

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

**Title:            BRIEFING ON NRC USE OF EXPERT  
                     ELICITATION IN HLW PERFORMANCE  
                     ASSESSMENTS - PUBLIC MEETING**

**Location:        Rockville, Maryland**

**Date:            Wednesday, June 21, 1995**

**Pages:           1 - 38**

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2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON NRC USE OF EXPERT ELICITATION IN  
5 HLW PERFORMANCE ASSESSMENTS - PUBLIC MEETING

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7  
8 Nuclear Regulatory Commission  
9 Commissioner's Conference Room  
10 11155 Rockville Pike  
11 Rockville, Maryland  
12

13 Wednesday, June 21, 1995

14 The Commission met in open session, pursuant to  
15 notice, at 10:35 a.m., Ivan Selin, Chairman, presiding.  
16

17 COMMISSIONERS PRESENT:

18 IVAN SELIN, Chairman of the Commission  
19 KENNETH C. ROGERS, Commissioner  
20 E. GAIL de PLANQUE, Commissioner  
21 SHIRLEY JACKSON, Commissioner  
22  
23  
24  
25

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2

3 JOHN C. HOYLE, Secretary

4 KAREN D. CYR, General Counsel

5 HUGH L. THOMPSON, JR., Deputy Executive Director,

6 Nuclear Material Safety and Safeguards

7 DR. MALCOLM KNAPP, Deputy Director, Office of

8 Nuclear Material Safety and Safeguards

9 DR. JANET KOTRA, Performance Assessment & Hydrology Branch,

10 Nuclear Materials Safety and Safeguards

11 NORMAN EISENBERG, Performance Assessment & Hydrology Branch,

12 Nuclear Materials Safety and Safeguards

13 MARGARET FEDERLINE, Deputy Division Director, Waste

14 Management

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

[10:35 a.m.]

COMMISSIONER ROGERS: Good morning, ladies and gentlemen. The chairman has been delayed and asked me to just start the meeting.

Let me just simply say that I don't have any prepared remarks, but this is a very interesting, I think, and important topic, of how we are to use the expert opinions that we elicit and I'm sure there are many thorny questions that can arise in the use of this technique of eliciting expert opinions in coming to regulatory judgments, and we're very interested in what the staff has done and how it's coming to some kind of a regularization of the use of this technique.

And so we are extremely interested in the briefing this morning. Commissioners?

[No response.]

COMMISSIONER ROGERS: Mr. Thompson?

MR. THOMPSON: Thank you, Commissioner. Today's briefing, as you say, will cover the status of the staff's efforts to develop guidance on the formal process of expert elicitation used in the high level waste program.

We first expressed our concerns about the Department of Energy's planned use of expert elicitation in our 1989 comments on DOE site characterization plan. And

1 since that time, the staff has followed with great interest  
2 the Department of Energy's numerous application of expert  
3 elicitation, and today we'll give just a brief status.

4 We're going to probably focus on the first part of  
5 the briefing, which goes to the purposes, and we'll skip to  
6 the schedule aspects toward the end.

7 Seated at the table with me, I know you know Dr.  
8 Knapp and Margaret Federline. Also is Norm Eisenberg and  
9 Janet Kotra from the Division of Waste Management. Janet --  
10 Dr. Kotra will conduct today's briefing, and if there are no  
11 questions, we'll just go right to her.

12 DR. KOTRA: Good morning, ladies and gentlemen of  
13 the Commission. My purpose, or our purpose here today is to  
14 discuss the status of the staff's development of draft  
15 guidance on the formal process of expert elicitation as we  
16 envision it will be used in the high level waste licensing  
17 process.

18 I'll present some of the reasons that the Waste  
19 Management staff believes that this guidance on this topic  
20 is appropriate at this time. I'll define the scope of our  
21 planned staff technical position, what we'd like to call an  
22 STP, and attempt to place the initial effort in this  
23 context, of how expert judgment generally may feature in the  
24 licensing process.

25 Had we more time, I would make reference to a

1 large body of NRC staff experience and activities,  
2 undertaken both here and at the Center for Nuclear Waste  
3 Regulatory Analysis, which we believe has contributed to our  
4 ability to develop guidance on this topic. I'll then  
5 briefly highlight the key points around which we intend to  
6 construct a staff technical position for public comment,  
7 most important of which will be a sample process which we  
8 believe contains the elements that are crucial to a high  
9 quality expert elicitation.

10 I'll conclude with a tentative schedule which  
11 staff hopes will culminate with the publication of a final  
12 STP by the end of next spring. Move to the next slide,  
13 please.

14 Why, then, does the staff believe that there's a  
15 need for procedural guidance on the conduct of formal  
16 elicitation? First of all, we recognize that there will be  
17 very large uncertainties associated with our imperfect  
18 knowledge, the data and the models that will be used to  
19 assess the long-term performance of a geologic repository.

20 The subjective judgments of experts, which have  
21 always featured in probabalistic analysis, are an essential  
22 component of performance assessment. DOE will have to rely  
23 in some manner on expert opinion; for example, when it  
24 chooses relevant data sets, when it selects models, and when  
25 it applies those models to estimates of key parameters which

1 serve as input to the overall performance assessment.

2 We know that an expert judgment will figure  
3 prominently in the support for a license application. What  
4 is at issue, therefore, is not whether it will be used but  
5 how explicitly it will be documented and the extent to  
6 which, in specific technical areas, a formalized process  
7 will be used.

8 As Mr. Thompson alluded to, the staff first  
9 expressed its concern about DOE's planned use of expert  
10 elicitation in our 1989 comments on the site  
11 characterization plan. Staff observed that the plan  
12 contained sufficient detail for us to evaluate whether  
13 expert elicitation would be used in the place of reasonably  
14 obtainable data and objective analyses.

15 The staff's concern was, as I said, that this  
16 would be a substitute rather than as a complement to data  
17 collection that we believe are necessary for a high quality  
18 license application.

19 Since that time, the staff has followed with a  
20 great deal of interest and have commented, where  
21 appropriate, on many uses that DOE has applied this  
22 technique. Most recently, members of the staff have  
23 attended workshops sponsored by DOE and conducted by  
24 contractors that are assessing the analysis of volcanic  
25 hazards at Yucca Mountain, and a similar exercise has just



1     been initiated for seismic hazards at Yucca Mountain, and  
2     we'll be following that one, as well.

3             Along with others -- the National Academy of  
4     Sciences, the Advisory Committee on Nuclear Waste, and the  
5     Nuclear Waste Technical Review Board -- the NRC has  
6     expressed concern with prior examples of DOE elicitations  
7     that spoke largely to the fact that a broad enough range of  
8     experts was not brought to bear to the problem, that DOE  
9     tended to rely too heavily on the family of DOE, staff and  
10    contractors, and that as a result, the elicitation produced  
11    results that did not reflect the full range of credible  
12    alternative technical models.

13            CHAIRMAN SELIN:   Dr. Kotra, along this line, I'd  
14    like to ask you a question on what's your view or the  
15    staff's view.  On the one hand, you have experts.  On the  
16    other hand, you have a range of interested parties who have  
17    their own experts.  Specifically, in this case, would  
18    guidelines be to just pick the five most qualified people  
19    based on some list that's published by the American  
20    Association of Volcanism, or would we ask the State of  
21    Nevada to offer an expert, DOE offer an expert, Clark County  
22    to offer an expert?

23            In other words, do the experts and the political  
24    considerations -- are they kept apart, put together, or how  
25    are they followed?

1 DR. KOTRA: As a technical person, I'm very loathe  
2 to endorse a political selection of experts to address a  
3 technical question. I think what's more important is that  
4 the full range of credible technical models and approaches  
5 be represented at the table, regardless of the affiliation  
6 of the individuals. I think that has to be paramount.

7 But to the extent that those can be drawn from a  
8 range of academic, national lab, university -- what have  
9 you -- affiliations, I think that that may be an important  
10 secondary consideration, but I think the first one needs to  
11 be that we get the respective models at the table. And I'll  
12 ask managers and other staff to comment on that, but that's  
13 my view as a technical person.

14 CHAIRMAN SELIN: I'd like the general counsel to  
15 comment on that also, if she has anything to add.  
16 Generally, in use of experts, are they always supposed to be  
17 picked sort of impartially, or do the experts tend to  
18 represent different points of view?

19 MS. CYR: They tend to represent the points of  
20 view. I mean, this process is used for a range of purposes  
21 here, in terms of how the staff wants to do it, in terms of  
22 them to be able to understand how DOE is making its  
23 selection. I mean, it's serving a lot of various interests,  
24 not just, you know, a narrow litigation interest. It's  
25 serving a lot of interests on the part of the staff.

1           So I think the concerns that they're outlining in  
2 terms of how they want this process to proceed represents,  
3 you know, additional concerns and issues beyond.

4           MR. THOMPSON: But it's slightly different than  
5 just getting an expert to testify to support a position that  
6 one of the parties has. So what we were attempting to do is  
7 establish some guidelines, and I think we'll get them in a  
8 little more detail, as to how you can have a full disclosure  
9 of the issues associated with a particular issue in which  
10 judgments are going to be made, and to get a range of expert  
11 opinion that covers those different views and the different  
12 theories that are associated with those particular judgments  
13 that are going to be required.

14           Our sense that DOE would conduct this process --  
15 you know, we may, in fact, have our own expert elicitation  
16 process to get an NRC position on this but this, in essence,  
17 was our proposal and guidance on how the applicant in this  
18 particular case, DOE, would go about in developing their own  
19 experts when they go out and select their expert judgments.

20           COMMISSIONER JACKSON: Given that you're going to  
21 be giving them guidance, will that extend to how the views  
22 of the different panel members would be aggregated?

23           MR. THOMPSON: Here I'm no expert. I think that  
24 will be covered in the briefing about how we go about  
25 integrating those views and the process and --

1           COMMISSIONER JACKSON: In other words, we should  
2 let you proceed.

3           MR. THOMPSON: Let Dr. Kotra proceed.

4           COMMISSIONER DE PLANQUE: Before you proceed,  
5 there is something that I've been waiting to see in these  
6 documents, in these briefings, that I still don't see yet  
7 and concerns me a little bit, and it bears somewhat on what  
8 you asked. Do you choose experts to represent the range of  
9 political views, the range of different organizational types  
10 or the range of technical skills?

11           But the question beyond that is what are the  
12 criteria for establishing that a person is indeed an expert?  
13 Are there technical credentials that you're going to say are  
14 necessary? Are there publication credentials that you're  
15 going to say are necessary?

16           And this is the point that I haven't seen  
17 addressed yet, and would seem to be critical. If you  
18 started from the situation, we must have every stakeholder  
19 represented, as one method of going forward, then what are  
20 the credentials that you would expect the representative of  
21 that stakeholder to have in order to be considered an  
22 expert?

23           MR. THOMPSON: There's a criteria for selection of  
24 experts that we will address and I'll ask Dr. Kotra to put  
25 that back into the briefing.

1 COMMISSIONER DE PLANQUE: Back-up slide number 1.  
2 I kept looking and didn't find it.

3 MR. THOMPSON: It's slide 1-1. It should have  
4 been 1.

5 DR. KOTRA: The specific details with regard --  
6 there's a quick answer to your question and I'll touch on it  
7 a little bit later. Quick answer to your question is that  
8 this guidance will not say, "Yes, you have to have an acid  
9 test of having every stakeholder represented."

10 The first criteria that we identify is technical  
11 competence and experience, and I will develop that a little  
12 more later in my presentation. But I couldn't agree with  
13 you more.

14 To echo what the general counsel has said, the  
15 staff recognizes that there's a much broader applicability  
16 of this technique beyond just the technical issues that will  
17 support a licensing case, and we fully acknowledge DOE's  
18 prerogative to employ elicitation as an aid in its  
19 programmatic and decision-making process prior to licensing.  
20 It's not our inclination or our desire here to prescribe how  
21 that should proceed.

22 However, the staff is also keenly aware that under  
23 the program approach, the Department of Energy intends  
24 significantly greater reliance on expert elicitation. And  
25 to the extent that the results of those elicitations are

1 used to support DOE's demonstration of compliance with our  
2 regulations, the staff believes it needs some way to  
3 evaluate the adequacy of the process, as well as the  
4 results.

5 CHAIRMAN SELIN: Actually, on that line, there's  
6 something else, and I didn't see it in the slides. If these  
7 experts are invisible to us -- in the licensing; I'm not  
8 going to this broad question of how DOE decides what's a  
9 good idea but gets back to the licensing process -- if the  
10 panel is invisible to us and only the results are visible --  
11 the panel is visible to us?

12 DR. KOTRA: Yes, that's one of the criteria we  
13 identify.

14 CHAIRMAN SELIN: Each of the expert's views, then  
15 who puts that together to decide what the consensus is? Is  
16 that DOE's job or is that --

17 DR. KOTRA: Well, I'm prepared to speak to that in  
18 terms of aggregation but I think one of the things that --  
19 one of the criteria that we identify for selection of  
20 experts is their willingness to be identified publicly with  
21 their individual judgments. You take that, together with  
22 our insistence on a traceability of the individual judgments  
23 and their impact on an aggregated result, I think that that,  
24 you know, gets you away from your premise here. They should  
25 not be invisible to us, and the individual judgments should

1 not be invisible to us.

2 CHAIRMAN SELIN: And therefore, the licensing  
3 panel will have individual opinions available to wait or  
4 just the overall --

5 MS. CYR: I don't think we totally understand how  
6 all this will turn out in the licensing process because the  
7 way experts have been used in the past -- this is a process  
8 that's not been used a lot in litigation -- we're still  
9 feeling our way in terms of how that might be used in  
10 litigation.

11 I mean, the kinds of information which the staff  
12 is trying to set forth in its procedures will help us  
13 because it will reveal all -- it will get you all that  
14 information out front and how we may have to work around  
15 that in terms of trying to get a particular individual on  
16 who's qualified to speak and how that view is represented.

17 But by having the guidelines, which the staff is  
18 trying to do, you'll at least know what all that information  
19 is. You'll be able to trace back and you'll have  
20 information that will help you decide exactly how this type  
21 of a process may be represented in the litigation.

22 CHAIRMAN SELIN: The problem that I have is I see  
23 the possibilities in both of them. Each of them makes me  
24 uncomfortable. One is the panel is essentially just a  
25 vehicle to get five individual views to the licensing board,

1 and then the licensing board has to figure out how to  
2 reconcile all these conflicting views, which at least has  
3 the value of having five experts but it leaves the  
4 integration problem to a litigative process.

5 The other one says no, that what we're really  
6 going through, which is why I think it's here, is to get  
7 these views together so that there is a kind of, if not a  
8 consensus, an integrated view, and then the question is can  
9 the licensing board put any more weight on that than they  
10 would put on the view --

11 DR. KOTRA: I will certainly defer to the general  
12 counsel to discuss the weight that the licensing board would  
13 put on this. However, long before it gets to a licensing  
14 board, DOE itself is going to need some mechanism to decide  
15 how to proceed. You know, in the absence of complete data,  
16 in the absence of a clear model to explain those data, they  
17 have to make some assumptions and they have to back those  
18 assumptions up. And it is that process that the technical  
19 staff is concerned with at this time.

20 I think that there certainly are plenty of  
21 questions that speak to the acceptability of the result in  
22 the licensing process, and I don't think that this modest  
23 attempt at issuing guidance in the technical arena is going  
24 to address all of that.

25 If I may continue, since 1991, both the



1 Commission's Advisory Committee on Nuclear Waste and the  
2 Nuclear Waste Technical Review Board have specifically  
3 called upon our agency to work with the staff of DOE to  
4 reach some understanding with regard to the appropriate  
5 process for formal elicitation of expert judgment.

6 And as you heard from Dr. Dreyfus a few weeks ago,  
7 DOE has also issued its own principles and guidelines on the  
8 use of formal expert judgment, which the staff will need to  
9 evaluate.

10 So for all of these reasons, then, and based upon  
11 our own experience with expert elicitation, as supported by  
12 the Center for Nuclear Waste Regulatory Analysis, we feel  
13 that at this time we are ready to proceed and it's now  
14 appropriate to develop a staff technical position on what  
15 constitutes an acceptable process for formally eliciting  
16 expert judgment.

17 And if I can skip over the next slide, I think we  
18 just mentioned that we are going to have a technical  
19 exchange with DOE, as April Gill mentioned the hearing a  
20 couple of weeks ago, and we will be taking up at that public  
21 meeting, with an opportunity for all interested parties to  
22 contribute, both our draft staff technical position, which  
23 will be published about that time, as well as DOE's own  
24 guidance.

25 With regard to -- no, I'm going to skip that.

1           It is the staff's intent to confine this initial  
2 effort to some general criteria for when a formalized  
3 process may be helpful, not unlike the ones that have been  
4 identified by DOE in its own principles and guidelines.

5           In addition, we will include a sample protocol,  
6 and I think this is probably the most important part of our  
7 guidance, where we spell out the individual steps, the  
8 selection of the experts, if you will, the aggregation of  
9 the results, the documentation that is necessary for a high  
10 quality process that will produce a result that is more  
11 likely to be useful in the licensing context.

12           It is specifically not our intent to prescribe or,  
13 for that matter, prohibit specific applications to specific  
14 technical areas in this guidance at this time. It's also  
15 not our intent to in any way discourage the use of less  
16 formal means, so long as they're sufficiently documented.

17           This does, at times, go into an expensive and  
18 time-consuming process, and we believe it should be used  
19 judiciously. And that's why we're identifying, in a general  
20 sense, those areas where we think it might be most helpful.

21           If the Commission is called upon to decide whether  
22 to issue a license for a geologic disposal facility, that  
23 decision will, like all other licensing decisions the  
24 Commission makes, be based on a combination of fact and  
25 opinion. The subject judgments of experts will be used and

1 brought to bear by the applicant or other parties to  
2 interpret data, predict long-term performance and, most  
3 importantly I think in our view, to assess the uncertainty  
4 of those estimates.

5 Consistent with previous decisions, these  
6 judgments may be used to complement but they may not  
7 substitute for reasonably obtainable data and objective  
8 analysis.

9 COMMISSIONER DE PLANQUE: Have you given any  
10 consideration yet to how reasonably obtainable is going to  
11 be defined?

12 DR. KOTRA: I think that's kind of the nub of the  
13 question in many respects, and I don't think that -- in a  
14 strange way, this process of expert elicitation helps focus  
15 your attention on where your data needs are. In fact,  
16 that's one of the first steps of the interaction with the  
17 experts, is are there data needs that have not been met?  
18 What additional information is needed to reach a judgment?

19 But I think that that's going to be an iterative  
20 process. It has been heretofore and certainly, under the  
21 program approach, the staff is going to be keeping a very  
22 watchful eye on the decisions DOE makes to terminate further  
23 data collection.

24 MS. FEDERLINE: Let me just add I think it's  
25 important that the Commission recognized when they put Part

1 60 in place that there were going to be data that are not,  
2 over the long time scales and the spacial geological scales,  
3 available. And so this is an idea whose day has come  
4 because of the nature of the problem that we're dealing  
5 with, and we have to admit there's going to be data that is  
6 not obtainable.

7 COMMISSIONER DE PLANQUE: There's some that's  
8 physically unattainable or, by the nature of it,  
9 unattainable, but I would assume there might be a cost  
10 element in here, too, and that may be the most difficult  
11 part to deal with.

12 MS. FEDERLINE: Mm-hmm.

13 MR. THOMPSON: A time-in cost in certain areas.  
14 And in order to meet certain licensing schedules, I think  
15 DOE was going to have to make a decision as to whether or  
16 not they can obtain sufficient information, through the  
17 expert elicitation process, to justify preparing a license  
18 application and submitting it to the NRC.

19 MS. FEDERLINE: This is why this process is so  
20 important in the prelicensing period because it makes it  
21 transparent and it makes it documented in terms of how their  
22 thinking is going into the adequacy of data. We're going to  
23 be obliged to submit a sufficiency recommendation to the  
24 President. That's NRC's role. And so it's important that  
25 this process be documented as to how they arrive at the

1     sufficiency of data. And that's one of our main goals in  
2     moving forward with this.

3             DR. KOTRA: And this has been an open concern for  
4     us for many years now and it will probably accelerate our  
5     attention with the program approach, but it's not something  
6     that we haven't been aware of before.

7             I think our concern, expressed when we commented  
8     on the SEP, was that we needed more information from DOE as  
9     to where specifically they were going to apply this process,  
10    so we could make a judgment on that very issue.

11            As Margaret alluded to, our regulations anticipate  
12    that proof, in the ordinary sense of the word, absolute  
13    assurance, is not going to be the criteria of acceptability,  
14    and that we allow for explicitly a reasonable assurance  
15    finding. And I think that wrapped into that notion of what  
16    is reasonable is this awareness of availability, time, cost.

17            Regardless of how that decision is made in  
18    individual cases, we believe that a well documented,  
19    transparent process for identifying expert judgment can only  
20    serve to enhance that assurance.

21            If I may digress just very briefly, I would  
22    acknowledge here that both the conduct and the evaluation of  
23    formal elicitation is by no means new to the NRC technical  
24    staff. Its use is figured prominently in the development of  
25    new reg 1150 reactor safety severe accident risk analysis,

1 and it is also fundamental to seismic hazard analysis.

2 In particular, those methods that were developed  
3 to assess a seismic hazard in the Eastern U.S. have been  
4 incorporated by reference in the proposed revisions to 10  
5 CFR 100, Appendix A, which were published last October. And  
6 these revisions specifically recognize techniques which, at,  
7 their heart, are expert elicitation-based.

8 In view of this wealth of agency experience,  
9 including our own, in conducting and evaluating other  
10 elicitations, it's our intent to see to it that the draft  
11 technical position that we develop in this area receives  
12 extensive coordination with the Offices of Research, NRR,  
13 and the General Counsel. And some of this coordination has  
14 already commenced, and we want to thank the respective  
15 offices for their assistance in this regard.

16 Next slide.

17 COMMISSIONER ROGERS: Excuse me, just before you  
18 leave this one, it occurs to me that we have to be quite  
19 careful about what we mean by certain words, particularly  
20 "reasonable." We've already talked about that a little bit  
21 here, but it seems to me that just from what you've said so  
22 far, reasonably obtainable data and analyses, we had some  
23 feeling about what your thinking was there, that cost might  
24 be a factor.

25 Then when we turned to "reasonable assurance," to

1 me, that may be a different connotation in the word  
2 "reasonable." And I think that we have to be very, very  
3 careful of how we use that word "reasonable" and that we  
4 make clear exactly what the implications of it are in each  
5 situation in which we use it, because it seems to me I can  
6 see some real confusion developing.

7 Reasonably obtainable data and analyses, cost may  
8 be a factor. When we're talking about reasonable assurance  
9 to the public of our judgment, that may be a different  
10 matter. And I know that they may be linked, but it still  
11 may have a different implication. And I'm just suggesting  
12 that we be very careful on how that word "reasonable" is  
13 employed and we make very clear what we mean by it when we  
14 use it.

15 MS. CYR: I think that's a valid point, I mean, in  
16 terms of -- describe it in context, what it is that you're  
17 using the word to mean at that particular time.

18 DR. KOTRA: If I could return to the slides,  
19 number 7, I want to repeat that we appreciate that DOE has  
20 very wide latitude to use expert judgment without NRC  
21 oversight during this prelicensing period. The focus of the  
22 NRC staff in developing guidance at this time is on  
23 providing a basis for evaluating the process DOE is using to  
24 the extent that its use might hinder the collection of  
25 sufficient data.

1           Further, such guidance will also contribute to our  
2 basis for technical interactions with DOE during this  
3 period, and the guidance will ultimately be incorporated  
4 into our license application review plan. Once we receive  
5 the license, of course, we'll be preparing a safety  
6 evaluation report and considerations that go into the  
7 preparation of that report will include a review of DOE's  
8 use of expert elicitation and expert judgment generally.

9           Next slide, please. I'd now like to turn to the  
10 key issues around which the staff will be building this  
11 position. I'm going to skip over them fairly briefly and  
12 move to the process that we think is important and contains  
13 the steps that a number of you seem to be quite interested  
14 in.

15           First of all, we want to emphasize that NRC has  
16 always accepted judgment to support applications for  
17 licensing decisions and will continue to do so. However, we  
18 don't view it as a substitute for available data, that it is  
19 to complement the data, not to supplant it.

20           It can be either formal or informal, but in either  
21 case, in order to have that reasonable assurance that  
22 Commissioner Rogers mentioned, we need to have a clear trail  
23 of how it was applied and why.

24           If DOE does elect to use, in certain instances, a  
25 formal process, we want to see that this process is applied



1 with discretion, and it may be of greatest value in those  
2 cases where the data simply is not available at all, where  
3 the uncertainties are very large and significant to the  
4 compliance demonstration.

5 I emphasize the latter because there are many,  
6 many cases associated with the assessment of repository  
7 performance, where there will be large uncertainties. Not  
8 all of them will be of consequence in the ultimate  
9 demonstrate of compliance with our regulations.

10 So again, this process is a very useful tool to  
11 focus attention on those areas where those uncertainties are  
12 key to the performance assessment.

13 Lastly, this technique may also be brought to bear  
14 in deciding whether bounding assumptions are sufficiently  
15 conservative, and we think a more formalized process may be  
16 useful in that regard, as well.

17 So as I mentioned, this is a tool that can help  
18 focus limited site characterization, as well as regulatory  
19 resources, and we've provided a very general set, or we will  
20 be providing a very general set of conditions which may  
21 warrant it and those, as I said, are not dissimilar from  
22 what DOE has already advanced.

23 However, if DOE elects to use this process, we  
24 think it needs to be defensible and consistent. And to that  
25 end, we are providing a sample process that contains those

1 elements.

2 Formal elicitation is far from being a simple  
3 opinion poll. It is a process that lays out the technical  
4 basis for a judgment, decomposes a problem, and allows  
5 reviewers and all parties who are interested to see how a  
6 decision was arrived at.

7 As I will get to in a moment, the staff will  
8 identify in its draft STP this process, and given that this  
9 process will take place many times over many years as the  
10 repository is characterized, as it is developed and as it  
11 ultimately is licensed, we believe it's critical that DOE  
12 establish some sort of a mechanism for updating the results  
13 of prior elicitations if new data or analyses come forward  
14 that would possibly change the results of those  
15 elicitations.

16 The steps on the next slide, number 9, I'm only  
17 going to touch on this slide, and we can discuss any one of  
18 the elements that are listed there. I want to emphasize  
19 that these are put down in an order but we don't mean it to  
20 be a lock-step sequence that one has to follow. In fact, in  
21 many cases these steps are followed in an iterative fashion.

22 For example, you originally define the problem.  
23 You use that definition to select your experts and define  
24 what information needs to be provided to them. You bring  
25 the experts in and they say, "No, you didn't define the

1 problem exactly right. Please modify it." You modify the  
2 problem and that may drive the selection of additional  
3 experts, and so forth.

4 So there's an iterative nature to all of these  
5 steps and while documentation, for example, is listed at the  
6 end, we believe it's important that the process be  
7 documented properly from the get-go.

8 COMMISSIONER DE PLANQUE: I can't resist asking  
9 this. In reading DOE's document when they talk about the  
10 training aspect, "The experts will be trained for the  
11 elicitation of their judgments," et cetera. And that kind  
12 of struck me as being analogous to herding cats.

13 [Laughter.]

14 COMMISSIONER DE PLANQUE: Could you just say a  
15 little bit more about what you think they may have had in  
16 mind there?

17 DR. KOTRA: I'm very fond of cats and that's not  
18 an easy job.

19 COMMISSIONER DE PLANQUE: I know.

20 DR. KOTRA: That being aside, I think that one of  
21 the things that we -- our initial impression of DOE's  
22 document was it was a little thin on details such as you  
23 describe.

24 COMMISSIONER DE PLANQUE: A little.

25 DR. KOTRA: We believe that there are some key

1 things that the experts need to be trained to, and this is  
2 not in any way to imply that they are not experts and well  
3 respected --

4 COMMISSIONER DE PLANQUE: Does this mean training  
5 in the way they might present their views and format? Is  
6 that what was in mind?

7 DR. KOTRA: Well, it's training in what to expect  
8 in the elicitation process. They may be highly regarded  
9 experts in their individual fields, but they may not have  
10 specific experience in expressing their technical judgments  
11 in a probabalistic format that's going to be useful in a  
12 performance assessment.

13 And for that reason we believe it's necessary to  
14 kind of get everybody calibrated, you know, and on the same  
15 page with regard to that.

16 And lastly, I think equally important, is  
17 sensitizing the experts to the potential for biases, their  
18 own as well as the other panel members. There are number of  
19 categories of biases, and I think that there's been a lot of  
20 work that is shown that by sensitizing experts prior to  
21 this, you can reduce some, if not all of those biases if  
22 you've alerted them to them. That works probably more for  
23 cognitive biases than it does for motivational biases, but  
24 nonetheless, we think that's an important part of the  
25 training and we'll be discussing that in the guidance that

1 we develop.

2 Before I turn to the schedule --

3 MR. THOMPSON: Janet, would you go over the  
4 selection of experts? I think that was an issue that kind  
5 of came up before. I think that's slide 11.

6 DR. KOTRA: Okay, if we can go to slide 11, as I  
7 mentioned, and again, I may bring a bias to this as a  
8 technical person, but the guidance will certainly reflect  
9 that we believe knowledge and experience is, of course, the  
10 premiere qualification for an expert.

11 In addition, we would specify that some  
12 demonstrated ability to apply that knowledge to other  
13 problems in a broader area is important. The broad  
14 diversity of independent opinion and approaches is critical  
15 for the credibility of the judgments. And again I stress  
16 that that's a technical diversity, not necessarily a  
17 political diversity.

18 And lastly, a willingness to be identified  
19 publicly with the judgment speak to Dr. Selin's concern.  
20 Apparently, early on in the application of this technique,  
21 in new reg 1150 and in the seismic area and elsewhere,  
22 experts were allowed to be anonymous. And from what I have  
23 read, that has not proven to be as useful as originally  
24 thought, that the fear that one strong personality would  
25 somehow influence another or that the experts would be

1 inhibited from expressing their true views was really as not  
2 as much of a problem as was this failure to be identified  
3 and have their professional reputations associated with the  
4 judgments that they produced in this regard.

5 So we believe that that willingness to be  
6 identified publicly and the traceability of the individual  
7 judgments far outweighs any concern that might have driven  
8 one to an anonymous polling of the experts.

9 COMMISSIONER JACKSON: A question comes to mind  
10 and I don't know that it would be necessarily part of your  
11 criteria for selecting experts, but rather part of the  
12 process because it's something that exists in other bodies,  
13 like the National Academy, and that has to do with a  
14 declaration of conflicts of interest or potential conflicts  
15 of interest.

16 Just the very fact that you have a range of  
17 opinions of people who could be coming from a range of  
18 backgrounds, it's very important, in the documentation,  
19 really, that there is a reflection of where there are  
20 potentials, if not actual conflicts of interest. That  
21 doesn't necessarily rule out the use of that particular  
22 expert, but it is important to have that as a reference  
23 point if you're talking about a document trail and potential  
24 litigation.

25 DR. KOTRA: You've hit on a very controversial

1 point, even within the staff itself. We've recently  
2 requested and received the guidelines that the National  
3 Academy of Sciences uses in that regard and we're reviewing  
4 them for their utility in this context.

5 I think the thing that troubles us a little bit,  
6 and I think you also mentioned that, is that in many cases  
7 there are disciplines where the number of really qualified  
8 experts is quite limited and that DOE would be remiss if it  
9 did not include its own people, because of their technical  
10 knowledge.

11 That doesn't mean that that potential for bias  
12 should not be highlighted and made visible in the process so  
13 that the other experts, as well as anybody reviewing the  
14 process, is aware of them. But I don't think that -- I  
15 mean, at this point in time, the staff is not prepared to  
16 prohibit conflict of interest per se.

17 COMMISSIONER JACKSON: I think that's good, but I  
18 would also wish to point out that the potential for conflict  
19 of interest doesn't merely come because someone happens to  
20 be DOE-related.

21 DR. KOTRA: Indeed.

22 COMMISSIONER JACKSON: It can be from people with  
23 a broader background than that.

24 COMMISSIONER DE PLANQUE: Again, I saw this slide  
25 earlier, and the earlier, and the criteria make a lot of

1 sense, but I would still ask the next question. How do you  
2 determine that those criteria are satisfied, and who judges  
3 them? Who makes the determination?

4 DR. KOTRA: Well, I think that in the guidance  
5 that we will be developing, we will obviously flesh these  
6 out in a great deal more detailed than is possible here in a  
7 status report, and certainly publication record, recognition  
8 of peers figure prominently in the first bullet, that  
9 there's no getting around that if you're going to use the  
10 term "expert."

11 But beyond that, I think we will be certainly  
12 soliciting comment on that. As I understand the process  
13 working right now, the one that I have had the privilege of  
14 observing, is that a team is assembled by DOE and includes  
15 experts who are expert in decision analysis; it includes  
16 generalists who have an awareness of the general area but  
17 may not be subject matter experts per se. And they get  
18 together and define the criteria for selecting the subject  
19 matter experts in that particular discipline, for that  
20 particular application.

21 So it may vary from issue to issue in the  
22 particulars, but the general concerns that you've raised are  
23 certainly things we intend to identify.

24 COMMISSIONER DE PLANQUE: And again, I think this  
25 is important from a public perspective because the public



1 watching this process I think is not quite as familiar with  
2 the use of expert judgment as maybe we all are. And having  
3 the information available as to how these experts were  
4 chosen and what their credentials were I think is going to  
5 be extremely important as this goes forward.

6 MS. FEDERLINE: If I could just add, some of the  
7 experience we gained, you're aware that the center conducted  
8 an elicitation for us in the area of climate, and they  
9 conducted an interesting exercise, inviting nominations  
10 based on selection criteria.

11 And we received nominations from all over the  
12 country, and it was interesting that the top four or five  
13 candidates received the most number of votes from within  
14 their profession. So, you know, it's an interesting  
15 process.

16 DR. KOTRA: I think that the important point,  
17 though, is that the selection process, however it proceeds  
18 in a particular case, be transparent, be well documented,  
19 and if the experts truly reflect the broad range of credible  
20 technical approaches, the interaction between those experts  
21 will highlight, and I think it will become obvious if there  
22 are biases, if there are conflicts of interest. Those get  
23 flushed out and they get put on the table if the process is  
24 carried out properly.

25 COMMISSIONER JACKSON: I just urge you again that

1 I think you have to have an explicit mechanism for having  
2 people address that as individuals. Just as you say that  
3 there should be a willingness to be identified publicly,  
4 there has to be a willingness to lay out potential and  
5 actual conflicts of interest. It forces the individuals to  
6 think about it, as well as from the point of view of the  
7 transparency and openness of our process, that you've laid  
8 it out on the table from the beginning so that, you know,  
9 there's nothing that's hidden in that area.

10 Whatever the ultimate way you choose to do it, I  
11 think it's critical that it be done.

12 DR. KOTRA: We couldn't agree more and we'll take  
13 that to heart.

14 I can spend a few minutes on aggregation or I can  
15 just sum up with the schedule.

16 COMMISSIONER JACKSON: I'd prefer you spend a  
17 minute or two on aggregation.

18 DR. KOTRA: Then it will be done. If we move to  
19 17, which is the aggregation of judgments, as we implied  
20 earlier, we strongly believe that the individual judgments  
21 must remain available for direct use in performance  
22 assessment and sensitivity analysis. We have to have a  
23 mechanism to evaluate quantitatively the impact of  
24 individual judgments, whether or not a consolidated number  
25 or estimate emerges from the process.

1           We believe that experts should explicitly be  
2 solicited for their views on opposing points of view, and  
3 the basis for the differing views should be documented if  
4 the judgments are to be aggregated, and I would hasten to  
5 add that in not all cases is it necessary to aggregate  
6 results.

7           If you nail down the range and that range is so  
8 far below what is of concern to you in a particular area,  
9 then it doesn't matter that there is a four order of  
10 magnitude difference. You still have confidence that you're  
11 in the right ballpark. But in those cases, and probably  
12 the thorniest ones will require some combination or  
13 aggregation of results, a rationale should be provided.

14           The technical staff, at this time, is not prepared  
15 to prescribe a specific algorithm or specific method. We  
16 just say here at this time that whatever method is selected,  
17 a rationale for its applicability in a particular case  
18 should be documented and should be provided, and it should  
19 be very clear how that was done, and the impact of  
20 individual judgment on the consolidated views must be  
21 available. And, of course, everything has to be available  
22 to all parties.

23           COMMISSIONER JACKSON: This comment is implied in  
24 what you already said, but I would also say if the judgments  
25 are disaggregated, the rationale should be provided.

1 DR. KOTRA: Point well taken. We'll make a note  
2 of it.

3 In the absence of any further questions, I will  
4 just wrap up with the schedule that we have tentatively laid  
5 out. It's on the last page. It should be number 19.

6 Tomorrow, as you're aware, we'll be briefing the  
7 ACNW on these same points. Over the course of the summer we  
8 will be developing a complete draft and we will be  
9 subjecting that draft to fairly extensive coordination and  
10 review within the technical staff of the agency, as well  
11 as -- without and within NMSS.

12 We intend to publish a draft STP for public  
13 comment in September, and about that same time we'll conduct  
14 a technical exchange with DOE, as I mentioned earlier. We  
15 will come back to the ACNW after that document has been put  
16 out for public comment and brief them on the contents of the  
17 document. We will analyze the comments and prepare a final  
18 draft. If requested, we will brief the ACNW again.

19 And lastly, we intend to publish a final STP by  
20 the end of next spring.

21 CHAIRMAN SELIN: I think this is very useful. We  
22 have an extremely squishy process and you're trying to put  
23 some water in it. I was listening quite carefully at the  
24 context between just getting a bunch of people together to  
25 say, "How do you feel about this, Charlie?" versus trying to

1 put more precision than the underlying data will support. I  
2 think you've just done a terrific job.

3 I think having an STP and then giving the people  
4 who are going to use it more flexibility to decide which way  
5 do we bend, because this will be for litigative purposes or  
6 this will be for preliminary decisions that might be made by  
7 an agency, or anything between the two, is really the right  
8 thing to do, to have a broad, but more detailed than the DOE  
9 document, technical position, and then make sure your  
10 introduction does go into some of the questions that you've  
11 skipped under the pressure of time today, which is which way  
12 to go if this is to be part of an adjudicatory process,  
13 which way to go if this is to be part of sort of a fairly  
14 formal technical process, what emphasis if this is part of a  
15 preliminary, are we in the right ballpark, technical  
16 judgment.

17 I just think that's very positive, and your  
18 presentation makes it seem so simple, one wonders why it  
19 took so long to get there. It's the sign of a very good  
20 presentation.

21 DR. KOTRA: Thank you, sir.

22 CHAIRMAN SELIN: Very good. Commissioner Rogers?

23 COMMISSIONER ROGERS: Yes. Well, I certainly  
24 agree with the Chairman's remarks.

25 It occurs to me that while this whole exercise was

1 motivated by the DOE Yucca Mountain license, I don't really  
2 see anything very much in it that says that it's limited to  
3 that. It seems to me that you looked at things from a very  
4 broad point of view, and I wonder whether we shouldn't  
5 consider this as really a useful approach for any activity  
6 of NRC that requires the elicitation of expert judgments.

7           You cited the new reg 1150 use in the past. There  
8 may be other areas that we'd want to do this in the future,  
9 and I wouldn't want to see this somehow or other be tied  
10 totally to this particular problem of the DOE license for a  
11 repository if, in fact, it can apply more broadly. And we  
12 ought to consider that. I wouldn't want us to have to go  
13 back and do this again in some way if we wanted to use  
14 expert judgment in another area involving reactors, for  
15 example.

16           MS. FEDERLINE: If I could just respond, we've  
17 thought of that, too, the commonality of disciplines across  
18 the agency and what-not. What we would like to do is  
19 consider this as a pilot, because it is sort of a new area,  
20 get comments, and then get feedback to other parts of the  
21 agency.

22           DR. KOTRA: If I may, I would also note that the  
23 Office of Research has published, in contractor reports, for  
24 example, supporting further analysis of consequence analysis  
25 associated with 1150 and elsewhere, good practices that are

1 very similar to what we're identifying here. In fact, we've  
2 drawn heavily on that expertise in developing this as far as  
3 we have.

4 You're right. It has not been produced as a  
5 guidance document representing NRC's views per se; it's  
6 applicable in a broader area. But I would just echo what  
7 Margaret says. I think that our concern, in the Division of  
8 Waste Management, is that we get this out and available for  
9 DOE and other parties. And as a pilot, we could even  
10 solicit comment on the broader application.

11 COMMISSIONER ROGERS: Good idea.

12 COMMISSIONER DE PLANQUE: Speaking of the broader  
13 application part of it, have the processes used by other  
14 bodies, like the academy, which you said you were looking  
15 at, have they been helpful to you, or do you really feel  
16 like you're inventing the wheel here? And have you looked  
17 at others?

18 DR. KOTRA: It's very important to me that we not  
19 reinvent the wheel, and there's a great deal of literature  
20 out there on the application of this technique. It's an  
21 evolving science in its own right, and we're trying as much  
22 as possible to learn from that.

23 I think that it's important to keep in mind that  
24 the kind of peer reviews that the academy often is asked to  
25 do is a somewhat beast. There's a lot of similarities, but

1     there are some distinct differences. And I think to the  
2     extent that what we're interested in ranges into that area  
3     of differences, we have to be very careful to make very  
4     clear what we expect.

5             DR. KNAPP: I think it's worth noting that the  
6     center was very helpful to us here and last fall, bringing  
7     forward about a 100-page, principally literature view, with  
8     some comments. It helped to see what literature was out  
9     there and gave us a chance to condense into the things that  
10    Dr. Kotra has provided this morning.

11            COMMISSIONER DE PLANQUE: Okay, that's all I have.  
12    Thank you.

13            COMMISSIONER JACKSON: I just would like to  
14    reiterate Commissioner's Rogers' comments. I'm a big  
15    believer in consistency of approach across many different  
16    areas of what we do.

17            CHAIRMAN SELIN: Thank you.

18            [Whereupon, at 11:20 a.m., the above-entitled  
19    meeting was concluded.]

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CERTIFICATE

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

TITLE OF MEETING: BRIEFING ON NRC USE OF EXPERT  
ELICITATION IN HLW PERFORMANCE  
ASSESSMENTS - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Wednesday, June 21, 1995

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: Susan Harris

Reporter: Susan Harris



**STAFF BRIEFING ON USE OF EXPERT ELICITATION  
IN HLW PERFORMANCE ASSESSMENTS**

**STATUS REPORT**

**June 21, 1995**

**Contact: Dr. Janet Kotra  
Phone: (301) 415-6674**

## **PURPOSE**

**Status Report on Development of  
NRC Staff Technical Position on Use of  
Expert Elicitation in the HLW Program**

## **OVERVIEW**

- **Need for NRC Guidance**
- **Scope**
- **Role of Expert Judgment in NRC Licensing**
- **Staff Activities**
- **Proposed Positions**
- **Sample Process**
- **Schedule**

**WHY DOES STAFF BELIEVE THERE IS A NEED  
FOR GUIDANCE ?**

- **Large Uncertainties in Data, Modeling, and Knowledge of Future States**
- **Expert Judgment Will be Used to Support License Application**
- **Concern that DOE May Use Expert Judgment in Place of Data**
- **Specific Concerns with DOE Uses of Expert Elicitation**
- **Under Program Approach, DOE Intends Greater Reliance on Expert Elicitation**
- **Need to Address ACNW and NWTRB Concerns**
- **DOE Guidelines for Use of Formal Expert Judgment (6/1/95)**

## **DOE GUIDELINES ON USE OF FORMAL EXPERT JUDGEMENT**

- Issued June 1, 1995
- Staff Review Underway
- General Policies and Principles
- Little Detail on Application
- DOE/NRC Technical Exchange in September

## **SCOPE OF NRC GUIDANCE**

- **Conditions Which May Warrant Formal Elicitation**
- **Elicitation Protocol**
- **Does Not Prescribe Specific Applications**
- **No Intent to Discourage Less Formal Uses of Judgment,  
if Properly Documented**

## **ROLE OF EXPERT JUDGMENT AS INPUT TO NRC LICENSING DECISIONS**

- **Decision Based on Fact Plus Opinion**
- **Judgments Used to Interpret Data, Predict Repository Performance, and Assess Uncertainties**
- **Judgments May Complement, But Not Substitute For, Reasonably Obtainable Data and Analyses**
- **10 CFR Part 60 Requires "Reasonable Assurance"**
- **Proposed Part 100 Revisions Recognize Elicitation-Based Techniques**



## **PRIOR TO LICENSING**

- **DOE has Wide Latitude to Use Expert Judgment Without NRC Oversight**
- **NRC Concerned if Use Hinders High-Quality License Application**

## **REVIEW OF LICENSE APPLICATION**

- **NRC Staff Prepares Safety Evaluation Report**
- **NRC Staff Can Request Additional Information**

## **PROPOSED STAFF POSITION**

- 1. NRC Will Continue to Accept Judgment as Support for License Application**
- 2. But Not as a Substitute for Objective Analyses and Data**
- 3. Judgment May be Informal or Formal, Must be Documented**
- 4. Consider Formal Elicitation When:**
  - Data Not Available or Obtainable**
  - Uncertainties Large and Significant**
  - More Than One Model to Explain Data**
  - Assessing Bounding Assumptions**
- 5. Use a Consistent, Defensible Process**
- 6. Update Results**

## **SAMPLE PROCESS FOR FORMAL EXPERT ELICITATION**

- **Define Objectives**
- **Select Experts**
- **Identify Issues**
- **Assemble and Disseminate Info**
- **Provide Pre-Elicitation Training**
- **Elicit Judgments**
- **Provide Feedback**
- **Aggregate Views**
- **Document**

## **DEFINITION OF OBJECTIVES**

- **Define Explicit Objectives**
- **Objectives Guide Choice of Experts, Information Provided, and Form of Judgments**

## **CRITERIA FOR SELECTION OF EXPERTS**

- **Knowledge and Experience**
- **Demonstrated Ability to Apply Knowledge and Experience**
- **Broad Diversity of Independent Opinion and Approaches**
- **Willingness to be Identified Publicly with Judgments**

## **IDENTIFICATION OF ISSUES**

- **" Decompose" Broad Objectives into Simpler Subissues**
- **Experts Define Parameters Which Influence Overall Judgments**

## **ASSEMBLY AND DISSEMINATION OF BACKGROUND INFORMATION**

- **Assembled with Input of Experts**
- **Full Range of Views Should be Represented**
- **Uniform, Balanced, and Timely Distribution**
- **Experts Should Have Equal Access to Materials**

## **PRE-ELICITATION TRAINING**

- **Elicitation Process**
- **Expression of Judgments Using Subjective Probability**
- **Uncertainty Encoding**
- **Sources of Potential Bias**



## **ELICITATION OF JUDGMENTS**

- **Each Expert Should be Elicited Separately**
- **Review Definitions and Assumptions from Pre-Elicitation Meetings**
- **Uniform Questioning**
- **Internal Consistency Checks of Each Expert's Views**
- **Individual Elicitations Should be Recorded**

## **POST-ELICITATION FEEDBACK**

- **Prompt Feedback Of Results**
- **Need for Revision or Clarification of Individual Judgments Should be Solicited from Each Expert**
- **Rationale for Any Revisions Should be Documented**

## **AGGREGATION OF JUDGMENTS**

- **Individual Judgments Must Remain Available for Direct Use in Performance Assessments and in Sensitivity Analyses**
- **Experts Should Comment Explicitly on Opposing Views**
- **Document Bases for Differing Views**
- **If Judgments are Aggregated, Rationale Should be Provided**
- **Document Impact Of Individual Judgment on Consolidated Judgment**
- **Individual Judgments Must be Preserved, Documented, and Made Available to All Parties**

## **DOCUMENTATION**

- **What Was Done, Why, When, and By Whom**
- **Clear Descriptions of all Resulting Judgments and Reasoning**
- **Definitions of Issues and Terms**
- **All Assumptions and Calculations**
- **Complete References to Scientific Literature**
- **Information Provided Directly by Individual Experts**
- **Reasons for Rejection of Specific Data, Calculations, or Models**

## **SCHEDULE**

- |   |                |
|---|----------------|
| ● Brief ACNW on Draft Positions           | June 22, 1995  |
| ● Staff Review/Concurrence                | Summer 1995    |
| ● Publish Draft STP for Public Comment    | September 1995 |
| ● NRC/DOE Technical Exchange              | September 1995 |
| ● Brief ACNW on Draft STP                 | October 1995   |
| ● Analyze Comments and Prepare Final STP  | Winter 1995/96 |
| ● Brief ACNW on Final STP                 | Spring 1996    |
| ● Publish Final STP on Expert Elicitation | Spring 1996    |