research concerning interim guidance and the  
21 support of the final rule on radiological criteria for  
22 license determination -- license termination, sorry.

23 I first lay out the several general observations.  
24 One, that obviously decommissioning is a subject that's  
25 going to be of continuing and probably growing regulatory

1 importance. Secondly, that the license termination issue is  
2 a complex one, varies very widely from case to case from  
3 very simple determinations to really quite complex  
4 situations. And the NRC resources required to deal with it  
5 are correspondingly quite varied.

6 Then the next observation was really a picking up  
7 a little bit on what Dr. Garrick's constant philosophy is  
8 that we need to be dealing with a risk-informed,  
9 performance-based criterion. This is another case where the  
10 changes that are envisaged are along those lines. That's  
11 not saying there is some need for -- there is a need for  
12 regulatory consistency with respect to the use of the total  
13 dose standard basing things on health effects, having some  
14 flexibility in the regulatory approach because of this  
15 complexity, and also in this particular case recognizing the  
16 role of Agreement States. They, too, feel they have a stake  
17 in it.

18 An issue that was brought to us and which I know  
19 you're very familiar with, but it was raised first by the  
20 industry, nuclear energy industry, was this question of dual  
21 Federal regulation, and that this is a serious problem and  
22 one that is not easy to deal with, but somehow is going to  
23 have to be dealt with.

24 The main recommendations in our letter, first we  
25 were somewhat overawed by the complexity of the regulatory



1 guidance. I think the word we used was it was formidable.  
2 I think you responded in kind and said yes indeed you  
3 understood it and that maybe it needs to be -- need to take  
4 some advantage in this electronic age of finding ways to  
5 make it more comprehensible, user-friendly, and a little  
6 more menu-driven format.

7 Another issue that we felt we needed to bring out  
8 was that the ALARA approach maybe should be considered to be  
9 in some cases leading to unnecessary conservatism, and we  
10 feel that if you could meet the 25 millirem all-sources or  
11 pathways limit, that should be sufficient. I think in your  
12 answer to us you mentioned a concern or a feeling that in  
13 some cases if it was a simple thing to do, then one could  
14 perhaps go lower if it was a question of just wiping things  
15 down. But I think we still hold to the notion that that 25  
16 millirem should be for most cases sufficient to meet what  
17 we'd call ALARA.

18 COMMISSIONER DIAZ: Could you please elaborate on  
19 the reason why you believe that it's possible or it's  
20 justifiable?

21 DR. FAIRHURST: Well, yes. In the -- first of  
22 all, the doses that one receive from 25 millirem from all  
23 pathways I think generally would be considered to be of  
24 little concern as far as health effects.

25 COMMISSIONER DIAZ: Yes.

1 DR. FAIRHURST: There is also I think the feeling  
2 that the formula rem standard ground water but if you use  
3 the 25 millirem all pathways, it probably will in many cases  
4 satisfy the formula rem. I'm not an authority in this, but  
5 it's what I've been led to understand, that if you look at  
6 the requirements that are being suggested by people that  
7 this is not a major deviation from those in most cases.

8 COMMISSIONER DIAZ: But it's the ALARA interface,  
9 what I'm concerned, we always put the ALARA interfaces and  
10 the additional satisfaction of --

11 DR. FAIRHURST: Well, yes, you know, ALARA, as low  
12 as reasonably achievable, and one can then argue, Dr.  
13 Garrick wants evidence, wants facts, reasonable is a very  
14 subjective word, and the question is what is reasonable.  
15 And you can force somebody out of business perhaps  
16 financially by pushing them to an enormous amount of effort  
17 for very little benefit.

18 COMMISSIONER DIAZ: We have a long history of  
19 using ALARA.

20 DR. FAIRHURST: Pardon?

21 COMMISSIONER DIAZ: We have a long history of  
22 using ALARA.

23 DR. FAIRHURST: Oh, yes. Yes, I'm just saying  
24 that --

25 COMMISSIONER DIAZ: We've managed to keep it



1 within bounds.

2 DR. FAIRHURST: Right.

3 CHAIRMAN JACKSON: Well, I mean, isn't also if I  
4 go back to what Dr. Garrick was saying, that if you talk  
5 about using risk analysis or, you know, today, particularly  
6 within the ALARA framework, does that not offer a way not to  
7 abandon what has been a cornerstone of how we've done our  
8 business, but at the same time address the issue of  
9 unnecessary conservatisms from a cost-benefit point of view?

10 DR. GARRICK: Yes, and one thing that's very  
11 important, and I'm sure that Charles was going to comment on  
12 this, is that when we say in reference to this specific  
13 issue that the 25 rem is acceptable, that's not saying that  
14 we don't believe in ALARA. ALARA is a rational way to look  
15 at things.

16 CHAIRMAN JACKSON: That was my point.

17 DR. GARRICK: If you can meet a standard and  
18 spending 10 cents reduce it by 10, of course you would do  
19 that.

20 CHAIRMAN JACKSON: Right. That's all.

21 DR. GARRICK: Yes.

22 COMMISSIONER McGAFFIGAN: This is a more generic  
23 question, but I will point out you were listened to by the  
24 Commission. Our staff requirements memorandum on this  
25 particular point uses the word "may." It isn't quite as



1 definitive as definitive as you, but in addition if the  
2 licensee complies with the 25 millirem dose criterion using  
3 the screening methodology, the D and D code which itself is  
4 quite conservative, the licensee may have met the intended  
5 ALARA requirement. May have met. We didn't, you know --

6 DR. GARRICK: Yes.

7 COMMISSIONER McGAFFIGAN: Therefore additional  
8 demonstration of compliance may not be necessary. So we did  
9 listen, but we also wanted to take into account by using  
10 those may the circumstances where for 10 cents you get a  
11 factor of 10 --

12 DR. GARRICK: Yes. Absolutely. Absolutely.

13 CHAIRMAN JACKSON: Okay.

14 DR. FAIRHURST: And the final point that was made  
15 in the letter was that we felt that the D and D code that is  
16 being considered should have some flexibility for change if  
17 one finds, for example, that the foundations on which it's  
18 built change, such as the linear no-threshold hypothesis.  
19 And your response I think was that if that is changed, it  
20 will have other ramifications apart from just modifying the  
21 D and D code, and we know it will.

22 We also recommended that it would be useful to try  
23 to take some test sites, complex test sites, and go through  
24 the implementing guidance and see how it works out in  
25 reality. There was a suggestion made that there might be

1 some level of conservatism by using generic parameters and  
2 it might be possible and simple to locally add regional  
3 parameters, it might reduce the conservatism.

4 I might add in conclusion that yesterday we heard  
5 a presentation from the NRC staff about developing a  
6 standard review plan, and it appears that things are moving  
7 quite well along where they are about to test it on a  
8 complex site and they are considering a number of things to  
9 improve flexibility. So I think this is on course.

10 CHAIRMAN JACKSON: Yes. Thank you.

11 COMMISSIONER MCGAFFIGAN: Did they give you a copy  
12 of our SRM too at some point, because a lot of that was  
13 directed so that -- just so you know that your advice is  
14 listened to, a lot of the thoughts in the SRM I think and  
15 part of all of us was the result of your work and very much  
16 appreciated.

17 DR. GARRICK: We are encouraged.

18 DR. FAIRHURST: So we will give you an update  
19 later, I think, not just back-patting but we did very much  
20 appreciate your response and comments to us on that. It was  
21 helpful. It tells us that there is somebody listening and  
22 responding. Thank you.

23 CHAIRMAN JACKSON: Of course. Somebody up here  
24 even likes you.

25 [Laughter.]

1 CHAIRMAN JACKSON: That always helps.

2 Dr. Hornberger.

3 DR. HORNBERGER: Thank you, Chairman Jackson. As  
4 always, it is a pleasure to be here.

5 My task today is to report to you on some of the  
6 work that the ACNW did in looking at the waste-related  
7 research program within NRC. And this was, as you know,  
8 ACNW input to an ACRS report. ACRS was asked to review  
9 safety-related research and they asked ACNW to look at the  
10 waste-related portion.

11 The Office of Research has a fairly modest  
12 program, mainly in decommissioning and decontamination, and  
13 the ACNW did hear presentations from staff of the Office of  
14 Research on that.

15 The NMSS, of course, classifies their work as  
16 technical assistance, the work they do with the Center for  
17 Nuclear Regulatory Analysis. But we are familiar with that  
18 work mostly because we have been keeping track of the work  
19 related to Yucca Mountain, and a lot of that work we judge  
20 as quite innovative and very important, and so we classify  
21 it -- or we decided to include that under research. And,  
22 so, of course, we have had regular presentations and  
23 interactions with staff of NMSS.

24 We also had a meeting where we had some briefings  
25 from the Department of Energy with regard to their waste

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1 management research. This is not the Yucca Mountain, but  
2 this is a program that was done between their Office of  
3 Research and the Waste Management Division to sponsor basic  
4 research. And we also heard from EPRI, the industry side of  
5 the house, on how they conduct their research program.

6 So that is the background, just so you know what  
7 we did to come to some of the observations that we had --  
8 that we have listed.

9 The observations with respect to NMSS then, as I  
10 very quickly summarize out of the report, it is obvious that  
11 the Department of Energy has the big job in terms of coming  
12 forward with a license application for Yucca Mountain and  
13 their research program, obviously, has to show that. So  
14 that their research budget is much, much larger than the NRC  
15 budget.

16 We took -- one of the reasons we took a look at  
17 EPRI was because EPRI has a very -- also a very modest  
18 research program, and we were interested in the way they  
19 handle it. Of course, from the industry side, they have  
20 lots of flexibility, they have almost no constraints, and so  
21 they use performance assessment to prioritize the topics  
22 that they go after and then they simply go out and find the  
23 best person that they can to do the work that they want to,  
24 and they contract with that person. And, clearly, the NRC  
25 simply can't have that kind of flexibility.

1 But one of the observations that we did have was  
2 that the research and technical assistance programs within  
3 NRC really do have to be focused and flexibility and carry  
4 the respect of the scientific community. And, obviously,  
5 the NRC has to continue to have national and international  
6 stature in the whole waste management area.

7 CHAIRMAN JACKSON: Let me ask you a question. I  
8 noted that you made a number of some specific  
9 recommendations and one of them was, this goes back to  
10 high-level waste, you said -- well, and more broadly,  
11 actually. You said that the performance assessment model  
12 should be structured to represent repository performance as  
13 realistically as possible.

14 I mean is there an implication there that the NRC  
15 is not using realistic assumptions or realistic models? Or  
16 is this just kind of an overall --

17 DR. HORNBERGER: No, actually, I think that we did  
18 have that comment in a previous letter and we continue to  
19 believe that the NRC, the staff must continue to strive to  
20 be as reasonable as possible -- as realistic as possible,  
21 excuse me, and to ferret out any conservatisms that are  
22 built in and make sure that they are appropriate  
23 conservatisms.

24 CHAIRMAN JACKSON: So it is really a question of  
25 following a line with some modulation, --



1 DR. HORNBERGER: Yes.

2 CHAIRMAN JACKSON: -- as opposed to that they have  
3 been on entirely the wrong track?

4 DR. HORNBERGER: Oh, no. In fact, quite the  
5 opposite. We think that they are very definitely on track.

6 CHAIRMAN JACKSON: Okay. I just wanted to be  
7 sure.

8 DR. HORNBERGER: I think the first bullet in terms  
9 of recommendations, really, really should -- NMSS should  
10 continue to focus their technical work.

11 CHAIRMAN JACKSON: Okay.

12 DR. HORNBERGER: They have been doing an excellent  
13 job, by the way, in using the TPA, their total performance  
14 assessment code, to look at the priorities, to continue to  
15 assess the key technical issues and the sub-issues. And  
16 they have used it -- I had a chat with Margaret Federline, I  
17 guess in April, on this, and she said, yes, they do look at  
18 these results and they do have -- they try to maintain as  
19 much flexibility as they can to redirect work at the Center  
20 as appropriate. So --

21 CHAIRMAN JACKSON: Well, a concern I had had  
22 relative to the TPA was the data that the NRC had available  
23 to it, because in order to be realistic, you have to have  
24 data that tells you something about the site you are trying  
25 to model. Do you have any comments or concerns in that

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1 particular area?

2 DR. HORNBERGER: Yes. I mean, clearly, of course,  
3 the DOE, their TSPA suffers from exactly the same problem.  
4 So it is not just NRC TPA, but it is the DOE and, of course,  
5 EPRI uses their total performance model and they have  
6 exactly the same kind of constraints.

7 I think that there are clear areas where the  
8 database is sketchy, shall we say, and I think that Ray  
9 probably will highlight at least a couple of areas where we  
10 really -- we think that probably the database with regard to  
11 engineered systems, in particular, definitely needs work.

12 The NRC obviously can't afford to collect all of  
13 those data, they have to be very select in terms of what  
14 they focus on. And I think that is the focus and  
15 flexibility issue that we raised with respect to the  
16 high-level waste.

17 CHAIRMAN JACKSON: Is there more opportunity with  
18 making use of data that DOE itself generates, but in our --  
19 in the models?

20 DR. HORNBERGER: Yes. Oh, absolutely. Charles  
21 and I just were up on the seventh floor at lunch and had a  
22 demonstration of the three-dimensional geological model for  
23 -- that was developed by DOE. And the NRC is verifying this  
24 and basically considering what the criteria will be for them  
25 to accept it into their own use. And so DOE invested a huge

1 amount of money to develop a tool that is I think going to  
2 be very useful for the NRC, as one example.

3 CHAIRMAN JACKSON: Thank you.

4 DR. HORNBERGER: So, in terms of the  
5 recommendations, as I said, the continued focus of the  
6 technical work by using the TPA. We have had clear evidence  
7 over the past several meetings that the DOE design continues  
8 to evolve and we anticipate that it will evolve as we go  
9 into the future with changes. Therefore, the flexibility  
10 with the Center has to be maintained in terms of definition  
11 of the tasks. As I said, the main flexibility that we  
12 observed with EPRI is that they had freedom to engage  
13 anyone, any expert in the world without constraints as to  
14 prior work with DOE or anything else, and NRC doesn't have  
15 that.

16 Nevertheless, we do feel strongly that outside  
17 experts, engaged appropriately in a surgically precise  
18 manner, again, can enhance both the acceptability, and when  
19 you get advice from world experts, really leading experts in  
20 the world, I think that it does have -- it reflects  
21 credibility onto the program by having these excellent  
22 people from the outside concur with you.

23 And there have been a range of letter reports and  
24 this last bullet really comes from a letter that we wrote to  
25 you on comments on performance assessment capabilities,

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1 where we, in fact, again, identified, because of this switch  
2 -- not a switch, but the enhancement of interest in the  
3 engineered part of the system of the repository, which we  
4 believe is going to continue to become ever more important  
5 as we -- as DOE goes forward, that the NRC staff really does  
6 have to make sure that they have the right capabilities,  
7 either here or at the Center, or that they have the  
8 flexibility to engage help as they need it.

9 The next observation with respect to NMSS, again,  
10 it is really a repeat in the sense of the point that I just  
11 made. It is imperative that the outside world not view NRC  
12 analyses as overly simplistic. And, again, we think the  
13 ACNW believes that one way to help out in this is to engage  
14 prominent waste engineers and scientists in the resolution  
15 of waste management problem.

16 And, of course, we understand that funding has  
17 been an issue for years. We discussed, I think, a year ago  
18 about the decrease in funding for certain -- curtailing work  
19 on certain KTIs and this can throw monkey wrenches,  
20 obviously, into programs, and people do have to live with  
21 that. We don't have an infinite resource here. But, at any  
22 rate, we think that the Center funding has to be such to  
23 ensure that this ongoing effort is maintained.

24 Our observations with respect to the Office of  
25 Research, really, the first bullet here on the observation



1 has to do with priority setting. We heard the presentations  
2 on the research. We are impressed by the work that is being  
3 done by the Office of Research. But we thought that setting  
4 priorities and how priorities were set were a key, and it  
5 was unclear to us in our discussions whether the current  
6 structure for setting priorities was what we would consider  
7 rigorous.

8 We were told that certainly the staff experience  
9 and knowledge had gone into setting the priorities, and  
10 these people have had many years experience, and there is  
11 reason to believe that they are on top of things.  
12 Nevertheless, whenever -- especially with such restricted  
13 resources, you really want to make sure that you focus on  
14 the priorities. So our recommendation to the Office of  
15 Research, that we see a need for a structured organization  
16 for identifying the priorities and make sure that peer  
17 review is involved, and that it focuses on the users,  
18 because, after all, it is an applied program, if you like.

19 So that summarizes our input on research.

20 CHAIRMAN JACKSON: Thank you.

21 Dr. Wymer.

22 DR. WYMER: Thank you. My presentation today is  
23 on the near-field environment, performance of engineered  
24 barriers, particularly as they relate to the Yucca Mountain  
25 Repository. And a big part of what I will present is based

1 on a working group meeting that we held June 10th and 11th,  
2 a two-day meeting where we brought in experts from outside,  
3 as well as DOE and NRC and from the Center, and had  
4 presentations.

5 We think this topic is particularly important  
6 because of the increased attention paid by DOE to engineered  
7 barrier system performance. And it is important to the NRC,  
8 of course, because they have to keep up with things and have  
9 to license that repository, so they have to understand what  
10 DOE has done.

11 We also got a lot of input from the working group  
12 with respect to what are the really important technical  
13 issues, and there was a lot of sort of ad hoc discussion  
14 that wasn't even on the agenda that raised some areas that  
15 I'll get into which we thought were particularly important  
16 and relevant.

17 So, going to the next viewgraph, we have some  
18 general observations to start with, then I will give some  
19 specific insights that were obtained out of the working  
20 group. First, the Yucca Mountain Repository is different  
21 from other planned repositories around the world in that it  
22 is in an unsaturated and oxidizing environment, which really  
23 changes a lot of things with respect to corrosion, with  
24 respect to chemistry. Whereas, most of the repository  
25 designs are in a saturated environment which is primarily a

1 reducing environment, the chemistry is quite, quite  
2 different. So that's an important difference and it puts  
3 Yucca Mountain kind of apart from all the other repository  
4 design considerations.

5 The other thing that George mentioned is that it's  
6 like shooting a running deer. The EBS design continually  
7 changes as the Department of Energy picks up on new facts,  
8 new importances, new emphases arise, and so every time we  
9 hear from them there's something new and it's generally in  
10 the right direction and we are glad to hear it, but it does  
11 make it a moving target so it's kind of hard to keep up with  
12 the design.

13 Consequently and concurrently that means that the  
14 NRC Staff has to be quick on its feet and has to have  
15 flexibility to stay abreast of this evolving situation.

16 The Department of Energy talks about a robust  
17 depository and our understanding of what robust means is  
18 that it is simply enough that it is not going to collapse  
19 under its own complexity and that the defense barriers, that  
20 barriers are decoupled so that if one fails, everything  
21 doesn't fail, so robustness implies as much simplicity as  
22 possible and as much decoupling as possible of one barrier  
23 from another so that you don't have in the language of the  
24 reactor you don't have common mode failure.

25 We think it is important, and we are not sure we



1 see good evidence of this out of the EBS design options, we  
2 think it is important that there be a top-down systems  
3 engineering approach rather than a bottoms-up. By that we  
4 mean that you need to set the overall goals and the overall  
5 design features at the beginning and build toward those  
6 rather than seeing a lot of details emerge and let those  
7 form your design. There is probably quite enough of that  
8 going on as there should be and attention should be paid to  
9 that in the NRC's review of the situation.

10 Then something that emerged that wasn't really on  
11 the working group agenda but there was a lot of discussion  
12 that it emerged as a very important issue had to do with the  
13 preclosure issues of the repository. That thing may stay  
14 open for 100 years. DOE talks about 100, 200 years -- they  
15 get a little unrealistic in my view, but nonetheless they  
16 are talking a long time into the future keeping that  
17 repository open and during that time there are a lot of  
18 issues that come up having to do with heat loading and  
19 retrievability of waste packages and during that time the  
20 repository performance features can be confirmed or denied  
21 and the NRC needs to be certain I think that it pays  
22 attention -- we think -- that it pays attention to the  
23 preclosure aspects of the repository development, which one  
24 of our expert panelists said should be an evolving thing.

25 He even advocated continual changes in the design

1 of the waste packages and then some features of the  
2 repository as information is gained over the 50 to 100 years  
3 before closure -- so this is an area where little attention  
4 has been paid by either DOE or NRC as far as we have been  
5 informed to date and we think that it deserves attention.

6 On the next exhibit here, we get into I guess  
7 near-field environmental issues, and by that we mean  
8 anything from the concrete liner of the drift on in --  
9 anything inside there is what we define as the near-field.

10 One of the things that came out and our first  
11 reaction, my first reaction to it and I think maybe the  
12 committee's, was that gee, this is kind of obvious, why are  
13 you telling us this, is that it is very important how much  
14 water comes in and how much contacts the waste. Well, you  
15 know, that is what we call a privileged glimpse at the  
16 bleeding obvious, but when you think about it and you think  
17 about what DOE is planning, it turns out to be worth paying  
18 attention to. They are talking about a drip shield. They  
19 are talking about potentially backfills and they are talking  
20 about the effects on solubilization and transport of fission  
21 products and all this relates to water, so anything you can  
22 do to control the water is important and that is beginning  
23 to get a fair amount of attention, and I will say a little  
24 bit more about it.

25 There was some concern expressed about the

1 abstraction from the PA models, from the near-field process  
2 level models, into a PA model. The concern was, first, is  
3 the fullblown model adequately supported by data, a point  
4 that we dealt with a little bit earlier, and second, is the  
5 abstraction to this more simplified model done well? Does  
6 it really incorporate all of the salient points in the  
7 process level models? -- so we thought that attention needed  
8 to be paid to that. Now there is a great deal of attention  
9 going into that but nonetheless it was brought up and we  
10 thought it deserved mentioning here.

11           The near-field chemistry is near and dear to my  
12 heart and there is a lot of chemistry discussed, even though  
13 one of the participants characterized the meeting as a  
14 "corrosion meeting" -- he was a corrosion expert and my  
15 answer to that was to a hammer everything is a nail -- and  
16 he felt it was a corrosion meeting.

17           Actually, there is a lot known about the chemistry  
18 of the water entering the repository but there is not much  
19 known at all about what happens to that water when it starts  
20 hitting things inside the repository, especially at  
21 mechanistic level. There's a lot of empirical and anecdotal  
22 information but there is not a lot of true basic  
23 understanding of the chemical reactions that the in --  
24 flowing water will bring about as it contacts in particular  
25 the fuel material.



1           Those reactions are extraordinarily complex and  
2           are poorly, poorly understood on a fundamental level.

3           The next exhibit here deals with corrosion. As I  
4           said, one of the participants felt it was a corrosion  
5           meeting and it was very heavy on corrosion, and partly that  
6           is because there is a lot of expertise on corrosion both  
7           within the NRC and its contractors and at DOE.

8           There are good people doing good work on corrosion  
9           and there is a lot of interaction between those people but  
10          you need to distinguish, we feel, between a good expertise  
11          and a basic understanding of corrosion issues and specific  
12          understanding about specific corrosion problems relating to  
13          specific materials. That gets into the next point on this  
14          exhibit, which has to do with the wonder alloy C-22. That  
15          is a high nickel based alloy which has received a great deal  
16          of attention. It is extremely corrosion resistant.

17          I call it a wonder alloy. It is sort of a --  
18          without tongue-in-cheek, it's a very good material.  
19          However, the information base with respect to corrosion is  
20          limited with respect to the amount of time that people have  
21          been studying this material -- something less than two  
22          decades, which is a whole lot less of course than people  
23          have looked at iron and titanium and other kinds of alloys,  
24          so there was a lot of stress being put on the use of this  
25          alloy and it probably will play a very important part in

1 DOE's analysis.

2 CHAIRMAN JACKSON: Commissioner Diaz.

3 COMMISSIONER DIAZ: Just out of curiosity, has  
4 anybody been trying to look at single crystal alloys at all  
5 because of their tremendous resistance to corrosion and  
6 diffusion?

7 DR. WYMER: No. As far as I know, that has not  
8 taken place. Of course, that would be a mighty big single  
9 crystal but --

10 COMMISSIONER DIAZ: I have seen them big enough in  
11 Russia. They do make them big.

12 DR. WYMER: No, that has not -- that wasn't  
13 brought up and we're not aware of anything.

14 COMMISSIONER DIAZ: Interesting. There is a  
15 program from STIO that gives a nickel alloy, single crystal  
16 alloys, as being done now, last four, five years.

17 DR. WYMER: I know that single crystals are  
18 sometimes much more resistant to corrosion.

19 COMMISSIONER DIAZ: Much more -- and they're  
20 trying to put them in jet engines.

21 DR. WYMER: Even with the microcrystalline  
22 materials the corrosion resistance is high for this  
23 material. It is based primarily on the existence of an  
24 oxide layer because this alloy like all other metals --

25 COMMISSIONER DIAZ: Right, right --

1 DR. WYMER: -- most other metals is not --

2 COMMISSIONER DIAZ: And there would be no  
3 diffusion and so it is a tremendous advantage.

4 DR. WYMER: Despite the fact that this looks very  
5 good, one or two of the corrosion experts raised concerns  
6 having to do with localized or crevice corrosion that might  
7 occur when you get -- by evaporation concentrations of  
8 chloride iodine and other kinds of things that enhance  
9 corrosion.

10 One of the speakers brought up a very interesting  
11 observation which deserves to be proven or disproven. That  
12 is, he said that there is for C-22 a temperature regime  
13 during which corrosion can occur. Above that temperature  
14 and below a temperature it is practically nonexistent. I  
15 mean the corrosion is very low, which suggests that by  
16 judicious arrangement of conditions you can avoid that  
17 temperature regime for long periods of -- to exist for long  
18 periods of time and thereby greatly enhance the lifetime of  
19 the material.

20 So that they're knocked down or verified.

21 CHAIRMAN JACKSON: Yes.

22 COMMISSIONER MCGAFFIGAN: How quickly can you  
23 knock down or verify that? Is it relevant to licensing of  
24 Yucca Mountain, or is it a 20-year research project?

25 DR. WYMER: I can't answer that question



1 authoritatively, but my feeling is though that you could  
2 certainly ferret out a major difference between being in the  
3 temperature regime and being out of the temperature regime  
4 in a fairly short period of time.

5 COMMISSIONER McGAFFIGAN: Where is the temperature  
6 regime where corrosion may occur according to this?

7 DR. WYMER: It's fairly low.

8 DR. HORNBERGER: It's 100 to 120 C.

9 DR. WYMER: Maybe 80 to 120 or something like  
10 that. It's fairly low.

11 COMMISSIONER DIAZ: I'm sorry I'm smiling. We  
12 were working at 1,400 degrees Kelvin.

13 DR. HORNBERGER: Well, it won't get quite that  
14 hot.

15 DR. GARRICK: At a little different time constant.

16 COMMISSIONER McGAFFIGAN: Could I also -- if 80 to  
17 120 degrees centigrade is where the risk range is, is it  
18 easy to -- I mean, presumably you wouldn't want to be above  
19 that, that would be difficult to control, or maybe that is  
20 where you end up, if there's a lot of heat in the mountain  
21 maybe you end up above 120 and never have to worry about  
22 coming below it. But how -- which way were you going to try  
23 to control?

24 DR. WYMER: One of the -- I don't know, but one of  
25 the considerations is that if these alloys are as good as

1 they are claimed to be, then even in the corrosion regime  
2 they may well be stable for times long enough that high  
3 temperatures due to the decay heat are not important  
4 anymore, in which case you might drop down below that. So  
5 that's one consideration.

6 We need to know more about this particular point,  
7 because it is apparently important.

8 Another point was brought up with respect to  
9 corrosion of the outer layer. The C-22 is a thin inner  
10 protective layer in the waste package. There's a much  
11 thicker outer iron or steel layer which is really the main  
12 container for the waste. And that will corrode.

13 One of the experts brought up the fact that well,  
14 suppose you get a hole in that container and it rusts and  
15 the rust is on the inside rather than the outside, there's a  
16 volumetric change as you go from the metal to the oxide, and  
17 it'll expand and crush what's inside. And it may in fact  
18 bend, break, fracture, and some other ways do harm to the  
19 inner container, C-22 or whatever it is, whatever's chosen.  
20 And that has not been addressed in detail.

21 Also, the effect, when this happens, when you get  
22 iron oxidation, the effect of ferric ion on corrosion is the  
23 important factor.

24 Then one of the experts brought up the issue of  
25 weld integrity. He says we've got to have a couple miles of

1 welds there, and nobody really knows much about corrosion of  
2 welds. They know a lot about corrosion of massive  
3 materials, but welds are a horse of another color, and they  
4 always behave differently from the bulk material.

5 Am I overrunning my time?

6 CHAIRMAN JACKSON: No. Go ahead.

7 DR. WYMER: So the point was brought up that it's  
8 important to pay attention to some of these more practical  
9 aspects like weld integrity and their impacts on long-term  
10 performance of the waste package, waste canisters.

11 Then the whole issue of backfills is an important  
12 one. You can control ingressive water with backfills to a  
13 certain extent. You can control chemistry in the repository  
14 by using certain kinds of backfills having reducing  
15 properties or chemical properties to retain elements that  
16 might otherwise transport rapidly out of the container.

17 And then finally some of the experts question the  
18 use of taking credit for the fuel cladding, the Zircaloy  
19 cladding on the fuel as part of what you rely on to prevent  
20 release of the fission products, and indeed we said well,  
21 we're still thinking about that. We're not sure.

22 CHAIRMAN JACKSON: Doesn't that also put  
23 constraints relative to whether damaged fuel could go into a  
24 repository?

25 DR. WYMER: Sure, it does. Sure.



1 CHAIRMAN JACKSON: Because that issue has come up  
2 particularly since the repository is, you know, it's  
3 primarily for commercial fuel, and the issue is there, but  
4 also for other spent fuel.

5 DR. WYMER: Sure.

6 CHAIRMAN JACKSON: And then the issue of the  
7 condition of the fuel, which includes its cladding comes  
8 into play.

9 DR. WYMER: That's right.

10 CHAIRMAN JACKSON: And the impact on the overall.

11 DR. WYMER: Yes. Bending or cracking or any of  
12 these things is important. Yes.

13 CHAIRMAN JACKSON: Okay.

14 DR. WYMER: Then the final point was -- area that  
15 was discussed was the release of fission products and  
16 actinides from the fuel itself and the transport of those  
17 materials, and one of the invited experts particularly  
18 pointed out the fact that when you let the water reach the  
19 fuel and the water is saturated with oxygen, as it will be  
20 under normal conditions, then you're going to get oxidation  
21 of the UO<sub>2</sub> to some higher oxide, and also the radionuclides,  
22 of which there'll be about 3 or 4 percent in that fuel, can  
23 also -- some of those also can oxidize, depending on what  
24 they are. Because normally they'll be in an oxidation state  
25 governed by the fact that they were born in UO<sub>2</sub> and there

1 was that much oxygen available and no more.

2 So the formation of these oxidation products could  
3 in fact affect the release rates of the fission products and  
4 actinides and therefore the source term ultimately for the  
5 dose.

6 And finally there was the issue of secondary  
7 phases and of colloid formation. The secondary phases is  
8 not exactly the same as the formation of oxides. In this  
9 case they were talking about specific stable long-term  
10 stable secondary phases that would incorporate inefficient  
11 products or actinides within their structure. And this  
12 could dramatically change their release of fission products,  
13 actinides, but not much is known about that, and there is no  
14 good thermodynamic data base to use as a basis for  
15 calculating what the stable phases might be.

16 And finally colloids and pseudocolloids are I  
17 think clearly going to be of importance, and that was  
18 discussed at some length. A colloid is something like a  
19 plutonium polymer. A pseudocolloid is something like clay  
20 or iron which forms a colloid which then absorbs physically  
21 or chemically a fission product or an actinide, which then  
22 would move the way the colloid moves rather than as the way  
23 an ion in that material would move. And we felt that  
24 attention needed to be paid to those kinds of things because  
25 they could have a dramatic effect, the secondary phases, for

1     retarding movement, colloids for enhancing movement.

2             And then we thought that we wanted to know more  
3     about -- and I'm sure more is known, but we don't know it --  
4     more about the rank ordering of the importance of these  
5     various barriers to movement in the repository one with  
6     respect to another so that we know what's the 800-pound  
7     gorilla and what we don't care about.

8             CHAIRMAN JACKSON:    Sure.

9             COMMISSIONER MCGAFFIGAN:  A fairly fundamental  
10    question comes from this presentation and our presentation  
11    by the staff a few weeks ago about performance assessment in  
12    this area, and that is how much of a grip are we going to  
13    have on these engineered-barrier issues by the time we're  
14    licensing, and will a conservative licensing process with an  
15    array of expert opinion have to ultimately perhaps not guess  
16    that the C-22 is going to be quite as good as claimed, and  
17    how do we -- how is this all going to come down.  The staff  
18    seems to have -- and I don't have the exact transcript of  
19    the meeting in front of me -- but some real concerns about  
20    overemphasis on engineered barriers at the current time in  
21    some of the DOE work.  So I wonder if that's shared.

22            DR. WYMER:  Why don't you, John?

23            COMMISSIONER MCGAFFIGAN:  Well, either one of you.

24            DR. WYMER:  I'll take his lead.

25            DR. GARRICK:  Well, it is a difficult problem.

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1 But I recall the same anxieties when we first started  
2 looking at the reactors in terms of the contribution of  
3 mitigating systems, that there was great skepticism about  
4 our ability to be able to quantify, for example, the worth  
5 of a containment system or a high pressure injection system,  
6 and much progress was made on that in a relatively short  
7 period of time.

8 And I think when we started focusing on that, and  
9 we started dealing with the question of what is the real  
10 worth of containment, for example, because that was a  
11 classic, similar argument, that we don't know how much the  
12 containment -- we can design it to certain pressures and we  
13 can make it robust. But it wasn't too long before we were  
14 able to put some quantification to the whole process and  
15 suggest that for some containments, the capacities of those  
16 containments were anywhere from 1-1/2 to 4 times their  
17 design basis. And it was an extremely important  
18 breakthrough to get -- to begin to get those kinds of feels  
19 and senses of what the defense mechanisms were.

20 I think the same is true here. I think that right  
21 now it is new territory. It is a different problem. It is  
22 -- the processes involve extremely long time constants.  
23 They are serial for the most part, rather than parallel.  
24 They are passive for the most part, rather than active. But  
25 I am confident that if we just stop worrying about it and

1 start focusing on dealing with the question of how much  
2 value are we getting from a drip shield or backfill, or an  
3 outer barrier, 100 millimeters of steel versus 50, or 50  
4 millimeters of C-22 versus 20, I think we can -- I think we  
5 will be surprised.

6 There has been a lot of advancements made in what  
7 I would call structural mechanics from a probabilistic  
8 perspective and I am more confident than most people.

9 COMMISSIONER MCGAFFIGAN: Could I follow-up? You  
10 mentioned the word time constants, and one of the issues --  
11 I mean if you take -- if, hypothetically, we are working  
12 with a 10,000 year period, which is what we worked with, and  
13 that may not -- there are longer periods. One can consider  
14 the Academy talked about longer periods.

15 But one of the problems with these time constants  
16 is you can -- if you really believe the analysis for 10,000  
17 years, you sort of -- everything is nice and tightly  
18 contained right there at the site, and there is no -- there  
19 is no source term going very far. And how robust that  
20 judgment is is going to be the heart of the licensing  
21 process, if, indeed, there is a lot of emphasis on the  
22 engineered barrier.

23 But at some point these things break and we will  
24 have to look at what happens once the geologic system is  
25 providing the containment.

1 DR. GARRICK: Right.

2 COMMISSIONER MCGAFFIGAN: And how things go. But  
3 to some degree, because of the time constants, you can get  
4 into a situation where, if 10,000 years is the licensing  
5 period, is the period for analysis and deciding whether to  
6 grant a license, the problem gets defined away, and then it  
7 just pops up at 60 or a 100 or --

8 DR. GARRICK: The compliance problem gets defined  
9 away, but the risk problem does not.

10 COMMISSIONER MCGAFFIGAN: Right.

11 DR. GARRICK: Right.

12 DR. WYMER: Well, I would like to throw in my two  
13 cents on that. We can identify, and I have, a half a dozen  
14 areas of potential concern and things that deal with the  
15 adequacy of engineered barriers. But it is very possible, I  
16 think likely, that by not particularly sophisticated  
17 analyses, quite a few of these things will be laid to rest  
18 as being below the horizon, and there will only be a few  
19 that will stand out as peaks that we really -- that really  
20 deserve attention. And that's why we make the point that  
21 this rank ordering is -- early on, is important, because  
22 those things which even on a semi-quantitative or almost  
23 qualitative basis, you can rule out, reduce the field  
24 substantially, or on the basis of the fact that DOE is not  
25 even going to rely on those things in the first place.



1           So it seems to me that there is a -- we are just  
2 before making a major simplification in what we need to be  
3 concerned with. And if attention is paid to these, some of  
4 these issues that we have raised here, they can -- some of  
5 these will just be thrown aside and they won't even turn out  
6 to be important.

7           COMMISSIONER McGAFFIGAN: One last question.  
8 Whose job is it to bring about that major simplification? I  
9 mean you are recommending it. But is that DOE's job to  
10 bring it about?

11          DR. WYMER: It's DOE's job to recommend it. It is  
12 NRC's to be sure that they are good recommendations.

13          DR. GARRICK: Speaking of recommendations, as you  
14 know, this particular work is work in progress, and we  
15 intend to send you a letter and to make some  
16 recommendations.

17          CHAIRMAN JACKSON: Okay. Dr. Garrick.

18          DR. GARRICK: It's an interesting dichotomy. The  
19 essence of reactor safety is the presence of water. The  
20 essence of repository safety is the absence of water. You  
21 would think we could get it right somehow.

22          CHAIRMAN JACKSON: Well, the presence of water can  
23 also be a problem.

24          DR. GARRICK: Well, in some reactors, a special  
25 problem.

1 CHAIRMAN JACKSON: That's right.

2 DR. GARRICK: And under some temperature  
3 conditions.

4 I want to talk a little bit about planning.  
5 Planning is something you kind of really hate to do. But  
6 when you have done it, --

7 CHAIRMAN JACKSON: Oh, darn.

8 DR. GARRICK: -- you are really glad you did it.  
9 That's the case.

10 CHAIRMAN JACKSON: Good. Because it is over or  
11 because --

12 [Laughter.]

13 DR. GARRICK: Well, partly because of your  
14 leadership, we have moved in the direction of trying to  
15 become much more formal in our planning. The ACNW has  
16 always attempted to prioritize and plan its activities for  
17 the forward year and years. But it was -- this year was the  
18 first time we attempted to get a little more structure and a  
19 little more formal in the whole process.

20 We tried to lay down some rules that were the  
21 basis for our planning activity. We wanted to be darn sure  
22 that we didn't get ourselves so tied down to our plan that  
23 we were not in a position to offer advice as a result of  
24 some major changes and we did not want to get in a position  
25 that we couldn't respond quickly to change. So we had that

1 as one of our major commitments and rules for the planning  
2 process.

3 The one thing that does come from a plan is the  
4 ability to kind of look at yourself and measure against some  
5 sort of a baseline, and we have been doing that. We have  
6 established the plan as input to our operating plan. And,  
7 of course, our operating plan has such metrics in it as  
8 timeliness of our information, its quality, its efficiency,  
9 its effectiveness, et cetera.

10 Also, we, in this year, in a little more formal  
11 manner, completed a performance evaluation of ourselves.  
12 That was documented in a SECY document on June 1st. The  
13 status of our planning activity is that we were extremely  
14 pleased that the Commission also read that letter and  
15 responded directly to us, and those comments are very  
16 helpful and have to do with the fact that perhaps our  
17 planning was a little too narrow in scope, maybe it didn't  
18 match up with all of the elements of our charter, and we  
19 intend to take those comments as source material for the  
20 planning activity that we will engage in later this year.

21 We have received Commission requests for new work  
22 as a result of exposing the plan. For example, in the  
23 low-level waste area, the issue that has already been  
24 brought up this morning of criticality at Envirocare and a  
25 generic consideration of criticality in low-level waste

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1 sites is something we are currently addressing.

2 We have, certainly, been addressing the issue of  
3 risk. The comment was made to get outside of the box, if  
4 you wish, and look at some topical issues like reactor  
5 vessel handling and what to do about used reactor vessels.  
6 The Trojan reactor vessel has been mentioned in particular.

7 And, of course, clearance levels are another  
8 example of things that have been mentioned that we maybe  
9 ought to be prepared to deal with. And, of course, we have  
10 to be cautious about managing our scope because we have  
11 resource limitations just like everybody else. And in  
12 regard to that, there was a memorandum to the Chief  
13 Financial Officer concerning additional resources for fiscal  
14 year 1999 to give us increased confidence that we can,  
15 indeed, respond to these requirements.

16 The Committee is very pleased to report that we  
17 have issued letters on all of our first tier priority  
18 topics. The first tier priority topics included such issues  
19 as viability assessment and site characterization,  
20 risk-informed, performance-based issues, engineered barrier  
21 systems, decommissioning and research.

22 In kind of the spirit of accomplishments, we  
23 provided recommendations and advice on a rather large number  
24 of issues such as defense-in-depth. We wrote you a letter  
25 in October of last year. Multiple barriers in March of this

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1 year. The use of PRA in the waste field, this was the issue  
2 of what lessons can we carry from the vast amount of  
3 experience in the reactor field to the waste field, and we  
4 wrote a letter on that. And on the subject of the effects  
5 low-level ionizing radiation, prompted by Commissioner Diaz,  
6 and we wrote a letter on that.

7 One of the things that the Committee has been  
8 relatively sensitive to and quite active in is trying to  
9 heighten the awareness and the need for attention to the  
10 engineered barrier system issue in high-level waste disposal  
11 and the growing apparent dependence on engineered systems in  
12 -- being in the demonstration of the performance of the  
13 repository, and we have been very active in addressing that  
14 issue.

15 One of the highlights of the year and, certainly,  
16 one of the most technically stimulating activities we have  
17 engaged in in the last couple of years was the working group  
18 that Ray Wymer was the lead person on, that we had in early  
19 June, and we think that working group activity generated  
20 some extremely valuable source material for us to address  
21 much more intelligently the issues surrounding increased  
22 dependence on engineered barrier systems.

23 One of the things that the Commission has reminded  
24 us to do from time to time is to be aware of international  
25 activities in our work and in our gathering of source



1 material as a basis for our advice. We have done a number  
2 of things in direct response to that. One of the things we  
3 certainly are pleased that happened is that we got a member  
4 of the Committee, namely, Dr. Fairhurst, who has a vast  
5 amount of international experience and seems to know  
6 everybody in this business, and that has been extremely  
7 helpful in organizing a number of things, including a trip  
8 that we -- and a meeting we expect to have with the German  
9 RSK later this year.

10 Future activities, we expect to issue to you a  
11 major letter report on engineered barrier systems. We also  
12 expect to issue letters on such topics as post-disposal  
13 criticality, the NUREG, 10 CFR Part 63, total system  
14 sensitivity analysis. In fact, we have completed that  
15 letter at this meeting.

16 The interesting issue of importance measures and  
17 the whole question of can you really do importance measures  
18 for systems typical of repositories. The issue of  
19 decommissioning. And, of course, we expect to send you some  
20 advice on the viability assessment.

21 CHAIRMAN JACKSON: Commissioner McGaffigan.

22 COMMISSIONER MCGAFFIGAN: Could I ask one question  
23 on the post-disposal criticality issue? I know you got  
24 briefed on this yesterday, and I understand you asked some  
25 penetrating questions. If you go back to your risk-informed



1 definition of risk, the triplet model of risk, we have got  
2 something there that is vanishingly small, although we  
3 could, I guess, try to quantify it, and you questioned, and  
4 I think appropriately, trying to quantify vanishingly small.

5 The consequences from the Oak Ridge study, even if  
6 it happens, are not enormous. And so the question, from a  
7 regulator's perspective, and the reason you have been asked  
8 the question, obviously, is we -- the Commission is asking  
9 is it -- When is enough, enough?

10 DR. GARRICK: Yes.

11 COMMISSIONER MCGAFFIGAN: Do you have -- not  
12 trying to get the letter report out of your mouth right this  
13 moment, but do you have an initial impressions as to when  
14 enough is enough in this area?

15 DR. GARRICK: Well, I do. I think this is an  
16 ideal example of what we were talking about earlier, of an  
17 analysis that should be risk-informed. Even though, to do  
18 it quickly, we may be faced with a lot of uncertainties, I  
19 suspect we still would learn a great deal about it. We are  
20 going to probably encourage that kind of an approach be  
21 taken. We are not very sympathetic to an extensive research  
22 activity based on what we have heard so far.

23 COMMISSIONER MCGAFFIGAN: Okay. Thank you.

24 DR. GARRICK: We have mentioned the issue of  
25 international technical meetings. Dr. Fairhurst continues

1 to do that and be our ambassador, but we will enhance that a  
2 little bit and see what he is up to when we all go to  
3 Germany.

4 We expect to hold a stakeholders meeting in Yucca  
5 Mountain vicinity to enhance public participation. You  
6 recall that that is one of our goals, is to offer advice on  
7 how to enhance public participation. And we expect,  
8 finally, to conduct increasingly comprehensive  
9 self-assessments.

10 COMMISSIONER DIAZ: Excuse me. A few moments ago  
11 you mentioned that you have already reviewed or considered,  
12 or read about the clearance of materials and the potential  
13 development of a rule. Are you prepared to engage in this  
14 issue of the clearance of materials? You don't mention in  
15 your future activities.

16 DR. GARRICK: We are prepared to engage. I think  
17 that's what advice committees are prepared to do.

18 COMMISSIONER DIAZ: That's good.

19 DR. GARRICK: It is not a comfortable issue and a  
20 lot of people would just as soon that we not engage, but we  
21 will. We will engage.

22 COMMISSIONER DIAZ: All right.

23 DR. GARRICK: I think that completes our  
24 discussion. We are sorry we ran over a little bit, I guess.

25 CHAIRMAN JACKSON: Okay. That's all right.



1 COMMISSIONER MCGAFFIGAN: My only comment is I  
2 think next time they are going to have him do risk-informed,  
3 performance-based at the end of the agenda rather than the  
4 beginning.

5 [Laughter.]

6 CHAIRMAN JACKSON: No, I told them they would have  
7 all the time they needed. You had all the time you needed.

8 DR. HORNBERGER: Yes, we did.

9 CHAIRMAN JACKSON: Well, let me just say that the  
10 Advisory Committee's views on the matters you addressed  
11 today are of tremendous value and importance to the  
12 Commission as we are trying to deal with the complexities of  
13 a number of technical and policy issues.

14 You talked about risk-informed and  
15 performance-based regulation, which you know is an important  
16 area.

17 DR. GARRICK: Yes.

18 CHAIRMAN JACKSON: On the issues associated with  
19 licensing activities for high-level waste repository,  
20 decommissioning, which is becoming increasingly important,  
21 and other materials-related areas.

22 I want to commend you for the high quality of  
23 today's briefing and of the work you do, and just to tell  
24 you that the Commission does appreciate your efforts.

25 And so, unless there is any further discussion,



1 this meeting is adjourned.

2 DR. GARRICK: Thank you. Thank you very much.

3 [Whereupon, at 3:16 p.m., the meeting was  
4 concluded.]

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(202) 842-0034

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, July 21, 1998

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: Martha Buzzel

Reporter: Mark Mahoney



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

July 10, 1998

MEMORANDUM TO: John C. Hoyle  
Secretary of the Commission

FROM: John T. Larkins, Executive Director  
Advisory Committee on Nuclear Waste

SUBJECT: ADVISORY COMMITTEE ON NUCLEAR WASTE MEETING WITH  
THE U.S. NUCLEAR REGULATORY COMMISSION, JULY 21, 1998 --  
SCHEDULE AND BACKGROUND INFORMATION

The ACNW is scheduled to meet with the NRC Commissioners between 1:30 - 3:00 p.m. on Tuesday, July 21, 1998 to discuss the items listed below. Background material related to these items is enclosed.

INTRODUCTION - Chairman Shirley Ann Jackson 1:30 - 1:35 p.m.

PRESENTATIONS - Advisory Committee on Nuclear  
Waste

(Presenter and relevant letters listed  
under each topic)

1. Risk-informed, Performance-Based Regulation 1:35 - 1:50 p.m.

- B. John Garrick, Chairman, ACNW
- 3/26/98 ltr. to Chairman Jackson: Risk-Informed, Performance-Based Regulation in Nuclear Waste Management

2. Interim Guidance in Support of the Final Rule on Radiological Criteria for License Termination 1:50 - 2:05 p.m.

- Charles Fairhurst, ACNW
- 4/29/98 letter to Chairman Jackson: Comments and Recommendations on Interim Guidance in Support of the Final Rule on Radiological Criteria for License Termination



3. NRC Waste-Related Research (work in progress) 2:05 - 2:20 p.m.
  - George Hornberger, Vice-Chairman, ACNW
  - 10/8/97 letter to Chairman Jackson: Comments on Performance Assessment Capability in the NRC High-Level Radioactive Waste Program
4. Near-Field Environment and Performance of Engineered Barriers (work in progress) 2:20 - 2:35 p.m.
  - Raymond G. Wymer, ACNW
  - Working Group Meeting June 10-11, 1998
  - 3/6/98 letter to Chairman Jackson: ACNW's Support for the NRC Staff's Approach to Assessing the Performance of Multiple Barriers
5. ACNW Plans, Priorities and Accomplishments for FY 1998 and FY 1999 Plans and Priorities (Progress Report) 2:35 - 2:45 p.m.
  - B. John Garrick, Chairman, ACNW
  - 12/23/97 letter to Chairman Jackson: 1998 Strategic Plan and Priority Issues for the ACNW
  - 3/26/98 letter to Chairman Jackson: Commission Comments on the ACNW Strategic Plan and Priority Issues

CLOSING REMARKS - NRC Chairman

2:45 - 3:00 P.M.

cc: ACNW Members  
ACNW Staff

**List of ACNW Letter Reports Issued Since Last Commission Briefing**

December 23, 1997 Letter to Chairman. Subject: 1998 Strategic Plan and Priority Issues for the Advisory Committee on Nuclear Waste.

March 6, 1998 Letter to Chairman. Subject: ACNW'S Support for the NRC Staff's Approach to Assessing the Performance of Multiple Barriers

March 6, 1998 Letter to Chairman. Subject: NRC High-Level Waste Issue-Resolution Process and Issue Resolution Status Reports

March 26, 1998 Letter to Chairman. Subject: Commission Comments on the ACNW Strategic Plan and Priority Issues

March 26, 1998 Letter to Chairman. Subject: Risk-Informed, Performance-Based Regulation in Nuclear Waste Management

April 29, 1998 Letter to Chairman. Subject: Comments and Recommendations on Interim Guidance in Support of the Final Rule on Radiological Criteria for License Termination

April 30, 1998 Memorandum to R.L. Seale. Subject: ACNW's Contribution to the ACRS' Report to the Commission on NRC Safety Research

June 19, 1998 Letter to Chairman. Subject: ACNW Comments on NRC's Review of the DOE Viability Assessment

June 24, 1998. Report to the Commission. Subject: Review and Evaluation of the NRC Safety Research Program (Joint with ACRS).



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- George Hornberger, Vice-Chairman, ACNW
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  - 12/23/97 letter to Chairman Jackson: 1998 Strategic Plan and Priority Issues for the ACNW
  - 3/26/98 letter to Chairman Jackson: Commission Comments on the ACNW Strategic Plan and Priority Issues

CLOSING REMARKS - NRC Chairman

2:45 - 3:00 P.M.

cc: ACNW Members  
ACNW Staff





**ADVISORY COMMITTEE ON NUCLEAR WASTE  
MEETING WITH  
U.S. NUCLEAR REGULATORY COMMISSION**

**Rockville, MD  
July 21, 1998**

**Advisory Committee on Nuclear Waste  
Risk-Informed, Performance-Based Regulation**

**Dr. B. John Garrick  
Chairman, ACNW**

## **Risk-Informed, Performance-Based Regulation In Nuclear Waste Management**

- ACNW supports development of common terminology for RIPBR approach
- RIPBR provides a basis for optimizing regulations
- Concepts need to be sufficiently general to encompass not only nuclear waste disposal and reactor applications, but all NRC activities



## **Risk and Risk Assessment**

- Risk measures need to be interpreted in terms of a fundamental set of principles
- ACNW recommends adoption of triplet definition of risk:
  - “What can go wrong?”
  - “How likely is it?”
  - “What are the consequences?”
- Traditional deterministic safety analysis is but a subset of risk analysis

## **Risk Assessment and Defense in Depth**

- “Risk-informed” implies quantification of all elements of defense to make Defense in Depth (DID) transparent
- Connection between DID and overall performance measures, including individual uncertainties, allows implementation of DID concept
- Identification of uncertainties in each defense component is essential

# **Risk-Informed, Performance-Based**

- Risk Informed
  - Committee believes that risk approaches to decision making must consider risk in conjunction with other information
- Performance Based
  - Major differences between materials and reactor licensees occurs in the case of performance-based regulations
  - Current waste regulations are performance-based, e.g., 10 CFR Parts 60 and 61
- Regulatory Burden
  - Probabilistic Risk Assessment (PRA) Policy Statement
  - Careful transition in regulatory decision making is necessary



## **Closing Comments**

- Risk assessment is essential to judge the overall safety of a potential repository
- PA experience base of Yucca Mountain and Waste Isolation Pilot Plant and PRA experience provide a basis for applying RIPBR throughout the Agency
- Need flexible framework for the implementation of RIPBR across the full spectrum of the materials, processes, and facilities regulated by NRC



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

March 26, 1998

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: RISK-INFORMED, PERFORMANCE-BASED REGULATION IN NUCLEAR  
WASTE MANAGEMENT

The Advisory Committee on Nuclear Waste (ACNW) welcomes the opportunity to provide input to the Commission on its draft white paper on risk-informed, performance-based regulation (RIPBR) and to clarify the issues and concepts associated with implementing a risk-informed regulatory process. The ACNW supports the development of a basic document that provides a common terminology for the RIPBR approach and that elucidates how the associated concepts can be applied to both reactor and materials regulation across the agency. Moving to an RIPBR approach will help to develop more efficient and effective regulatory measures that focus directly on public safety and will provide a basis for optimizing the regulations.

The ACNW believes that it is essential to develop a broad understanding of RIPBR throughout the agency. Because of the fundamental technical and regulatory differences among reactor systems, waste management and disposal systems, and nuclear materials management systems, it is important that the concepts articulated in the white paper be sufficiently general to encompass all of these activities and regulations. Many of the concepts in the paper are oriented toward reactor applications. The ACNW believes that the context or framework should be broadened for applying RIPBR to the management of radioactive waste and nuclear materials. The ACNW's recommendations and comments that follow are intended to help provide such a framework.

**Comparisons Between Nuclear Waste Disposal and Reactor Applications**

The primary differences between nuclear power plants and waste disposal facilities are the type of facilities involved and the nature and timing of the events that can lead to a threat to public safety. The events in the nuclear plant risk scenarios are related primarily to short-term equipment and human error problems, while in waste disposal facilities, they are related primarily to long-term physical processes. Waste release events generally take place over hundreds and thousands of years, while times of concern in a nuclear plant may be fractions of a second or a day. Containment in a nuclear waste facility is provided by both natural and generally passive engineered systems, while in a nuclear plant, except for basic structures and atmospheric dispersion, active systems and short-term operator response dominate the mitigation of accidents. Monitoring capability differs greatly between the two. In general,



monitors for reactor performance are on-line with short response times. For waste facilities, there are extreme limitations on monitoring reliability because of the very long times involved and the general difficulty in measuring parameters affecting an eventual threat to public safety. Differences between nuclear plants and waste disposal facilities point to the need for sufficiently fundamental concepts and definitions that embrace the full spectrum of activities regulated by the NRC.

## **Definitions of Terms and Concepts**

### **Risk and Risk Assessment**

The Committee believes that the definition of risk in Section 3, page 2 of the white paper is too narrow. Risk measures need to be interpreted in terms of a fundamental set of principles that serve the broad scope of activities regulated by the NRC. The ACNW recommends adoption of the *triplet definition of risk*<sup>1</sup> because it defines risk at a sufficiently fundamental level to apply to the wide variety of nuclear materials applications that the NRC regulates. This definition may be incorporated in a section added to the white paper before the numbered paragraphs. The triplet definition takes the view that when one asks, "What is the risk?" one is really asking three questions: "What can go wrong?" "How likely is it?" and "What are the consequences?"

The first question, "What can go wrong?" is usually answered in the form of a "scenario" (a combination of events that could occur) or a set of scenarios. Examples in the nuclear materials field include events causing early failure of the engineered barrier system in a waste repository or loss of a sealed source.

The second question, "How likely is it?" can be answered in terms of the available evidence and the processing of that evidence to quantify the uncertainties involved. In some situations, data may exist on the frequency of a particular type of occurrence or failure mode (e.g., actuarial data on losses of sealed sources or accidental overexposures). In other situations, there may be little or no data and a Bayesian approach for analyzing uncertainties will be required.

The third question, "What are the consequences?" assesses, for each scenario, the probable range of outcomes (e.g., radionuclide release rates or dose to the public) given the uncertainties. From this assessment, the important scenarios can be identified. The outcomes or consequences are the "end states" of the analyses. The choice of consequences, that is, the measures of risk, can be whatever seems appropriate for reasonable decisionmaking in a particular regulated activity. The choice could involve combinations of end states or even non-safety consequences, such as technical feasibility, cost, and schedule (i.e., programmatic risk).

### **Traditional and Probabilistic Approaches**

The triplet definition of risk and risk assessment provides a clear framework for distinguishing between what many practitioners and regulators refer to as *deterministic* and *probabilistic*

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<sup>1</sup> Kaplan, S., and B. J. Garrick, "On the Quantitative Definition of Risk," *Risk Analysis*, Vol. 1, No. 1, March 1981.



analyses. The ACNW recommends that Sections 1 and 2 in the white paper be modified to incorporate the concepts discussed below. In particular, traditional deterministic safety analysis addresses only two of the three risk questions in an explicit manner (i.e., "What can go wrong?" and "What are the consequences?"). Such questions have always been the building blocks of so-called deterministic safety analysis, even in arriving at the design-basis accident. Thus, safety analysis is seen to be a subset of risk analysis. It is not a matter of deterministic analysis versus probabilistic analysis, but more a question of expanding the scope of the analyses to include consideration of likelihood in a direct manner. In simple, well-understood systems, likelihood may be easy to establish with reliability. In more complex situations, such as a waste repository analysis, the definition of likelihood becomes the central challenge.

### **Risk Assessment and Defense in Depth**

The white paper discusses *defense in depth* (DID) in footnotes 1 and 4. The ACNW specifically endorses the Advisory Committee on Reactor Safeguards' (ACRS) recommendations<sup>2</sup> to modify footnote 1 and delete footnote 4. As currently drafted, footnote 4 does not recognize the difficulty in assessing the performance of multiple-barrier systems in the waste management licensing arena. The ACNW recommends that the DID concept be discussed in the main body of the paper with respect to the following issues. The white paper should make the point that a "risk-informed" approach implies quantification of all elements of defense. Although the uncertainties of some elements of defense may be substantial, the fact that they have been identified can greatly aid in deciding how much defense makes regulatory sense.

The concept of DID has always been, and should continue to be, a fundamental tenet of regulatory practice in the nuclear field. In a risk-informed era, the opportunity exists to make DID transparent. In particular, the tools of probabilistic risk assessment (PRA) and performance assessment (PA) should be challenged to expose the capability of all elements of defense. Good decisions on the adequacy or the necessity of elements of defense can be made only through identification of the individual performance of each defense system in relation to overall performance. A clear display of the uncertainties associated with each defense system is essential. The connection between elements of defense and overall performance measures, including their individual uncertainties, allows implementation of the DID concept.<sup>3</sup>

### **Risk Based and Risk Informed**

The Committee agrees in principle with the distinction made in Sections 4 and 5 of the white paper between *risk based* and *risk informed*, whereby the former implies that decisions must be

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<sup>2</sup> Letter dated March 11, 1998, from R. L. Seale, Chairman, ACRS, to Shirley Ann Jackson, Chairman, NRC, Subject: ACRS Comments on Draft Paper on Risk-Informed, Performance-Based Regulation.

<sup>3</sup> Letter dated October 31, 1997, from B. John Garrick, Chairman, ACNW, to Shirley Ann Jackson, Chairman, NRC, Subject: Recommendations Regarding the Implementation of the Defense-in-Depth Concept in the Revised 10 CFR Part 60.

based *exclusively* on risk assessment results, while the latter implies that decisions are based on risk in conjunction with other information. The Committee believes that a risk assessment is not a decision analysis, *per se*, and that risk-based approaches to decisionmaking must consider other factors, such as costs, benefits, and socio-political issues, in addition to risk.

The Committee does not agree, however, with the implication in the white paper that factors such as "the basis for current regulations, engineering analysis and judgment, and the defense-in-depth philosophy" are outside the boundaries of risk assessment. These factors affect the uncertainties of the risk measures — uncertainties that should be part of a complete risk assessment. There is nothing about the triplet definition of risk that implies that risk assessment cannot include these factors.

### Performance Based

Section 6 of the white paper titled "Performance-Based" needs to be rewritten to reflect a much broader use of the term in all NRC regulations. The current waste regulations, including 10 CFR Part 60, high-level waste (HLW); 10 CFR Part 61, low-level waste; and the decommissioning rule, contain performance objectives and criteria, which are generally based on calculated dose, as key regulatory requirements. These are *performance-based* approaches. The discussion in Section 6, pages 4-6 of the white paper, does not appear to recognize that dose-based approaches are fundamentally *performance based*.

The ACNW believes that one of the major differences between materials and reactor licensees occurs in the case of performance-based regulations. For example, the first and third attributes of performance-based regulations mentioned in the white paper fail in the case of HLW regulations (10 CFR Part 60). The first attribute indicates that monitoring is essential, but the assessment of performance by monitoring of closed geological repositories is an unresolved issue. The third attribute might be taken to imply that subsystem requirements are a necessary part of the regulations. Such an interpretation runs counter to RIPBR.<sup>4</sup> The white paper does acknowledge these differences in footnote 4, but because possible misinterpretation of the definition of "performance-based regulations" may create an ambiguity in the HLW licensing process, the definitions should be more explicitly stated.

### Regulatory Burden

The white paper, which discusses the issue of regulatory burden in Section 5 on page 4, should be augmented to address the following issue. The Committee is concerned that the spirit of the PRA Policy Statement is compromised if *risk-informed* continues to be interpreted (in the regulatory field) as *in addition to*, rather than as a *substitute for* outdated regulations. The Committee agrees that a careful transition to greater use of risk methods in regulatory decisionmaking is necessary. Although the PRA Policy Statement promises a reduced burden on licensees, the commitment by the NRC to address this issue is weak. What appears to be missing is a clear indication of how and when the regulatory relief implied in the PRA Policy

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<sup>4</sup> See footnote 3

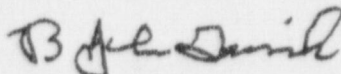


Statement will occur. The ACNW recognizes that the white paper is not the place to establish policy, but there is an opportunity to clarify this issue by addressing "reduction in licensee burden" explicitly in the paper.

### Closing Comments

This letter has discussed RIPBR primarily in relation to geological repositories and nuclear waste isolation. Risk assessment is the essential basis upon which the overall safety of a potential repository will be judged. While very different in detail, PRA of nuclear power plants and PA of geological repositories are similar in terms of system complexity and the application of probabilistic methods to the determination of safety. The PA experience base of Yucca Mountain and the Waste Isolation Pilot Plant, together with the extensive PRA experience with nuclear power plants, provides a varied and extensive risk assessment landscape for considering the applicability of basic definitions and concepts. In simpler situations, the risk may be relatively well defined. Examining the definitions and concepts recommended in this letter against such a wide spectrum of applications gives the Committee high confidence in their applicability to all the nuclear materials regulated by the NRC. However, this conclusion presumes an extremely flexible framework for the implementation of RIPBR across the full spectrum of the materials, processes, and facilities regulated by the NRC. This is the underlying point of our recommendations. We believe such a framework is necessary and feasible. We appreciate the opportunity to offer our views on how to make the subject white paper serve this extremely important purpose.

Sincerely,



B. John Garrick  
Chairman



**Advisory Committee on Nuclear Waste  
Interim Guidance in Support of the Final Rule on  
Radiological Criteria for License Termination**

**Dr. Charles Fairhurst  
ACNW**

## Observations

- Decommissioning will be of continuing regulatory importance
- License termination issue is complex, varying widely from case to case in the need for NRC resources
- Need for regulatory consistency with respect to use of total dose standard, flexibility in regulatory approach, and recognition of the role of Agreement States
- Dual federal agency regulation concerns raised by NEI with ACNW pose a real problem

## **ACNW April 29, 1998 Letter Recommendations**

- Repackage interim guidance in a more comprehensible, user-friendly, menu-driven format
- Reconsider ALARA approach as it may lead to unnecessary conservatism (ACNW believes compliance with 25 mrem meets intended ALARA requirement)
- Provide flexibility in DandD model (e.g., ability to accommodate impact of results of additional studies on LNT hypothesis)



## **ACNW April 29, 1998 Letter Recommendations (Cont.)**

- NMSS should prepare implementing licensee guidance and proceed to test code on a complex site
- Consider using pertinent regional parameters in the DandD code to reduce the possibility of unnecessary conservatism



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

April 29, 1998

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

SUBJECT: COMMENTS AND RECOMMENDATIONS ON INTERIM GUIDANCE IN SUPPORT OF THE  
FINAL RULE ON RADIOLOGICAL CRITERIA FOR LICENSE TERMINATION

Dear Chairman Jackson:

During its 99th meeting on March 23-25, 1998, the ACNW heard and discussed a presentation by the Office of Nuclear Regulatory Research on NRC's final rule and regulatory guidance for demonstrating compliance with the radiological criteria for license termination.

The issue of license termination is complex because of the very broad spectrum of licensees and sites. In many cases, such as sealed-source sites, license termination is simple. In other cases, license termination can be granted only with restrictions and financial guarantees. In a few other cases, license termination may not be granted under any circumstances because of the magnitude or extent of contamination.

In the case of a simple license termination, there is no need to use dose-based models to demonstrate compliance with the final rule. For the more complex sites, it is appropriate to start the process of decommissioning using a dose-based screening model and to progress to a more detailed site-specific analysis as necessary.

In this letter, the ACNW has focused on the more complex sites requiring dose-based models. The much broader task of addressing the whole gamut of types of license terminations, especially those cases involving uranium and thorium, will be addressed in a future letter.



To gain insight on the practical application of the new approach, the Committee supports the decision to introduce the new screening tool and decision methodology and to issue the documents immediately on an interim basis for 2 years. The Committee considers the new approach using the DandD computer code to be consistent with the trend toward introduction of a risk-informed, performance-based (RIPB) philosophy in essentially all NRC licensing.

The new approach allows licensees to use a simple generic approach for low-risk sites or to use increasingly more realistic and site-specific analyses, iteratively as needed, to demonstrate compliance. The licensee can assess the relative cost and benefits of continuing with additional data collection, or remediating specific areas in order to achieve compliance.

Although the ACNW has not investigated all potential sources of conservatism in the new DandD code, we are persuaded that it is not inherently over-conservative as a screening tool. Introduction of regional parameters rather than a single set of national parameters could reduce conservatism. The 2-year trial period recommended above will allow these and similar concerns to be carefully evaluated.

There are several issues concerning the new approach in its current form that can and should be addressed. In particular:

1. The regulatory guidance documentation is formidable and likely to deter even the most motivated of licensees from using and gaining familiarity with it. The Committee urges that the staff repackage the guidance in a more user friendly, menu-driven electronic format that includes guidance to licensees on additional relevant NUREGs.
2. The approach outlined in the guidance for implementing the as low as reasonably achievable (ALARA) requirement may lead to unnecessary conservatism when using the DandD screening model. The Committee believes that if a licensee complies with the 25 mrem dose criterion using the screening methodology, the licensee will have met the intended ALARA requirement. (The dose calculated using site-specific analyses is expected to be lower in most cases).
3. NRC should retain the flexibility to adjust the new DandD model if additional studies invalidate the linear no-threshold dose response hypothesis.

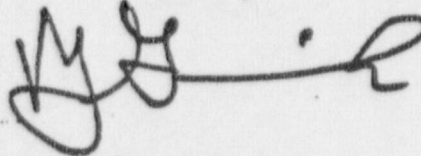


4. Introduction of the new decontamination and decommissioning approach will require significant resources during the 2-year trial period for field testing, training, evaluation, and guidance development. In particular, the ACNW encourages NMSS to follow-through with its plans to test the DandD code on a complex site. A strong commitment and adequate resources are needed if NRC is to move forward with RIPB regulation.

The problem of dual regulation, that is, by the Environmental Protection Agency and by NRC, was raised by representatives of the Nuclear Energy Institute during the meeting. This is a serious issue that needs to be resolved. The ACNW believes that by introducing the RIPB approach to license termination, the new methodology could assist in alleviating the conflicts associated with dual regulations as it should lead to more defensible and consistent regulatory decisions.

The ACNW plans to become more familiar with the DandD code and the license termination process during the next 2 years of testing and will keep the Commission informed of any significant developments.

Sincerely,

A handwritten signature in black ink, appearing to read 'B. John Garrick', with a long horizontal flourish extending to the right.

B. John Garrick  
Chairman

**Advisory Committee on Nuclear Waste  
NRC Waste-Related Research Program**

**Dr. George M. Hornberger  
ACNW**

## **Observations - NMSS**

- Disparity between DOE and NRC research budgets
- NRC must retain unquestioned stature in national and international waste management (WM) communities
- Research and TA programs must be focused, flexible, and respected by the scientific community



## Recommendations - NMSS

- NMSS should focus technical work by using total systems performance assessment (TPA)
- NMSS protocols with CNWRA should allow flexibility in definition of tasks
- Outside (non-CNWRA) experts enhance flexibility and acceptance
- Concurrent with continuing development of PA models and IRSRs, NRC staff needs additional capabilities to assess engineered systems (e.g., engineering analysis, materials science & chemistry)

## **Observation - NMSS**

- At the time of licensing it is imperative that NRC's Yucca Mountain evaluations not be viewed as overly conservative or simplistic
  - Senior recognized experts should be involved
  - CNWRA budget allows for use of outside experts

## **Recommendations - NMSS**

- NRC must engage prominent waste engineers and scientists in the resolution of WM problems
- CNWRA funding should ensure that this is achieved

## **Observations - RES**

- Research must be responsive to user needs, e.g., timely and authoritative
  - Unclear whether the current research structure complies

## **Recommendation - RES**

- Need for structured organization for identifying and prioritizing research that:
  - relies on peer review for priorities & evaluating results
  - focuses on coordination between researchers & users





UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

October 8, 1997

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: Comments on Performance Assessment Capability in the  
NRC High-Level Radioactive Waste Program

The purpose of this letter is to advise the Commission about the NRC staff's performance assessment (PA) capability in the High-Level Radioactive Waste (HLW) Program. Performance assessment is an important tool in NRC's precicensing activities, including the following: understanding the importance of specific site characteristics and the design of engineered features to the performance of an HLW repository at Yucca Mountain, prioritizing key technical issues (KTIs) and staff activities, developing revised standards and regulations for licensing, and preparing for review of the Department of Energy's (DOE's) viability assessment (VA) of the proposed repository. The evaluation of staff HLW PA capability continues to be a priority issue of the Advisory Committee on Nuclear Waste (ACNW).

The observations and comments in this letter have been developed, in part, on the basis of the 93rd ACNW Meeting at the Center for Nuclear Waste Regulatory Analyses (hereafter the Center) in San Antonio, Texas, on July 23-24, 1997. The ACNW previously reviewed and commented on staff HLW PA capability in letters dated December 2, 1991, and May 27, 1994.

#### Recommendations

The Committee makes the following recommendations:

- Selected capabilities should be added to the program to provide further assurance that the staff has the ability to assess the containment capacity of the engineered systems. Support for KTIs relating to the near-field performance of the repository should be restored. Among the disciplines for which the ACNW believes added capability is necessary are engineering analysis, materials science, and chemistry. The crosscutting discipline of corrosion science and engineering is also an essential part of the mix.
- The PA models should be structured to represent repository performance as realistically as possible and thereby provide the necessary information for regulators to make decisions in the context of the full state of knowledge about the performance measures of the repository. Improved coordination and communication between the NRC staff and the Center will be essential.

- Greater emphasis should be given to collecting, organizing, and documenting the supporting evidence for the performance assessments to enhance acceptance of the results. An important element of this is improvement in communicating the abstraction of process models into probabilistic models. Of particular interest to the Committee is visibility of the treatment of such phenomena as chemical and geological processes leading to the mobilization of radionuclides in the near field.
- A working version of the NRC's Total Performance Assessment code, version 3.1 (TPA-3) should be implemented as soon as practicable.
- A program for verifying TPA-3 should be developed. TPA-3 should be benchmarked against other codes for Yucca Mountain. The Committee also encourages exposure of the methods of TPA-3 and associated background information to the scientific community through extensive and timely peer review.

### Accomplishments

The Committee commends the staff for its many impressive accomplishments in upgrading and preserving a dedicated HLW PA team in the face of budget cuts and programmatic uncertainties. The organization of the HLW Program around a specific set of KTIs and the grouping of expertise and disciplines within the KTIs provides an important means of focusing the staff's efforts on issues most important to performance of the repository. Performance assessment is important in the staff's efforts to provide integration across disciplines in the KTIs and to set priorities for activities. The Committee was pleased to see the clear integration of PA with other Yucca Mountain activities. This effort has led to the development of sound, near-term plans for precicensing activities, including resolving outstanding issues and preparing for review of DOE's total system performance assessment supporting the viability assessment (TSPA-VA). The revised and updated TPA-3 code increases the staff's capability in performance assessment modeling. The code should facilitate the KTI investigations with its ability to evaluate the importance of specific site characteristics and the effectiveness of engineered barriers. The ability to conduct sensitivity and uncertainty analyses for subsystems and for the total system is improved. The development of the code is a solid effort and we encourage the staff to pursue aggressively the implementation of TPA-3. Many of these staff activities conform to recommendations contained in the ACNW letter of May 27, 1994, on PA capability.

### Engineered Barrier System

The ACNW is concerned about the staff's capability to evaluate quantitatively the engineered barrier system of the proposed Yucca Mountain repository. This concern is punctuated by lessons learned from PA, including the apparently increasing dependence on engineered barriers to demonstrate compliance with a dose- or health-based standard for the repository. With increasing evidence that engineered systems must be an important part of the waste isolation strategy for Yucca Mountain, it is important that these systems receive extensive scientific and engineering scrutiny.

We are concerned about the decision to reduce the effort at the Center on certain KTIs, most



notably those dealing with engineered barriers and radionuclide transport. The shifting emphasis of the DOE to the performance of engineered systems accents the need for the Commission to provide resources to restart work on the KTIs most important to an independent assessment of the performance of engineered systems and near-field radionuclide transport. A concern is that without restarting the work of the NRC staff and the Center, the performance assessment effort, including the TPA-3 code, will not have the scope to assess adequately the DOE work. The Committee urges the Commission to act on this issue as soon as practicable.

Beyond the issue of the scope of the engineered systems assessment capability of the NRC staff, the ACNW believes that added capability is necessary to analyze adequately the engineering design of long-lived, passive high-integrity systems. In particular, additional staff effort is required in engineering analysis, materials science, and chemistry (especially corrosion and colloid chemistry) to have the full capability to assess the engineered systems.

### **Realistic Performance Assessment Models**

The ACNW has three primary points to make regarding the staff's performance assessment modeling activities: (1) the PAs should have a risk-informed perspective; (2) the PAs should be transparent about the supporting evidence (data and information); and (3) the relationship between process model and probabilistic calculations needs to be made clear.

Risk-informed performance assessment provides the opportunity to assess *realistically* the performance of an HLW repository. Our concern is that the TPA-3 activity is relying too much on bounding and worst-case calculations. Although bounding calculations are a very useful part of any technical investigation in providing insights on what is important to the performance measures of a model, such calculations are often of little value in representing what is likely to happen. In the opinion of the ACNW a much preferred approach is to limit bounding and worst-case calculations to the task of scoping the investigation and deciding what may or may not be important to model. Decision making requires more information. The decision-maker needs to know the total range of uncertainty of the performance measures. The primary tool for communicating uncertainty, rather than just an upper bound, for example, is to embed the performance measures in probability distributions so that the full range of values and all their supporting evidence are visible. For example, if the value preferred by the regulator is the 90th percentile value, then it is explicitly clear just how conservative the regulator has chosen to be.

The Committee stresses the importance that the evidence (i.e., data and all other information) that is the basis of the PA model be clearly visible, particularly regarding the abstraction from physical process models to probabilistic calculations. We are especially concerned with the abstraction of information about the engineered systems, especially under the circumstances of not having a fixed design. In addition, supporting evidence for modeling important phenomena such as the chemistry of redox reactions is weak. Our current impression is that more attention is being given to methods than to the required information to support those methods.

### **Analysis Capability**

The ACNW was impressed with the progress in the development of NRC's TPA-3 code. We are anxious to follow the development of TPA-3 and look forward to more discussions with the staff.



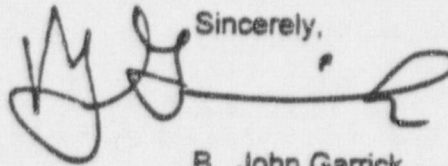
The ACNW urges the staff to implement a working code in an expeditious manner so that the code is fully functional as the TSPA-VA analyses are made available to NRC.

The Commission has indicated an interest in moving toward a risk-informed, performance-based philosophy of regulation. Of concern to us is whether the TPA-3 effort is keeping pace with the development of methods and ideas on how to implement such a philosophy.

An issue with TPA-3 is how to verify the code. The problem as stated by the staff is that because the code is designed specifically for the Yucca Mountain site, international bench marking is almost impossible. It is true that parts of the code, such as NEFTRAN (NEtwork Elow and TRANsport), have been benchmarked. The NRC staff must see that TPA-3 is benchmarked against applications of other codes to Yucca Mountain. The ACNW also believes that the NRC staff should pursue other avenues of peer criticism of its codes, such as publication in refereed engineering and scientific journals.

Although the ACNW believes that it is important to develop a PC compatible version of the code to reach more users, we would not like to see other important activities compromised to reach this goal. A PC compatible version should not be created at the risk of oversimplification. Meanwhile, to conduct a full range of analyses in reviewing DOE's TSPA-VA, the staff requires the NMSS Advanced Computer System or a suitable alternative.

We believe that these comments provide constructive guidance on the future direction of the performance assessment effort and look forward to following NRC staff progress in this important activity.

 Sincerely,  
B. John Garrick  
Chairman

**Advisory Committee on Nuclear Waste  
Near-Field Environment and the Performance  
of Engineered Barriers**

**Dr. Raymond G. Wymer  
ACNW**

## Introduction

- Topic is important to DOE's Repository Safety Strategy, which relies heavily on EBS performance
- NRC's review of the license application will need to address adequacy of DOE data and models for EBS performance
- Working Group presentations by invited experts, NRC/CNWRA, and DOE on near-field environment chemistry, materials corrosion, release and transport of radionuclides, and modeling of these areas
- Provided a forum for raising significant technical issues and identifying information and modeling needs that may be important for licensing



## Insights Gained from Working Group

- Placement in the unsaturated zone makes Yucca Mountain unique compared to other repository designs
- EBS design is continually evolving even as the DOE works to complete its Viability Assessment
- Concept of a “robust” repository design
- Need for a “top down” systems engineering approach for selecting EBS options
- Need for more attention on preclosure issues, e.g.,
  - QA/QC for Waste Package fabrication and welds
  - Preclosure aspects of repository development

## **Insights Gained from Working Group (Cont.)**

- **Near-Field Environment Issues**
  - Parameters and factors affecting the amount of water that comes into contact with waste most important to performance in current models
  - Abstraction of near-field process level models into PA models
  - Near-Field Chemistry

## Insights Gained from Working Group (Cont.)

- Corrosion Issues
  - Both NRC/CNWRA and DOE have good capability and detailed understanding of corrosion issues
  - DOE selection of C-22 alloy as corrosion resistant material (CRM) imposes specific data needs and modeling requirements
    - Information base for C-22 limited
    - Claimed longevity based on passive corrosion in Yucca Mountain environment
    - Conditions leading to localized corrosion a concern
    - Temperature regime establishes period of vulnerability ( $\Delta T_{\text{vuln}}$ )



## **Insights Gained from Working Group (Cont.)**

- Corrosion Issues (Cont.)
  - Impact of corrosion products on waste package integrity
  - Weld integrity and impacts on long-term performance
  - Use of specific backfills can have significant impacts on performance of different materials
  - Some experts question defensibility of cladding credit

## Insights Gained from Working Group (Cont.)

- Release and Transport Issues
  - Reaction products of spent fuel oxidation may take up specific radionuclides -- the release rate (i.e., the source term) would then be governed by the slower dissolution of this secondary phase
  - Need for research in a few key areas to support licensing review capability
    - Secondary phases
    - Colloids
- Need for rank ordering of most important EBS components for performance (i.e., dose to critical group)



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

March 6, 1998

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Dear Chairman Jackson:

SUBJECT: ACNW'S SUPPORT FOR THE NRC STAFF'S APPROACH TO ASSESSING THE  
PERFORMANCE OF MULTIPLE BARRIERS

During its 98th meeting on February 24-26, 1998, the Advisory Committee on Nuclear Waste (ACNW) heard a briefing on, and discussed with the NRC staff, SECY-97-300, "Proposed Strategy for Development of Regulations Governing Disposal of High-Level Radioactive Wastes in a Proposed Repository at Yucca Mountain, Nevada." In our previous letter of October 31, 1997, "Recommendations Regarding the Implementation of the Defense-in-Depth Concept in the Revised 10 CFR Part 60," the Committee recommended, among other matters, abolishing subsystem requirements in the planned revision to 10 CFR Part 60 and instead requiring quantification of the performance of individual barriers. The purpose of this letter is to reiterate this position and to express our support for the direction the NRC staff is taking in its proposed strategy on the subject of subsystem requirements.

The basis for our recommendation was that improved information and methods of analysis, together with a determination of the risk of an appropriately defined critical group, allowed for a more direct and reliable assessment of Yucca Mountain performance than would be derived from prescribing the performance of repository subsystems. Important to our position on this approach is the requirement that, in addition to calculating the risk to the critical group, there should be the requirement that individual barriers be assessed quantitatively for their contribution. The key difference between the two approaches is quantifying subsystems to reveal their contribution to overall performance versus prescribing the performance of subsystems regardless of their contribution to overall performance. The Committee believes that the former approach provides assurance on just how effective



individual systems are in achieving an overall performance requirement while preserving the need for flexibility to achieve an optimum or a near-optimum design. Finally, the approach is believed to be an excellent example of a *risk-informed* analysis.

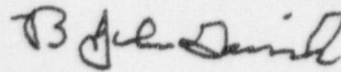
The staff indicated that it plans to require a system of multiple barriers without specifying quantitative requirements for individual barrier performance. Further, the staff plans to require DOE to demonstrate the contribution of individual barriers and their respective uncertainties to total systems performance by providing results of intermediate calculations within the performance assessment. The staff believes that this transparency in analyses will provide insights about the key contributors to system-level performance needed to support licensing decisions. Finally, the staff indicated that possible approaches to demonstrate individual barrier contributions and uncertainties may include the use of sensitivity analyses, scatter plots, and importance analyses.

Factors increasing confidence in a risk-informed approach to assessing subsystems, as well as total system performance measures, include: (1) over 20 years of experience in the application of probabilistic risk assessment to nuclear reactors and other systems; (2) some 15 years of experience in conducting performance assessments, especially in regard to the proposed Waste Isolation Pilot Plant and Yucca Mountain repositories; and (3) the growing amount of site-specific information obtained through the site characterization process. A key feature of the improvements in analysis is in the area of quantifying uncertainties of key parameters and models. Exposing the uncertainties associated with performance, especially the performance of subsystems, adds new meaning to the concept of multiple barriers. In one sense, knowing the uncertainties is a step toward quantifying the multiple barrier approach and providing insight on just how much safety margin actually exists.

The ACNW commends the staff for proposing to require quantification of multiple barrier performance in favor of quantitative subsystem requirements and considers the approach to exemplify a true risk-informed analysis. To implement such an approach, the ACNW articulated two primary needs in a letter dated October 31, 1997, "Application of Probabilistic Risk Assessment Methods to Performance Assessment in the NRC High-Level Waste Program." One is that performance assessments should, to the extent practicable, be developed using realistic models with uncertainties included. The Committee has also recommended that a methodology be developed, using an event tree or similar type of approach, that presents performance assessment modeling results in a way that clearly indicates the rank-ordered contributors to total system

performance (e.g., dose) and to evaluate the performance of different subsystem components. The ACNW continues to encourage the staff to explore use of a post-processing methodology that enables rank-ordering of contributors to total system performance in demonstrating individual barrier performance.

Sincerely,

A handwritten signature in dark ink, appearing to read "B. John Garrick". The signature is fluid and cursive, with the first letter of each word being capitalized and prominent.

B. John Garrick  
Chairman

**Advisory Committee on Nuclear Waste  
Plans, Priorities and Accomplishments  
for FY98 and FY99**

**Dr. B. John Garrick  
Chairman, ACNW**



## Introduction

- ACNW initiated development of strategic plan and identified priorities for FY98 to improve efficiency and effectiveness, consistent with NRC's strategic plan
- Strategic plan is built on need to remain flexible to proactively advise the Commission on emerging regulatory issues
- ACNW is carefully monitoring its progress and resources through its operating plan
- Completed self-assessment and survey on efficacy of ACNW

## Status

- Received Commission comments on FY98 strategic plan and will incorporate comments during ACNW's next planning cycle
- Received Commission requests for new work in LLW, risk, and D&D, but need to select work carefully due to resource constraints
- Requested additional resources for FY99 to respond to specific Commission's requests
- Issued letters on all first-tier priority topics

# Accomplishments

- Initiated risk-informed reviews on DID/multiple barriers, use of PRA in waste, & on effects of LL ionizing radiation
- Provided timely advice, e.g., on multiple barriers to influence development of 10 CFR Part 63, on RIPBR White Paper and D&D Guidance for final rule per Commission request
- Alerted NRC of heightened role of the EBS in HLW disposal and of possible need for increased capability to evaluate EBS
- Conducted working group to focus NRC on key contributors and uncertainties affecting EBS performance
- Increased Committee attention on international activities



## **Future Activities and Products**

- Issue major letter report on EBS
- Issue reports on recent briefings, including Post-Disposal Criticality, 10 CFR Part 63, Total Systems Sensitivity Analyses, Importance Measures, D&D SRP and Viability Assessment (VA)
- Participate in international technical meetings
- Hold stakeholders meeting in Yucca Mountain vicinity to enhance public participation
- Conduct self assessment report and establish FY99 priorities

## Wrap up

- Expect most of first-tier priorities to remain in FY99; possible shift in focus from VA to LA, including staff's development of SRP for HLW repository, and shift in focus from EBS near field to repository design
- ACNW continues to strive to identify issues that could become important in future decisions and offering advice on these issues
- ACNW agrees with the Commission on the importance of planning to improve efficiency and has demonstrated progress in FY98 in supporting the Commission's priorities



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

December 23, 1997

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: 1998 STRATEGIC PLAN AND PRIORITY ISSUES FOR THE ADVISORY  
COMMITTEE ON NUCLEAR WASTE

The Advisory Committee on Nuclear Waste (ACNW) has developed a Strategic Plan that includes priority issues it will consider in 1998. A copy of the plan is attached for your consideration. The ACNW's Strategic Plan is anchored to the NRC's Strategic Plan, and supports the NRC mission, vision, and select goals, strategies and substrategies relevant to NRC's responsibilities for management and oversight of commercial nuclear waste and materials. The ACNW's Strategic Plan also interfaces with the ACNW Operating Plan, which is being updated to reflect the priority issues identified herein.

One purpose of the ACNW Strategic Plan is to guide the Committee in carrying out its mission over the next year. A highlight of the plan is identification of the Committee's near-term priority issues for this year, and longer-term issues for times beyond one year. The ACNW does not plan to focus to any great extent on most of the longer-term issues this year due to resource constraints and timeliness of these issues, unless directed to do so by the Commission. In addition to priority technical issues, activities related to ACNW operational processes that we plan to initiate this year to improve our efficiency and effectiveness are identified.

We would appreciate any comments or suggestions from the Commission.

Sincerely,

B. John Garrick  
Chairman

Attachment: As stated



## ACNW 1998 STRATEGIC PLAN AND PRIORITY ISSUES AND ACTIVITIES

This plan provides strategic direction to the ACNW in 1998 and beyond for focusing on issues most important to the NRC in carrying out its mission of protecting public health and safety, promoting the common defense and security, and protecting the environment. It also communicates ACNW's mission, vision, goals, and priority activities and shows how these goals support the NRC's Strategic Plan.

### SCOPE OF ACNW ACTIVITIES

The ACNW provides advice on issues concerning the storage and disposal of high- and low-level radioactive waste (HLW and LLW, respectively), including the interim storage of spent nuclear fuel, materials safety and decommissioning, and other issues as requested by the Commission.

### ACNW MISSION

The ACNW's mission is to provide independent and timely technical advice on nuclear waste management issues to support the NRC in its conduct of an efficient regulatory program that enables the Nation to use nuclear materials in a safe manner for civilian purposes.

### ACNW VISION, DESIRED OUTCOMES, AND COMMITMENTS

#### Vision

The ACNW strives to provide advice and recommend solutions that are forward-looking, are based upon best-available science and technology, can be implemented, and reflect the need to balance risk, benefit, and cost to society to enable the safe use of nuclear materials.

#### Desired Outcomes

The ACNW strives to:

1. provide technically sound and timely advice that can be incorporated into NRC technical approaches, documents, and regulations;
2. provide advice that reflects state-of-the-art science and technology that can be readily incorporated into NRC regulatory practices;

3. communicate its message clearly and concisely to its intended audience;
4. be respected by the Commission, NRC staff, EPA, DOE, and the public and be perceived as adding value;
5. be trusted by the public to provide frank, open advice, and offer a forum for public participation in the regulatory process, thereby making the regulatory decisionmaking process more transparent to the public;
6. assist in resolving conflicts between NRC and DOE, EPA, and other stakeholders by providing a forum for interaction, and by continually encouraging communication between and among these entities; and
7. operate in a spirit of openness as intended by the Federal Advisory Committee Act (FACA) and the Government in the Sunshine Act.

#### Commitments

The Committee makes the following commitments in pursuit of its vision:

1. be responsive to the Commission's needs;
2. remain flexible, be responsive to change, and consider various options and contingencies;
3. foster an atmosphere of mutual problem-solving with the NRC staff;
4. challenge the status quo, as appropriate, thereby becoming an "engine for change";
5. identify in advance those issues that could have an impact on NRC's ability to achieve its mission;
6. focus on risk, by asking, "what is the risk, what are the contributors to risk, and what are the uncertainties?";
7. keep abreast of international trends and developments that could influence NRC policies or approaches;
8. maintain technical excellence and independence;
9. operate in a cost-effective and efficient manner; and

10. measure the Committee's effectiveness.

## GOALS AND OBJECTIVES

The ACNW has developed general goals and objectives consistent with its mission and vision. The five goals listed below serve to provide strategic direction for the ACNW this year and support select goals, strategies, and substrategies identified in NRC's Strategic Plan. For each goal, objectives that help us to focus on our priority issues are identified.

**Goal 1:** Assist the NRC in positioning itself to respond to external change and uncertainty in the management of nuclear waste. This goal supports the NRC mission, vision, and select strategies or substrategies under NRC Goals 2 through 7.

*Objective 1: Advise the Commission in a timely fashion on issues of a technical nature that may require changes in the regulations.*

*Objective 2: Inform the Commission about issues that could cause problems for the NRC or society if not given adequate attention, and recommend solutions.*

**Goal 2:** Strive to ensure that NRC is employing the best science in resolving key safety issues. This goal supports the NRC mission, vision, and select strategies or substrategies under NRC Goals 2 through 7.

*Objective 1: Keep abreast of cutting-edge methods and technologies being developed and utilized world-wide that are applicable for assessing and managing risks associated with cleanup, disposal, and storage of nuclear waste.*

*Objective 2: Advise the Commission on projected or perceived technical shortcomings in NRC staff capabilities that could adversely impact the agency's ability to address safety issues.*



Goal 3: Advise the NRC on how to increase its reliance on risk as a basis for decisionmaking, including using risk-assessment methods for waste management, that (1) implement a risk-informed approach, (2) are consistent across programs where possible, and (3) quantify and reveal uncertainties. This goal supports the NRC mission, vision, and select strategies and substrategies under NRC Goals 2 through 7.

Objective 1: *Propose approaches and encourage the staff to gain a better understanding of the inherent risks of licensed activities in nuclear waste and materials, and the relationship between regulations, cost, and safety.*

Objective 2: *Examine risk-assessment approaches being utilized within the NRC's waste and materials programs and recommend improvements for making more transparent the underlying assumptions and associated uncertainties, incorporating greater realism where appropriate, and identifying apparent inconsistencies in approach.*

Goal 4: Support the NRC in improving public involvement in its waste programs and gaining increased public confidence and respect. This goal supports the NRC mission, vision, and select strategies or substrategies under NRC Goal 6.

Objective 1: *Provide opportunities through the FACA process for more public involvement in the regulatory process.*

Objective 2: *Recommend ways for the NRC to gain more meaningful public involvement in the regulatory process.*

Objective 3: *Assist the NRC in making more transparent the agency's decisionmaking process and ensuring agency documentation is thorough, clear, and readily understandable.*

Goal 5: Improve the effectiveness and efficiency of ACNW operations. This goal supports the NRC mission, vision, and select strategies or substrategies under NRC Goal 7.

Objective 1: *Increase the value of ACNW advice to the Commission and staff.*

Objective 2: *Improve and modify existing operational procedures to accomplish "more with less."*

## PRIORITY ISSUES AND PROCESS IMPROVEMENTS

In support of its first four goals, the ACNW has identified priority issues for this year, and longer-term issues it plans to address in the future, given sufficient resources. Also identified are the criteria the Committee uses to select its priority issues. In support of its fifth goal, the ACNW has identified priority process-related activities it plans to carry out this year to improve its effectiveness.

The priority issues identified for 1998 are considered first-tier priorities, and the longer-term issues are considered second-tier ACNW priorities. The Committee does not plan to focus to any great extent on second-tier issues this year, unless directed by the Commission, or dictated by external events, such as changes in nuclear waste legislation. Each priority issue supports one or more of ACNW's goals, as indicated.

For each first-tier priority issue, the Committee plans to prepare a task action plan that identifies the nature and scope of the issue and a strategy for addressing it, including planned product[s] and schedule, and performance measures and targets that will enable the Committee to determine if it has achieved its goals.

## CRITERIA FOR SELECTING PRIORITY ISSUES

- the protection of the public health, workers, and the environment from adverse effects of the management of nuclear waste, especially in regard to disposal facilities, i.e., the risk significance of an issue;
- issues that arise from strategies and activities of licensees and applicants;
- timeliness based on when an issue is scheduled to come before the Commission, and when the advice would be of greatest benefit to influence the Commission's regulatory decisions;
- the relationship of an issue to the NRC's Strategic Plan, including trends and directions in regulatory practice, such as the adoption of a risk-informed, performance-based method of regulation and decisionmaking;
- the potential for or likelihood of an issue to pose undue risk or costs to society;



- issues that are requested for ACNW review by the Commission or Commissioners; and
- issues that arise based on the scientific and technical basis of information supporting the safety and performance assessments of nuclear waste disposal facilities, including the quality and level of expertise involved.

### FIRST-TIER PRIORITY ISSUES

Viability Assessment and Site Characterization - The DOE is scheduled to complete its Viability Assessment (VA) by September 1998. The NRC staff anticipates receiving draft VA products before then, and submitting a Commission paper on its review of the VA in November 1998. In addition, the staff is developing Issue Resolution Status Reports (IRSRs) that document the status of and acceptance criteria for each Key Technical Issue (KTI) to support its review of the VA and License Application (LA), as well as a VA Review Plan. The staff's review of the VA will be a preliminary review of the eventual LA, and is expected to provide valuable insights. The ACNW plans to review DOE's conclusions and the NRC staff's review of the VA, as well as monitor the IRSRs. The ACNW also anticipates tracking the evolution of DOE's site characterization program and the DOE's waste isolation and containment strategy. This issue supports ACNW Goals 2 and 3.

Risk-Informed Performance-Based Regulation - The ACNW will continue to support the agency's effort to move from deterministic regulations toward risk-informed and performance-based regulation. The Committee anticipates continuing to encourage the NRC to adopt regulatory approaches that are comprehensible and enhance public understanding of the key safety issues, and continuing to encourage the NRC to use risk as a basis for setting priorities. Issues to be addressed under this topic include the following: HLW regulatory framework issues, including NRC staff's strategy to revise 10 CFR Part 60; NRC's comments on the proposed EPA HLW standard (40 CFR 197); NRC's review of DOE's proposed Siting Guidelines in 10 CFR Part 960; performance assessment, including continued monitoring of NRC's iterative performance assessments using the TPA code; problems associated with dual regulatory authority between EPA and NRC; and the evolving issues related to the use of expert judgment. This issue supports ACNW Goals 1 through 4.

Engineered Barrier System (EBS) - The ACNW will focus on the role of the EBS in the proposed repository, various components of the EBS and their



significance to performance, and the NRC's capability to evaluate EBS performance. A major focus will be on processes affecting waste package degradation and radionuclide release, including redox reactions, corrosion, radiolysis, microbiological effects, and reactions with introduced materials (e.g., concrete, iron). Also included will be the models and methods used to predict long-term degradation of waste packages over time, and the appropriate use of bounding models. This effort will likely include examining the use of coupled models to predict the near-field environment and its impact on containment, release, and transport of radionuclides. **This issue supports ACNW Goals 1 through 3.**

Decommissioning - The ACNW has a strong interest in waste disposal issues related to decommissioning. In the past, the ACNW has advised the Commission on streamlining the Site Decommissioning Management Program (SDMP), aspects of the Proposed and Final Rule on Radiological Criteria for License Termination, and lessons learned from decommissioning the Pathfinder site. The ACNW expects to review supporting guidance documents due in early 1998 for implementing the Final Decommissioning Rule, dose models and parameter selection criteria for decommissioning assessments, application of the LLW Performance Assessment Methodology to SDMP sites, and development of a multi-agency-sponsored decision support system to support decommissioning. Also of interest is the issue of incidental wastes at DOE facilities. Other activities may include tracking staff efforts to assess inherent risks of decommissioning and activities to simplify the decommissioning process, and assisting the Commission in contingency planning for a possible rapid increase in plant decommissioning due to deregulation. **This issue supports ACNW Goals 1 through 3.**

Research - The ACNW will examine waste-related research and technical assistance programs in the NRC. It will provide input to an ACRS report to Congress by February 1998, and a report to the Commission by June 1998. The ACNW will continue to monitor the NRC's research program to ensure that it is changing in response to the agency's shifting emphasis to risk-informed, performance-based regulation. This effort will include assuring that research is focused on helping to assess the relationship between regulations and safety, and understanding the inherent risks of licensed activities. **This issue supports ACNW Goals 1 through 4.**

As part of the priority technical issues described above, the Committee may focus on several initiatives throughout this year and beyond that would apply to some or all of these issues, such as international activities and seeking ways to improve public participation in NRC waste programs. International activities may include participating in technical exchanges with other

nations' regulatory waste programs or advisory panels. With respect to improved public participation, the Committee may explore ways to encourage the public to participate in ACNW meetings. If resources and time permit, the ACNW may also review lessons learned from other countries, other waste programs in the U.S., and directly from the public on ways to involve the public more meaningfully in NRC regulatory programs. An example may be to encourage the public to participate formally in the performance assessment process. These issues support ACNW Goals 2 through 4.

## SECOND-TIER PRIORITIES

Repository Design/Thermal/Coupled Processes - The ACNW will continue to focus its attention on the HLW repository design, including thermal testing and results, and the significance of coupled effects on the performance of the proposed repository. The ACNW will evaluate the adequacy of models to predict repository behavior. For example, retrievability would be considered under this topic. In addition, the issue of performance confirmation, including the type and quantity of data to be collected during this phase, will be explored. This issue supports ACNW Goals 1 through 3.

Interim Storage Facilities for Spent Fuel - The ACNW will begin to identify issues that the NRC may need to consider and prepare for in the event that proposed legislation is enacted to create a central, interim HLW storage facility. This issue supports ACNW Goals 1 through 3.

DOE Oversight - The ACNW will review waste-related activities associated with NRC's possible regulation of certain DOE facilities, if NRC assumes responsibility for those activities as a result of privatization or enactment of new legislation. This issue supports ACNW Goals 2 through 4.

LLW and Agreement States Program - The ACNW will examine the role of the NRC in LLW disposal from the perspective that current trends in the national program may ultimately interfere with society's benefiting from the use of nuclear material. The ACNW will advise the NRC on alternatives to the current national LLW disposal program. The ACNW also may examine interactions between NRC and Agreement and non-Agreement States, and whether communications can be improved. This issue supports ACNW Goals 1 and 4.

Radiation Risk Levels for Low-Level Ionizing Radiation - The ACNW will continue to examine the issue of radiation risk levels for low-level ionizing radiation. The ACNW may consider the question of what research, if any, the NRC should sponsor regarding the linear no-threshold (LNT) hypothesis, and the



appropriate regulatory approach, given the uncertainty about the LNT hypothesis. This issue supports ACNW Goals 1 through 4.

Control and Accountability of Radioactive Devices - The ACNW will examine the NRC's role in this issue, and whether, from a risk perspective, the NRC should initiate a rulemaking or take on a more aggressive role. This issue supports ACNW Goals 1 and 3.

#### PRIORITY OPERATIONAL ACTIVITIES

Operational processes or activities that the ACNW plans to implement this year in support of ACNW Goal 5, "Enhance the effectiveness and efficiency of ACNW operations," is discussed below.

Strategic Planning - On an annual basis, the ACNW will conduct a top-down planning meeting to identify primary goals and priority issues and activities, followed by a self-assessment to measure performance against these goals. The ACNW will establish performance goals and indicators to measure effectiveness, and will use such tools as customer surveys to solicit feedback from the public on the Committee's effectiveness.

Implement Changes in Operational Procedures - To improve its efficiency and effectiveness, the ACNW will improve its current processes for the following activities: letter writing, scope and duration of meetings, interactions with Commissioners and the program offices, use of ACNW staff and consultants. Improvements may include:

- ensure letters are concise and consistent;
- allow more time for strategic planning and agenda planning during meetings;
- seek more opportunities to collaborate with ACRS to explore issues of common interest;
- spend more time meeting individually with Commissioners;
- increase the number of interactions with Program Office Directors;
- use consultants to expand expertise;
- encourage ACNW staff to initiate special projects and make presentations to the Committee;



- foster an atmosphere of mutual problem solving with the staff;
- consider options for gaining earlier access to predecisional material to assist the Committee in providing more timely advice; and
- better define and limit the number of priority topics.

#### UPDATING THIS PLAN

The ACNW will conduct a strategic planning meeting at least once a year, and will update this plan as needed. Revisions to the plan may be based on input from the Commission, changes made to the NRC Strategic Plan or Annual Performance Plan, results from customer surveys and self-assessments, external events and factors, and available resources.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555

March 26, 1998

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: COMMISSION COMMENTS ON THE ACNW STRATEGIC PLAN AND PRIORITY ISSUES

This letter responds to your letter of March 16, 1998, in which you provided the comments of the Commission on the Strategic Plan and Priority Issues of the Advisory Committee on Nuclear Waste (ACNW). We appreciate the Commission's review and comments. The Commission's view on our planned activities is very important because our primary mission is to provide the Commission with timely and useful advice.

We will modify our Strategic Plan to reflect all objectives, the scope, and duties outlined in the ACNW Charter, as noted in your letter. The Committee will review our Charter in the near future, as required by statute, to assess the need to revise it consistent with the Commission's current views on ACNW activities. Our Operating Plan is consistent with the comments provided in your letter. Your comments on the use of the Strategic Plan terminology are useful, and we will, in the future, revise the terminology so as not to be confused with agency requirements under the Government Performance and Results Act.

The ACNW will attempt to accommodate as many of the suggested review areas (i.e., Trojan waste classification, issues surrounding Envirocare and generic criticality issues at low-level waste (LLW) sites, and setting appropriate standards for clearance levels of materials) as practical in our future activities. The Committee is very much interested in being responsive to the Commission's needs and direction; however, we are limited in the number of review activities we can undertake and will have to communicate with you further on the actual resources needed to be fully responsive to your comments on LLW and other issues. We appreciate your thoughtful and useful comments on our Strategic Plan and Priority Issues.

Sincerely,

B. John Garrick  
Chairman