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NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON PERFORMANCE ASSESSMENT PROGRESS IN HLW, LLW AND SDMP - PUBLIC MEETING

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON PERFORMANCE ASSESSMENT

5 PROGRESS IN HLW, LLW AND SDMP

6 ***

7 PUBLIC MEETING

8 ***

9 Nuclear Regulatory Commission

10 Commission Hearing Room

11 11555 Rockville Pike

12 Rockville, Maryland

13

14 Thursday, May 15, 1997

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16 The Commission met in open session, pursuant to

17 notice, at 2:07 p.m., the Honorable SHIRLEY A. JACKSON,

18 Chairman of the Commission, presiding.

19 COMMISSIONERS PRESENT:

20 SHIRLEY A. JACKSON, Chairman of the Commission

21 KENNETH C. ROGERS, Member of the Commission

22 GRETA J. DICUS, Member of the Commission

23 EDWARD McGAFFIGAN, JR., Member of the Commission

24 NILS J. DIAZ, Member of the Commission

25

1 STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:

2 JOHN C. HOYLE, Secretary

3 KAREN D. CYR, General Counsel

4 JOSEPH CALLAN, EDO

5 MALCOLM KNAPP, NMSS

6 JOHN GREEVES, NMSS

7 NORM EISENBERG, NMSS

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

2 [2:07 p.m.]

3 CHAIRMAN JACKSON: Good afternoon, ladies and
4 gentlemen. Today, the Commission will be briefed by the NRC
5 staff on its performance assessment program, which covers
6 three technical areas that are of great importance to the
7 Commission. These areas are low-level radioactive waste
8 disposal, high-level radioactive waste disposal and site
9 decommissioning.

10 The staff made it clear at least year's Commission
11 briefing on this subject that developing a performance
12 assessment model in any one of these three technical areas
13 is a complex and challenging task. I remember your very
14 informative briefing, Mr. Eisenberg.

15 However, the development of high-quality
16 performance assessment models for low- and high-level waste
17 and site decommissioning would enable the Commission to
18 obtain significant quantitative and qualitative input for
19 making risk-informed regulatory decisions on these matters.
20 But we also understand the performance assessment is more
21 than risk assessment.

22 The Commission is looking forward to hearing the
23 new developments in the performance assessment program as it
24 relates to radioactive waste disposal and SDMP sites. If
25 none of my clients have opening comments, Mr. Callan, why

1 don't you proceed.

2 MR. CALLAN: Thank you, Chairman. Good afternoon.

3 Chairman, you covered the points I was going to

4 make in my opening remarks. I will just introduce those at

5 the table. With me are Mal Knapp, the deputy director of

6 NMSS, John Greeves, the director of the Division of Waste

7 Management and, as you introduced him, Chairman, Norman

8 Eisenberg, the senior advisor for performance assessment who

9 works for John Greeves in his division and, as last year,

10 Norm Eisenberg will be the principal briefer.

11 Norm?

12 MR. EISENBERG: Okay, thank you very much.

13 If we could go to slide two, this is an outline of

14 the briefing. I will begin by defining performance

15 assessment, just to get us all on an even footing. Second,

16 because of the Commission focus on PRA, I will discuss the

17 similarities and differences between PRA and performance

18 assessment which we feel is the manifestation of PRA and

19 waste management.

20 Third, I will discuss for each of the Division of

21 Waste Management program areas the PA program recent

22 accomplishments and limitations that we have. And, finally,

23 I will summarize.

24 Performance assessment is a type of systematic

25 safety analysis that explores for a waste facility what can

1 happen, how likely it is and what the impacts of the
2 occurrence are. In this regard, the performance assessment
3 is consistent with the Kaplan-Garrick triple used to define
4 risk. Performance assessment integrates information, number
5 one, across a wide variety of disciplines. We go from
6 inside near the waste package all the way out to the far
7 field in the biosphere so we include disciplines such as
8 corrosion science, geochemistry, radio nuclide transport,
9 hydrology, heat transfer, rock mechanics, the list goes on
10 and on. In addition, PA integrates information across
11 program areas. For example, design information, site
12 characterization information, analytical studies and, of
13 course, our bottom line is regulatory compliance.
14 The term performance assessment as used in the
15 Division of Waste Management encompasses a broad range of
16 quantitative analyses applied to waste disposal facilities
17 and we try to match these analyses to the need.
18 Deterministic bounding analyses are used most often but
19 probabilistic analyses are used for complex facilities or
20 issues like the high-level waste repository.
21 CHAIRMAN JACKSON: Let me ask you a question. I
22 don't want to de-track you but perhaps Dr. Knapp or
23 Mr. Greeves can answer this question. Can you give us some
24 examples of actual regulatory uses that have been made, if
25 there have been any, of performance assessment results and

1 do you have regulatory guidance documents in the performance
2 assessment area that, in fact, you make use of?
3 MR. KNAPP: I will turn to these gentlemen to talk
4 a little bit about the documents but you give me an
5 opportunity to talk about something we did when I was active
6 in this area over 15 years ago. And that was when the
7 Department of Energy was actively investigating the Hanford
8 site, known as PWEB. And we used performance assessment as
9 a basis for debating with them and I believe reaching
10 conclusions that we preferred over the analysis of
11 groundwater at PWEB. That was a very early application of
12 some embryonic things that Norm has subsequently developed
13 in detail. But that is one that comes to mind. Although
14 you might not call it a formal regulatory use, in our
15 interactions with the Department of Energy in high-level, it
16 was a very useful tool.
17 CHAIRMAN JACKSON: It is coming to resolution on
18 some technical issues.
19 MR. KNAPP: Exactly. I am sure they could have
20 other examples but I will turn to John to talk about it.
21 MR. GREEVES: I will try and be brief and give you
22 a couple of examples. One, Norm is going to talk about the
23 branch technical position in low-level waste. That is an
24 example of guidance level use in a regulatory format.
25 Another one is, as you know, with the

1 decommissioning rule, there is a whole set of guidance that
2 needs to lay underneath of that. The staff is working on
3 that guide presently and our goal is to have it available in
4 a timely way. So that is another example.
5 And a third, it might not be quite the example you
6 were looking for but DOE has completed eight performance
7 assessments on ten of their sites and they have a
8 headquarters review group that is, in fact, performing a
9 regulatory function at this point in time in terms of
10 reviewing the performance assessment that was conducted at
11 the site.
12 I am not as familiar as I would like to be with
13 that process but I am told it has many of the elements that
14 we are using and I will just finish with one. We have got
15 the West Valley project facing us in the future so I see
16 these tools being applicable to that in a regulatory
17 environment where we have a direct role.
18 CHAIRMAN JACKSON: Could you speak to the issue of
19 the regulatory guidance documents and the extent to which
20 they either exist or are being developed?
21 MR. GREEVES: As far as the regulatory guidance
22 documents, the principal one that I would point to is the
23 branch technical position. We put out a draft of that in
24 '94, we have been working on it since and you are going to
25 hear Norm talk about it in terms it is about ready to go out

1 the door.

2 Norm, can you add any other regulatory guidance?

3 MR. EISENBERG: Well, there is the --

4 MR. GREEVES: The high-level waste material, the

5 expert elicitation documentation.

6 MR. EISENBERG: Right. Then regulatory decisions

7 have been made on specific cases. I don't know if you

8 recall but last year we talked a little bit about the Curtis

9 Bay facility and as I understand it, either in a few weeks

10 or a few weeks ago they had a public meeting because they

11 are going to take the site off the list. So there is real

12 world regulatory decisions being made.

13 CHAIRMAN JACKSON: Thank you.

14 MR. EISENBERG: Okay, I think we are on slide

15 four.

16 Some points of comparison between performance

17 assessment and PRA. Both are types of safety system

18 analysis and have very similar analytic structures. I will

19 say a little bit more about that later.

20 Although PRA is used as a complement to

21 deterministic requirements for reactor regulation,

22 performance assessment is used to demonstrate compliance

23 with regulatory requirements for waste facilities. In

24 simple cases, it may just be a simple deterministic

25 analysis. Both performance assessment and PRA generally

1 treat the same types of uncertainties related to model
2 parameters. The models themselves and future states of the
3 system or scenarios.
4 Performance assessment and PRA integrate risks
5 from likely and unlikely events and both methodologies are
6 adaptable to the nature of the problems studied. However, I
7 think, the differences from site to site for commercial
8 nuclear reactors is much less than the differences from site
9 to site for waste facilities. There is a lot more
10 variability.
11 CHAIRMAN JACKSON: Are there places where the
12 actual models overlap? I mean, have you ever used similar
13 models or the same types of models?
14 MR. EISENBERG: Certainly in some cases,
15 especially in the area of doses, certainly the fundamental
16 methodologies are similar. However, they must be adapted
17 for the case at hand so we couldn't, for example, use the
18 CRAC code to analyze the volcano extruding waste into the
19 atmosphere from a repository because a very important part
20 of the problem was the interaction of the waste with the
21 magma and the dynamics of the ash plume migration. That is
22 something that isn't in CRAC so it wouldn't do a good job on
23 that.
24 CHAIRMAN JACKSON: I guess what I am really
25 asking, more in terms of kind of probabilistic

1 distributional assumptions of dating the distributions and
2 how things are parameterized, that kind of thing.
3 MR. EISENBERG: I think there may not be a whole
4 lot of similarity in that regard. As I will point out
5 later, both methods use Latin hypercube sampling in order to
6 do a whole --
7 CHAIRMAN JACKSON: Which I am going to ask you to
8 define.
9 And last two quick questions, you know, is most of
10 our performance assessment work done in house? And how many
11 experts such as yourself do we have on staff?
12 MR. EISENBERG: For high-level waste, of course,
13 we share resources with the center and they make a great
14 many contributions to our efforts. For low-level waste, we
15 have used some other contractors to help us but there was a
16 large effort internally. For SDMP work, we are also getting
17 outside contractor help but a lot of work is being done in
18 house. In fact, the case work is largely done in house.
19 MR. GREEVES: I'd like to point out that a number
20 of the staff sitting here with us are the people we rely on
21 in terms of doing this performance assessment, right here.
22 CHAIRMAN JACKSON: So we better not have anything
23 happen to them.
24 MR. GREEVES: We can't afford to have anything
25 happen to them. I would say there is a large amount of the

1 work being done in house and I would also like to point out
2 that research is doing performance assessment. They are
3 developing some tools for us. So there is a lot going on
4 and I am pleased with it, I would like to see more of it.
5 But we will do what we can with the resources we have.
6 CHAIRMAN JACKSON: So six people?
7 MR. EISENBERG: No, I think Keith McConnell is the
8 section leader for performance assessment and I think there
9 are nine or ten people in the section. So that is a core
10 group. But then we take advantage of talents elsewhere on
11 the staff as needed.
12 COMMISSIONER DIAZ: And the center, do we do
13 approximately 50 percent of the work in house?
14 Approximately, a ballpark?
15 MR. GREEVES: I think it is more than half. That
16 would be my assessment. I could get back to you with a
17 better answer.
18 CHAIRMAN JACKSON: Thank you.
19 MR. GREEVES: It is basically the center is the
20 main contractor we use and, actually, we are trying to use
21 them in all three of these areas.
22 CHAIRMAN JACKSON: Okay. Commissioner McGaffigan?
23 COMMISSIONER McGAFFIGAN: Could I ask in
24 comparison with other agencies, you mentioned DOE had done
25 some performance assessments. Does EPA use performance

1 assessment? You know, their norm sites, the coal ash sites,
2 that sort of thing, or any other area? Do they look at the
3 sort of -- develop the sort of models you guys use here?
4 MR. GREEVES: Again, my information is somewhat
5 limited. Maybe Dr. Knapp would like to add to it. But,
6 yes, they are doing things. In fact, one of the tools we
7 are working on, EPA participates in the funding process for
8 one of those we are developing in house. So I know they do
9 some of it. Carl Papierello speaks about it frequently, he
10 likes some of their codes. But, Mal, you want to add to
11 that?
12 MR. KNAPP: I would say there is not an
13 unreasonable amount of overlap in terms of what we try to
14 do. That has, again, gone on for years. But the codes are
15 different.
16 In general, I would say that EPA's codes tend to
17 be a little more generic and a little less site specific
18 than ours. I would argue that ours tend to be a little more
19 realistic than theirs are but I suspect if there were an EPA
20 representative to my right --
21 CHAIRMAN JACKSON: We would hear it the other way.
22 MR. KNAPP: Exactly. But the codes, we have a
23 number of codes that are somewhat in common that differ a
24 little because of our different missions and I think we talk
25 about them and occasionally debate them enthusiastically.

1 As a matter of fact, yesterday in a meeting of
2 discourse, the group on radiation standards, we were talking
3 about how we were going to reconcile some of the differences
4 in codes.
5 CHAIRMAN JACKSON: Did I hear you say that EPA
6 funds some work together with us?
7 MR. GREEVES: We just had a briefing today on a
8 code development process that research has a lead on it and
9 it has been funded by a number of entities, including DOE,
10 EPA and NRC. That funding profile looks a little bit like
11 the budget cycle in the last five or six years but it is a
12 valuable tool that I think could be back giving you more
13 information on when it becomes more useful.
14 COMMISSIONER McGAFFIGAN: Could I clarify whether
15 realistic was a synonym for conservative or stringent? I
16 have heard in this norm case the EPA code is a code that we
17 would love -- well, I am not sure we would love to use
18 because we don't think it is realistic, we think it is too
19 liberal in its assumptions.
20 MR. KNAPP: I don't have a simple answer for that.
21 It would depend on the code and the particular assumptions.
22 Some, we view as more realistic. Of those cases where we
23 feel we are more realistic, in some cases we think that EPA
24 may be nonconservative. Some of our concerns, and I will
25 look to Norm and John to correct me, but in low-level codes,

1 we would say there are some areas where their more generic
2 codes developed earlier were less conservative. But I
3 wouldn't say we are putting conservatism in.
4 If you would like, I would argue that we are
5 realistic and they may be nonconservative. But that might
6 be for two or three variables in the code and the fourth
7 variable it might be either way. It is just there is no
8 simple answer but I would certainly ask either of them to
9 correct me or elaborate.
10 MR. EISENBERG: I think that's right. There is
11 not an across-the-board, simple relationship.
12 CHAIRMAN JACKSON: Okay, why don't you proceed.
13 MR. EISENBERG: I think we are on slide five.
14 I would like to talk a little bit about the
15 approaches in PA and PRA. There are many shared approaches,
16 the structure of the analysis, both have a risk focus.
17 Latin hypercube sampling was adopted by the PRA folks. It
18 was developed in the waste program. Latin hypercube
19 sampling is a type of stratified sampling.
20 Instead of doing strict Monte Carlo -- well, there
21 will be a slide coming up, two slides, where we will talk
22 about doing sampling or propagating uncertainties for
23 consequence models.
24 CHAIRMAN JACKSON: Would it be better to wait,
25 then?

1 MR. EISENBERG: Okay, let's wait. You convinced
2 me.
3 Certainly, also, the categorization and treatment
4 of uncertainties. However, there are some fundamental
5 differences between the systems analyzed in waste and the
6 systems analyzed in PRA for reactors. There are differences
7 in approaches because of the differences in systems.
8 For example, waste systems are largely continuous
9 and their components degrade in a continuous fashion.
10 CHAIRMAN JACKSON: Actually, so do reactors but
11 they are treated discretely.
12 MR. EISENBERG: Yes.
13 CHAIRMAN JACKSON: Some of them do. That's my
14 statement. You don't have to agree.
15 Sorry to throw you off, but go on.
16 MR. EISENBERG: The waste systems have engineered
17 and natural components whereas the reactor is a largely
18 engineered system with natural events possibly impinging on
19 it. The waste facility is often large and dispersed with
20 many similar components like waste packages, while the
21 reactor is a single system with major failure modes
22 affecting the entire system.
23 For example, a single leaking waste package in a
24 repository of 20,000 may not be a major thing. If you have
25 a loss of coolant in the reactor vessel, that's a problem.

1 The mission time for the reactor, say 40 years, is
2 long compared for the time of development of the
3 consequences of a reactor accident, say hours to days;
4 whereas, for a waste system, the mission time, say 10,000
5 years, is comparable to the time of development of
6 consequences, which is also thousands to tens of thousands
7 of years. Thus, for the waste facility, one failure mode,
8 say waste package corrosion, will be overlapped by other
9 failure modes such as an earthquake.
10 For a reactor, these multiple events occurring
11 together are so unlikely they are generally left out of the
12 analysis with good cause.
13 Finally, the waste facilities are largely passive
14 while the reactor has many active redundant safety systems.
15 CHAIRMAN JACKSON: Let me stop you for a second.
16 You are going to talk about how uncertainties are accounted
17 for in the decisionmaking process at the same time when we
18 talk about the Latin hypercube sampling. Is that what you
19 promised?
20 MR. EISENBERG: One slide later.
21 CHAIRMAN JACKSON: Okay. And let me just ask one
22 last question. Can you talk a little about how passive
23 systems are treated probabilistically in performance
24 assessment and would you venture a statement as to whether
25 that approach would also work for passive reactor systems?

1 MR. EISENBERG: We tend to treat the passive
2 systems and their behavior in the consequence analysis
3 because that is really the essence of the waste system
4 behavior. We treat some -- but, of course, we include
5 uncertainties as we will see in a minute.
6 But in terms of probabilistic treatments in terms
7 of conditions that occur or don't occur, these are treated
8 similar to the way external events are for the reactor
9 analysis.
10 We are working on a problem and I hope we are
11 successful trying to develop importance measures for the
12 waste system. Since we don't have a strong embedding in
13 fault tree and event tree analysis, we can't take full
14 advantage of the current methods, the pressure vessel type
15 importance, things like that, and we are trying to develop
16 some other methods. If we are successful, they might be
17 applicable to some of the passive systems in the reactor
18 business also but we are not sure we will succeed.
19 CHAIRMAN JACKSON: Thank you.
20 MR. EISENBERG: Okay. The next figure shows the
21 sequence of analysis for PRA and performance assessment and,
22 as you can see, they are quite similar. The components of
23 the analysis are similar but they are not identical and if I
24 could just take one as an example, the source term analysis
25 in a level two PRA deals with phenomena relating to

1 migration of radio nuclide material from a damaged core to
2 outside the containment structure and those phenomena could
3 include high-temperature chemical reactions of the corium
4 plate-out inside the containment building and leakage
5 through penetrations in the building.
6 For performance assessment, the facility source
7 term involves or could involve corrosion of the waste
8 package, chemical conditioning of the water coming in
9 contact with the waste, dissolution of the waste, and all of
10 that occurs at relatively low temperatures to what might go
11 on inside a reactor vessel. So the structure is quite
12 similar but the components we use in each facet are
13 different.
14 Okay, here comes -- I can't avoid it any longer.
15 This slide attempts to show how a linked chain of
16 performance assessment consequence models with uncertain
17 inputs produces a distribution of performance for the
18 system. In other words, this is variability. Treatment of
19 uncertainty in the inputs is propagated to a distribution of
20 outputs giving you a measure of uncertainty in the output.
21 Just for example, model A could represent the
22 source term with uncertain inputs for things like corrosion
23 rate, the solubility limit, flux into the waste package.
24 Model B might be transport of radio nuclides into
25 groundwater with uncertain inputs for porosity, permeability

1 and groundwater flux. Model C could represent biosphere
2 transport with uncertain variables representing foodstuff
3 intake, irrigation rate variables like that.
4 By sampling these input parameters repetitively,
5 one runs the whole chain of models and gets an estimate of
6 performance related to that particular choice. When you do
7 this hundreds of thousands of times, you get a distribution
8 of performance for the entire system. One way to do that is
9 to do strict Monte Carlo sampling where the input parameters
10 are chosen randomly.
11 We used a method called Latin hypercube sampling
12 which partitions each distribution into segments that are
13 equally probable and we sample from them without
14 replacement. So we have a whole routine to go through in
15 order to generate samples for the inputs that give us these
16 variable outputs. The advantage is that you are assured of
17 covering the entire probabilistic regime with the
18 appropriate probability weights in a much more economical
19 fashion than doing strict Monte Carlo sampling which, of
20 course, is going to sample a whole lot around the mean.
21 CHAIRMAN JACKSON: Do you perform sensitivity
22 studies?
23 MR. EISENBERG: Once we have the distribution of
24 outputs and we have the distributions of inputs, we can then
25 look for correlations which translate into sensitivities.

1 It is kind of a global type of sensitivity rather than
2 sensitivity in a particular point in this multi-dimensional
3 parameter space.
4 CHAIRMAN JACKSON: And how do you identify the
5 dominant contributors to risk for a given scenario?
6 MR. EISENBERG: We have so far looked at these
7 correlations and the ones that come up being having the
8 greatest influence or the highest effect on the output are
9 deemed the ones that are most important.
10 I should say in that regard that the same variable
11 might appear as an input to different models or the inputs
12 to the models might be correlated. So in what I just said,
13 the irrigation rate is related to the rainfall. Well, the
14 infiltration of water into the waste package is related to
15 the rainfall too. So you have these correlations and they
16 have to be taken care of and considered in the sampling.
17 CHAIRMAN JACKSON: What is the role of expert
18 opinion? And then I am going to defer to Commissioner
19 McGaffigan.
20 MR. EISENBERG: Well, I would say expert judgment
21 is used to generate the distributions, the probability
22 distributions for the various parameters, the PDFs. I think
23 it is -- you could almost take as a given in the waste
24 business these parameters are rarely, if ever, measured
25 directly. These are almost always inferential measurements

1 so that if you are interested in the porosity of a geologic
2 unit, one thing you can do is take a piece of core, take it
3 into the lab, push water through it and see what its
4 permeability is.
5 Well, you can also pump water into it and see how
6 much water you can pump into it with a given back pressure.
7 That is another way. So there are all different ways to
8 approach these things and these various lines of evidence
9 have to be integrated and expert judgment plays a strong
10 role --
11 CHAIRMAN JACKSON: -- role in that integration.
12 MR. EISENBERG: And interpreting these fundamental
13 data into the inputs for the performance assessment.
14 CHAIRMAN JACKSON: Commissioner McGaffigan.
15 COMMISSIONER McGAFFIGAN: I am not sure this is
16 the right time to ask this but Latin hypercube sampling
17 versus Monte Carlo, what biases get introduced? I mean, I
18 understand Monte Carlo. I haven't studied Latin hypercube.
19 If you have the same graphs for the various models
20 and you run it, how close do they come to each other?
21 MR. EISENBERG: If you are able to take enough
22 samples, and there is an art to determining how many
23 samples, and in fact sometimes what we do is we run 200 and
24 then we run 400 and if the answer doesn't change very much
25 we say, well, 200 is good enough.

1 But the answer is, if done properly, there should
2 be no biases introduced because you are using the same
3 probability distributions; you are just using an economical
4 way of sampling.
5 CHAIRMAN JACKSON: It's the sampling, right.
6 MR. KNAPP: One of the ways I think of it is if
7 you use Monte Carlo with the same numbers as Latin
8 hypercube, there is a risk that when you generate your final
9 response surface there might be some holes in it. Just by
10 virtue of where you picked your initial parameters there is
11 an area where you don't have very much data.
12 Whereas, by Latin Hypercube, you would tend to get
13 a better distribution among your input parameters so you
14 would have more confidence in the response surface for the
15 same number of runs. And runs can be in the -- not now as
16 much as they used to be. But they can be expensive. So
17 anything you can do to run fewer runs and still have high
18 confidence is very valuable.
19 That was what was the basis for the development of
20 Latin hypercube.
21 CHAIRMAN JACKSON: But now with workstations --
22 MR. KNAPP: you know, it is interesting that 20
23 years ago we had models that were right on the ragged edge
24 of what workstations could do and 10 years ago. So even
25 today, as the models are developed with, I think, some very

1 good results from what has been done in the last year or so,
2 Latin hypercube is still a valuable asset.
3 CHAIRMAN JACKSON: Let me ask you two last
4 questions.
5 Can you describe the peer process for your
6 performance assessment program? Peer review.
7 MR. EISENBERG: Well, of course, let me talk about
8 high-level waste. There, we have usually a team of
9 performance assessment analysts plus other required
10 disciplines that are doing the study. Quite often or
11 universally before it goes out it is given distribution to
12 other staff that have not been involved for internal peer
13 review as well as the normal management review.
14 We have always issued our performance assessments
15 for review in public and we published papers on it and peer
16 reviewed the literature.
17 CHAIRMAN JACKSON: And perhaps either Dr. Knapp or
18 Dr. Greeves, you know, NMSS has done considerable work on
19 expert elicitation in the high-level waste program and so
20 you have obviously developed a strong knowledge base. Have
21 you passed along any of this to NRR and Research?
22 MR. KNAPP: My understanding is that we have and
23 are but I would certainly turn to John and Norm to talk
24 about specifics.
25 MR. EISENBERG: Yes. First of all, when we were

1 developing the BTP on expert elicitation, we passed it
2 around to all the other offices in the agency and we
3 certainly have made it available to them and they indicate
4 that they use it as it seems to apply in their work and we
5 of course participate in the PRA coordinating committee and
6 the subject comes up there and is discussed.
7 MR. GREEVES: The real key is DOE is using this
8 process, as they indicated this morning. And it has, I
9 think, been a valuable tool.
10 CHAIRMAN JACKSON: Thank you.
11 MR. GREEVES: I think Norm probably has that later
12 in a slide, too.
13 MR. EISENBERG: Okay, if I could just make one
14 more point on slide seven --
15 CHAIRMAN JACKSON: You're taking a chance.
16 [Laughter.]
17 MR. EISENBERG: I would say that a distribution of
18 the output is produced and it may be some normalized
19 releases or individual dose, whatever. But because the
20 uncertainties are large for many waste facilities, some
21 realizations will exceed the regulatory limit, almost
22 always. This means that the staff has to provide reasonable
23 but protective limits for compliance and must use
24 appropriate statistical criteria to determine compliance.
25 Given that the performance of the system is represented as a

1 distribution.

2 For example, in the low-level waste PA BTP,
3 compliance is based on the mean of the distribution of dose
4 plus there is a cap on the ninety-fifth percentile of the
5 dose distribution. So that is the kind of thing we will be
6 facing here and, I expect, for decommissioning in the
7 future.

8 Slide eight.

9 The evolution of PA as a programmatic tool can be
10 described in four stages. Method development began in the
11 mid-'70s with the same group at Sandia National Labs that
12 was doing the pioneering work on the reactor safety study.
13 From that, we got insights into the repository system and it
14 helped to formulate Part 60.

15 Second, we entered a demonstration of capability
16 phase in the mid-'80s to early '90s. It helped to identify
17 R&D needs and the need for integration across the various
18 disciplines.

19 We are now in a mode of applying PA to high-level
20 waste. It is an integrated technical basis for interactions
21 with the Department of Energy. It is an input to rule
22 development and it is helping to set NRC program priorities.

23 Another stage that we entered very recently is the
24 high-level waste tools and methods have been adapted for
25 other waste applications and those include things like the

1 low-level waste performance assessment working group which
2 started in 1990 and continues to now, the development of the
3 PA branch technical position on low-level waste,
4 demonstration of the test case and some applications in SDMP
5 which began in 1995.
6 Slide nine, please.
7 Performance assessment supports the Division of
8 Waste Management mission in decommissioning, low-level waste
9 and high-level waste. For decommissioning, the goal is
10 evaluation of options for remediation and decommissioning.
11 For most cases, simple analyses suffice. For complex sites,
12 we perform analyses to support the NEPA process.
13 For low-level waste, we are providing guidance and
14 support for state regulators and are attempting to maintain
15 an NRC review capability.
16 For high-level waste, our focus in the proposed
17 Yucca Mountain repository, of course. Two main areas of
18 activity are analyses to support high-level waste
19 regulations including those for interactions with EPA and
20 interactions with DOE on important stages of the program,
21 viability assessment, recommendation of the site to the
22 President and, of course, licensing.
23 Slide 10, please.
24 Now, I am going to begin the description of
25 performance assessment in the three Division of Waste

1 Management program areas. For decommissioning performance
2 assessment, we try to fit the analysis method to the problem
3 at hand. As I have said before, simple analyses for simple
4 problems, complex tools when we have to.
5 We do a probabilistic treatment to the extent
6 appropriate of source term which, as I mentioned before, is
7 highly variable for the decommissioning sites, for
8 environmental transport and for the dose calculations and
9 the decommissioning PA because it is involved in NEPA has to
10 consider chemical as well as radiological effects.
11 Slide 11.
12 Recent progress and plans in decommissioning PA.
13 We have a draft methodology for performance assessment
14 applied to SDMP sites, we got a draft methodology in January
15 and will be briefing the ACNW next week. This methodology
16 includes the ability to evaluate sites under the new
17 decommissioning rule. Those sites which will not be
18 releasable for unrestricted use.
19 We have a very preliminary analysis of the no-
20 action alternative for Sequoyah Fuels and Sequoyah is being
21 used as a test case to evaluate this draft methodology.
22 We have published a draft EIS for the Shieldalloy
23 site in 1996. There is a public meeting scheduled for
24 September and a preliminary final environmental impact
25 statement for July. This is an example of the failure of

1 institutional controls.

2 We have a preliminary analysis for Parks Township

3 with a plan to publish the draft EIS in July of '97 and the

4 final in March of '98. That analysis includes a

5 probabilistic analysis of the well location for an intruder.

6 MR. GREEVES: Which the staff is conducting. It

7 is the staff making these calculations.

8 MR. EISENBERG: Slide 12.

9 Now going to the scope for low-level waste PA, we

10 developed methods to treat uncertainty, especially the

11 propagation of parameter uncertainty, developed process

12 level models to describe the performance of various

13 components and for low-level waste you have the unique thing

14 is the engineered component such as cells and covers.

15 We have a flexible overall performance assessment

16 methodology. It is an iterative approach that links site

17 characterization, design and performance assessment.

18 Individual dose is the compliance end point and to date it

19 has been applied only to hypothetical sites and designs.

20 Recent progress and plans, the draft BTP on low-

21 level waste performance assessment will be ready for

22 public -- issued for public comment momentarily. The -- we

23 have assisted in the reviews of the Nebraska low-level waste

24 state regulatory program and plan to participate in the

25 IMPEP review for Texas in June and provided assistance as

1 called on by states for their low-level waste regulatory
2 program.
3 Slide 14.
4 The scope for high-level waste PA, we have to
5 treat both the undisturbed repository and disrupted
6 repository with associated probabilities. We have to
7 consider the entire chain of consequence models, if you will
8 recall the earlier chart. In some decommissioning work you
9 can get away with a subset if you make very conservative
10 bounding assumptions about pieces of the system. In high-
11 level waste, we have to look at everything.
12 We do a probabilistic treatment for model
13 parameters and future states which, of course, lead to
14 scenario classes, things like climate change, earthquakes
15 and vulcanism.
16 The potential regulatory changes, that is a new
17 standard based on the current law or on proposed
18 legislation, may reorder the importance of subsystems and
19 issues. For example, currently proposed legislation and the
20 NAS recommendations both would treat human intrusion as a
21 separate stylized calculation whereas the current standard
22 causes it to be incorporated into the distribution of total
23 system performance. This reemphasizes the need for flexible
24 quantitative performance assessment methods.
25 Slide 15.

1 We have two slides of recent progress and plans.
2 In May 1996, we had a technical exchange on DOE's
3 latest total system performance assessment, TSPA-95, which
4 resulted in general agreement on the importance of
5 infiltration and establishing the basis -- having a strong
6 basis for mixing depth assumptions in the dilution analysis.
7 We have reached general agreement with DOE on the
8 use of expert elicitation. The branch technical position
9 was published in November of '96. DOE adopted the BTP for
10 their work, as they indicated in their statement that they
11 gave today.
12 NRC and center staff have been observing the
13 ongoing expert elicitations on volcanism, seismic hazard,
14 unsaturated flow and other topics as they are progressing.
15 CHAIRMAN JACKSON: Now that the DOE has come out
16 of the mountain, they have completed their principal
17 tunneling, I don't know what the status is of the various
18 alcoves within the ESF but have you been able to use any of
19 the site-specific data in your models?
20 MR. EISENBERG: Yes. Maybe the best example is
21 that there has been a long-running controversy over what the
22 infiltration rate is in the Yucca Mountain repository and
23 whether the flow from the surface is localized in fractures
24 or whether it is spread out in the matrix and the chlorine
25 36 measurements in the tunnel seem to indicate that indeed

1 there are areas where the flow is focused.

2 CHAIRMAN JACKSON: So you have been able to

3 actually fold that into your model?

4 MR. EISENBERG: Yes. And as more information is

5 available, they are the principal processors of the

6 information. But as it becomes available to us, we fold it

7 into our models.

8 They have also been gathering information on the

9 structure of the geology in the region, as evidenced also

10 under ground and that has also been folded in.

11 Okay. Slide 16.

12 We have another area of progress that we have

13 provided analysis to EPA for evaluating the implementability

14 of draft rules. We had information exchange meetings last

15 spring. Some summary analyses of this implementability

16 nature were published in the annual report for high-level

17 waste which you heard about yesterday and Wes Patrick spoke

18 to that.

19 We expect to more fully document these analyses in

20 a NUREG coming this year.

21 Finally, we have a more user-friendly total system

22 performance assessment code. It facilitates use by a

23 broader segment of the staff. We have a beta testing

24 version that was delivered on March 17. It is under review.

25 We are currently running the TSPA code or the total system

1 PA code. We call it the TPA code, on a Sun workstation. It
2 was formerly run only on the Cray supercomputer and we
3 anticipate that this rapid local response will facilitate
4 the analysis.
5 CHAIRMAN JACKSON: This is the code developed by
6 the center?
7 MR. EISENBERG: Well, it was developed jointly by
8 the center and the NRC staff.
9 Okay, moving into the summary and the look
10 forward, first some generic points.
11 Guidance on the use of performance assessment,
12 which is, as I claimed, the waste management version of PRA,
13 will consider the complexity, the safety issues, the
14 availability of the data and the capabilities of the
15 licensees and I believe that is consistent with the PRA
16 implementation plan.
17 We will continue a program of PA training for the
18 NRC staff.
19 We have teamed new hires with experienced PA
20 staff. The staff as well as the tools which are the
21 computer codes and the computer facility are essential
22 ingredients to provide a technical basis for making risk-
23 informed regulatory decisions in the entire waste management
24 program.
25 Declining funding is a challenge which we are

1 trying to address by the use of more powerful computing
2 tools and enhanced staff training.
3 Now, for some specifics, in decommissioning, we
4 have tried to achieve a degree of optimization by applying
5 the staff experience in PA, both high level and low level,
6 to the complex decommissioning sites. Under the current
7 regulatory regime and the current schedule, PA is providing
8 analyses for about a third of the complex sites requiring
9 site-specific environmental impact statements. The
10 remainder of the sites are on backlog.
11 Low-level waste --
12 CHAIRMAN JACKSON: They are on backlog in terms of
13 your being able to provide the analysis.
14 MR. EISENBERG: That's right.
15 CHAIRMAN JACKSON: Because of your resources.
16 MR. GREEVES: Let me jump in a little bit. As you
17 know, there are a large number of these sites. Fortunately,
18 not all of them are the "large" sites but nominally we have
19 about 13 large sites.
20 We are working aggressively on Parks Township, you
21 have heard about that, we have briefed you on that. The
22 Sequoyah Fuels site, we are actively looking at making that
23 a trial run on the test case. Another one, the West Valley
24 site is going to be challenging us early on.
25 The point is, we have 14 of these sites and we are

1 working aggressively on three. I don't know how we would
2 handle any more than that at any one point in time. So
3 these others are there. The owners of these sites are
4 developing their plans. If they all come in at once, that's
5 the problem. So we are pretty thin.
6 CHAIRMAN JACKSON: You can say that again for the
7 record.
8 MR. GREEVES: The staff is thin. Stretched.
9 [Laughter.]
10 MR. GREEVES: I would be happy to go further.
11 CHAIRMAN JACKSON: No, that's fine. I think
12 you've gone far enough.
13 [Laughter.]
14 MR. EISENBERG: On low-level waste, we plan to
15 respond to comments on the BTP and finalize ti as resources
16 permit, pursuant to the direction-setting issue number five.
17 COMMISSIONER DICUS: Could I ask you a question
18 about that? Is that, given the fact the resources permit is
19 a qualifier but is that on track or is that going to be
20 delayed?
21 The states, I understand, were rather critical
22 about that.
23 MR. GREEVES: Yes, there are some states that have
24 been critical of it. I think the view is mixed. But even
25 at the recent low-level waste forum meeting, a number of the

1 states said, where is it. In fact, they would love to have
2 had us come in, some of them, would love to have us come out
3 and brief at this forum meeting.
4 But when you are working on these sites over here
5 and people are putting in extra hours, it is hard to keep up
6 with the BTP. I would have hoped that we could have gotten
7 it out before this and called it a product. It is right
8 there in terms of going out through the door.
9 But an example, to answer your question, there was
10 also the test case which we wanted to go with the BTP. We
11 can't get the test case done. The documentation is showing
12 how to implement the branch technical position.
13 CHAIRMAN JACKSON: How far behind are you on that,
14 roughly?
15 MR. GREEVES: In which?
16 CHAIRMAN JACKSON: When do you see yourself
17 getting to the point of --
18 MR. GREEVES: I don't see us finishing the test
19 case.
20 CHAIRMAN JACKSON: You don't see finishing it at
21 all?
22 MR. GREEVES: Keith?
23 CHAIRMAN JACKSON: Can you talk about the test
24 case again, Dr. Greeves? They want to --
25 MR. GREEVES: Could I ask Keith to come up to the

1 table? He is more familiar with it --

2 CHAIRMAN JACKSON: Sure.

3 MR. McCONNELL: My name is Keith McConnell. I am
4 the section leader for performance assessment. I would say
5 right now we are several months behind on BTP itself. The
6 original SRM that we got asked us to come back to the
7 Commission in August of this year and we are just about
8 ready to go out for public comment, as I have said, and we
9 are looking at a 90-day public comment period. We expect,
10 as people are aware, a significant number of comments and
11 some tough issues to address before we come back to both the
12 ACNW and the Commission.

13 The test case, we have used it, we have used the
14 results of it quite a bit but we are not staffed to do the
15 documentation. I would say that extends into fiscal year
16 '98.

17 MR. GREEVES: This is a program that has 10 to 20
18 FTE back in the early '90s and with the DSI-5, we are at
19 four FTE and, frankly, the West Valley site came in on top
20 of us and it is a real challenge. So it is going to have
21 first bidding in terms of these kind of resources.

22 Mal, do you want to --

23 MR. KNAPP: The only thing I would say is I don't
24 want to belabor issues which we visited in strategic
25 assessment, recognizing things like low-level waste sites by

1 and large are being developed in agreement states,
2 recognizing what our limitations are and what we are trying
3 to do.
4 I think what we have here is responsive to the
5 spirit of the SRM on DSI-5. That is the best I can do.
6 COMMISSIONER McGAFFIGAN: The test case, is that a
7 real case or what do you mean by a test case? I am just not
8 familiar. Is it a low-level waste site, a real site, that
9 you are applying the BTP to?
10 MR. McCONNELL: It is a hypothetical site.
11 COMMISSIONER McGAFFIGAN: It is a hypothetical
12 site?
13 MR. McCONNELL: It is a hypothetical site for
14 humid conditions with a realistic source.
15 MR. KNAPP: Understand it is hypothetical
16 deliberately because, were we to pick a real site, there
17 would be implications with our results.
18 CHAIRMAN JACKSON: Okay.
19 MR. EISENBERG: Okay. Slide 19.
20 Clearly, in high-level waste we have moved from a
21 demonstration of PA capability to heavy usage of it in
22 support of programmatic goals. We will invest in
23 refinements to our computing capability, especially our
24 total performance codes, only to the extent that such
25 refinements are expected to have a significant impact on

1 performance.

2 Our near-term focus for performance assessment is

3 developing a technical basis for the new high-level waste

4 rules. Early feedback to DOE on the total system

5 performance assessment for the viability assessment, we have

6 been doing this. We have been attending abstraction

7 workshops and expert elicitations. We plan a technical

8 exchange with DOE, as you heard earlier today, in July on

9 their approach for the total system performance for

10 viability assessment and we expect to receive the PA for

11 viability assessment in September of '98. At the requested

12 budget level, we plan to use PA to help prioritize our KTIs.

13 CHAIRMAN JACKSON: Commissioner Rogers?

14 COMMISSIONER ROGERS: Yes.

15 To what extent are licensees able to use

16 performance assessment for decommissioning, particularly

17 those sites which are not the biggies that represent an

18 organization with a lot of capability and a lot of

19 resources? Is it a tool that is actually useful for

20 licensees to adopt or is it just something that we have to

21 sort of retain for our own purposes and share basic

22 conclusions from it with licensees.

23 In other words, can they -- you know, it seems to

24 me this has taken us a long time and a lot of hard work to

25 get where we are and I don't quite see how a garden variety

1 licensee could do it at all and so how do we couple that
2 into the activities of licensees other than to evaluate
3 their plans when they have gotten them together? Is there
4 any way this can be used to assist them in analyzing their
5 own sites?
6 MR. EISENBERG: Well, remember that we are using
7 performance assessment in a programmatic sense that covers a
8 wide variety of analytic techniques and at various levels of
9 complexity so I would tend to agree that, for some
10 facilities, it is inappropriate and the licensees would not
11 use these very complex tools nor would they try to maintain
12 a capability to do so.
13 However, for some of the sites, they are doing
14 very complex analyses because that is what the problem calls
15 for.
16 COMMISSIONER ROGERS: I guess what I am trying to
17 get at, is there any way that this very specialized
18 expertise that we are developing here now could somehow or
19 other be partly digested and fed to licensees so that they
20 could use bits and pieces of it? In other words, through
21 some kind of guidance or some technical reports or something
22 that they could actually use?
23 MR. GREEVES: Let me try for a minute.
24 This is what I view as a graded process. There
25 are a number of licensees out there now that use the RESRAD

1 approach. RESRAD is a code, it's out there, DOE does
2 briefings, people go around the country. And our staff uses
3 RESRAD. I think what Norm was portraying was, use the
4 simplest tool you can and if you can satisfy the criteria
5 then you're out.
6 So we have sites where we run the RESRAD code, the
7 licensees, they are capable of running that, many of them,
8 if they hire the right consultant. So that one is a fairly
9 first-level type of approach.
10 Separately, we mentioned earlier on, we got this
11 decommissioning rule that we are expecting to deal with and
12 we are putting in place guidance on how to deal with that.
13 So the goal is, within a period of time, that we would have
14 some tools out there, and you probably heard about the D&D
15 code that would allow people to determine what the
16 concentration is, if they have a single isotope and is there
17 a way we can come up with a concentration for that. And
18 then it gets more complicated as you go on. So I think we
19 have between three and four levels.
20 Most of what Norm was talking about here today was
21 the fourth level, the third and the fourth level. It is
22 more complicated. The probabilistic distributions, et
23 cetera. There are a couple of levels above that that we do
24 need to get out to the licensees that I think, you know,
25 within the next year we will have some of that. There are a

1 few tools like RESRAD out there now and, also, under the
2 action plan, the licensee could come in and use a 30
3 microcurie per gram uranium. He doesn't have to do a
4 performance assessment. What he has to do is go in and do a
5 survey and show he is under 30 micorcuries per gram of
6 uranium or 10 microcuries per gram of thorium. So it is
7 what I call a graded approach to a regulatory process and I
8 think it will be better after we get this guidance out that
9 is coming underneath --
10 CHAIRMAN JACKSON: So you are working on this?
11 MR. GREEVES: Yes, we are. And I would expect the
12 next time we brief you, we will include that.
13 CHAIRMAN JACKSON: Have more to say?
14 MR. GREEVES: Excuse me?
15 CHAIRMAN JACKSON: You will have more to say on
16 that?
17 MR. GREEVES: Yes.
18 CHAIRMAN JACKSON: Commissioner Dicus.
19 COMMISSIONER DICUS: I understand that there have
20 been some differences in the use of PA between DOE and NRC,
21 particularly like waste package lifetime. I wonder if those
22 differences still existed and, if so, are they particularly
23 significant? Are we going to try to resolve them?
24 MR. EISENBERG: Well, of course, we are trying to
25 resolve them. This is part of the meetings that we attend

1 with them and the technical exchanges that we have with
2 them.
3 I think, and Chairman Jackson asked the question
4 how the PAs for DOE and NRC compare this morning.
5 I would say that there are three areas that need
6 to be discussed in terms of comparability. There is the
7 results of the performance assessment. That is, the
8 estimates of performance of the system. There is the
9 overall methodology and approach and how comparable those
10 are. Then there are the specifics of the models and
11 parameters and assumptions that are used to describe the
12 various components of the system, so I think there are those
13 three levels.
14 In terms of overall performance, generally we
15 have, and it is probably because it goes with the territory,
16 come up with higher doses, worse performance for the system,
17 than DOE. Right now, based on the last analyses available,
18 it is one to two orders of magnitude for the average dose in
19 the undisturbed case. So that is one answer.
20 A second aspect of the answer is that the methods
21 that are used are quite comparable. They share an awful lot
22 in common. There is a little wrinkle regarding the
23 treatment of scenarios and how disruptive events are treated
24 but I expect we will be working on ironing that out with
25 them.

1 The real differences start to arise in the various
2 areas of assumptions and parameter ranges and models and
3 some of the significant differences based on their most
4 recent analysis which, of course, we expect to see some
5 changes in the one for the viability assessment, is that
6 they placed a lot of reliance on matrix diffusion. That is,
7 they assumed that the flow in the fracture and radio nuclide
8 transport in fractures was tied very heavily and integrated
9 with the flow and transport in the matrix. That had the net
10 result of slowing down the migration of the radio nuclides.
11 We didn't. We didn't assume -- we weren't so
12 positive. So that is a difference that we need to see
13 worked out. There has been an historical difference in
14 assumptions on infiltration rates and, as you heard this
15 morning, we are coming together. They seem to be moving up
16 into the area where we have been.
17 Another area of concern is the potential for
18 dilution and how much dilution you can take credit for at
19 Yucca Mountain and how the entire process works and the one
20 thing we also feel needs to be worked on is the consequences
21 of volcanism. We have made a lot of progress in closing on
22 the probabilities but we need to maybe look some more at
23 consequences.
24 So there are certain areas where there are
25 differences and we expect to continue to pursue that.

1 CHAIRMAN JACKSON: Commissioner Diaz.

2 COMMISSIONER DIAZ: On something that you said,
3 you said there is one to two orders of magnitude difference
4 between dose assessment?

5 MR. EISENBERG: Between the expected dose in the
6 undisturbed repository case.

7 COMMISSIONER DIAZ: Can you give me an idea of
8 where they lie in absolute value?

9 MR. EISENBERG: TSPA-95 at five kilometers had
10 four-tenths of a millirem and NRC doing an analysis for one
11 of these EPA analyses got 23 millirem.

12 CHAIRMAN JACKSON: That is a large difference.

13 Commissioner McGaffigan.

14 COMMISSIONER McGAFFIGAN: You may regret making
15 the last remark you did on page 7 but the essence of your
16 remark was when you are dealing with the performance measure
17 you end up with the distribution and you end up having to
18 regulate the mean and the 95 percent confidence interval.
19 That set me to thinking about last week's briefings from NRR
20 and the various documents we are about to put out where we
21 are dealing with issues like 10 to the minus 6 probability
22 of core damage frequency and what that really means.

23 Is there interaction between -- we were looking
24 for things like 95 percent confidence intervals. In fact, I
25 think those words were used by the Chairman last week.

1 Is it appropriate to use some of these same
2 techniques in NRR space that you are using in NMSS space?
3 That may be the Chairman's question.
4 CHAIRMAN JACKSON: No, you didn't. You are
5 following on my earlier question about sharing.
6 MR. EISENBERG: Well, certainly John Austin has
7 been participating in PRA coordinating committee and we have
8 been following what has been going on over there. But
9 remember --
10 CHAIRMAN JACKSON: They have been following what
11 you have been doing I think is really more the question.
12 MR. EISENBERG: We go more directly to the issue
13 which is what is the dose. You are using surrogates like
14 large early release frequency and things like that.
15 CHAIRMAN JACKSON: Right, but I think the message
16 is you are dealing with this issue of what it means to
17 regulate the mean at a certain confidence interval. And
18 that is what we have been pressing in reactor space and I
19 think that may be -- he and I talk back and forth, but --
20 COMMISSIONER McGAFFIGAN: That is what I am trying
21 to get at. It sounds like the technique you have come up
22 with here may have some application there in terms of
23 telling us something about confidence around means.
24 MR. GREEVES: This is part of the branch technical
25 position and we expect to get some comments on this too.

1 The low-level waste branch is the one that is going to go
2 out and we may learn something through the comment process.
3 COMMISSIONER McGAFFIGAN: NRR might learn
4 something too.
5 CHAIRMAN JACKSON: Okay, well, thank you very
6 much.
7 The Commission wishes to thank you for an
8 excellent and a very informative briefing. Mr. Eisenberg,
9 you are setting very high standards here. You can never
10 fall from this particular perch on your performance
11 assessment program. And, as I had indicated earlier, these
12 are areas of great importance to the Commission. Evaluation
13 of long-term performance of low-level waste disposal, high-
14 level waste disposal and site decommissioning, as you have
15 illustrated so amply is not a simple task. But it would
16 appear that, based on today's briefing, you are really
17 making real progress and have a much better sense of that on
18 developing models that should allow us to characterize site
19 performance.
20 I am particularly struck by the synergy that seems
21 to have developed between the low-level waste program and
22 the SDMP program and you are to be commended for that and
23 that appears to be an excellent approach. It is useful in
24 both areas and they can play off each other.
25 So the Commission encourages you to continue to

1 develop this program and particularly as you develop the
2 ability to do these assessments on other platforms and, as
3 you have just heard, to interact and share the knowledge you
4 have gained in this area both with others within the NRC who
5 are developing PRA models as well as on the outside, to the
6 extent it makes sense through the appropriate regulatory
7 guidance.
8 These kinds of interactions among our staff can
9 improve the final products for all that are involved in
10 these developmental efforts and allow us to potentiate our
11 resources when we have a lot of work, as you have outlined,
12 Dr. Greeves, on our plates but yet are in a budgetarily and
13 a programmatically constrained system. But it has to be
14 optimized.
15 So you might consider further the development of
16 base line regulatory guidance even beyond your branch
17 technical position as well as the simple perhaps modular
18 pieces of your codes or other products that could be used by
19 licensees to expedite the processes, particularly as they
20 relate to decommissioning.
21 Thank you.
22 Unless we have further comments, we are adjourned.
23 [Whereupon, at 3:13 p.m., the briefing was
24 adjourned.]
25

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 PERFORMANCE ASSESSMENT PROGRESS IN HLW, LLW AND SDMP - PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Thursday, May 15, 1997

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

Transcriber: Christopher Citchall

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STAFF BRIEFING ON THE STATUS OF THE PERFORMANCE ASSESSMENT PROGRAM

Norman A. Eisenberg
Office of Nuclear Material Safety and Safeguards
Division of Waste Management
U.S. Nuclear Regulatory Commission

May 15, 1997

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OUTLINE OF BRIEFING

1. What is Performance Assessment (PA)?
2. PA and Probabilistic Risk Analysis (PRA)
3. Scope, accomplishments, and limitations in the use of PA
   - Site Decommissioning Program
   - Low-Level Waste Program
   - High-Level Waste Program
4. Summary and look ahead

WHAT IS PERFORMANCE ASSESSMENT?

- A type of systematic analysis:
  1. What can happen?
  2. How likely?
  3. What are impacts?
- Integrates information
- Provides quantitative estimates of performance
- Performance Assessment is matched to need:
  - Deterministic, bounding analyses for most issues
  - Probabilistic analyses for more complex problems, with large uncertainties

PA & PRA: POINTS OF COMPARISON

- Similar analytic structure
- Regulatory framework
  - PRA is a complement to deterministic requirements
  - PA used to demonstrate compliance; may reduce to deterministic for simple problems
- Types of uncertainty: parameter, model, scenario
- Probabilistic Analyses
  - PA and PRA consider likely and rare events
- Both are adaptable to hazards and complexity of application
  - Reactors have similar complexity and hazard
  - Waste facilities are very diverse

PA & PRA: APPROACHES

SHARED APPROACHES

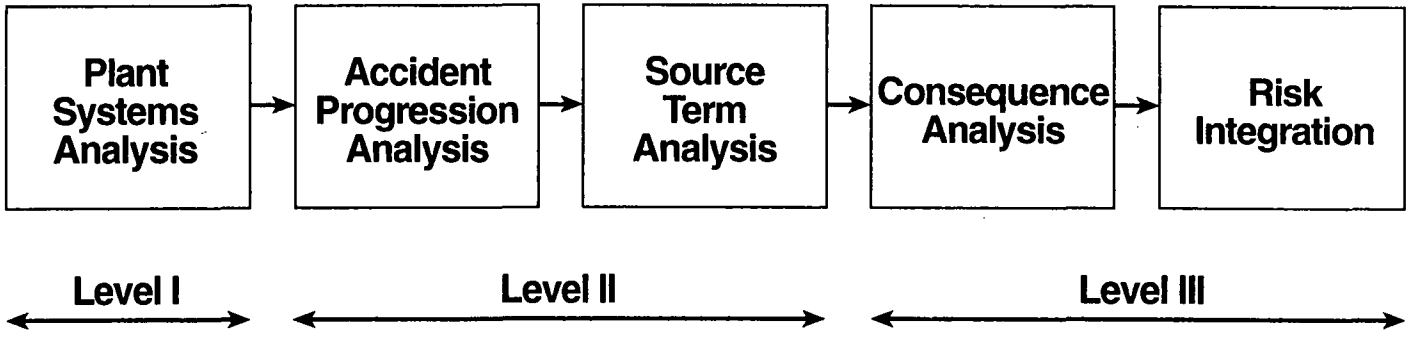
- Structure of analysis
- Risk focus
- Latin-Hypercube Sampling (developed in waste program)
- Categorization and treatment of uncertainties

ASPECTS REQUIRING DIFFERENT APPROACHES

- Continuous versus discrete failure
- Waste system with natural and engineered components
- Large dispersed system comprised of many similar components versus single, coherent system
- Continuously evolving system with overlying failure scenarios versus generally independent failure modes
- Largely passive system versus many active, redundant safety systems

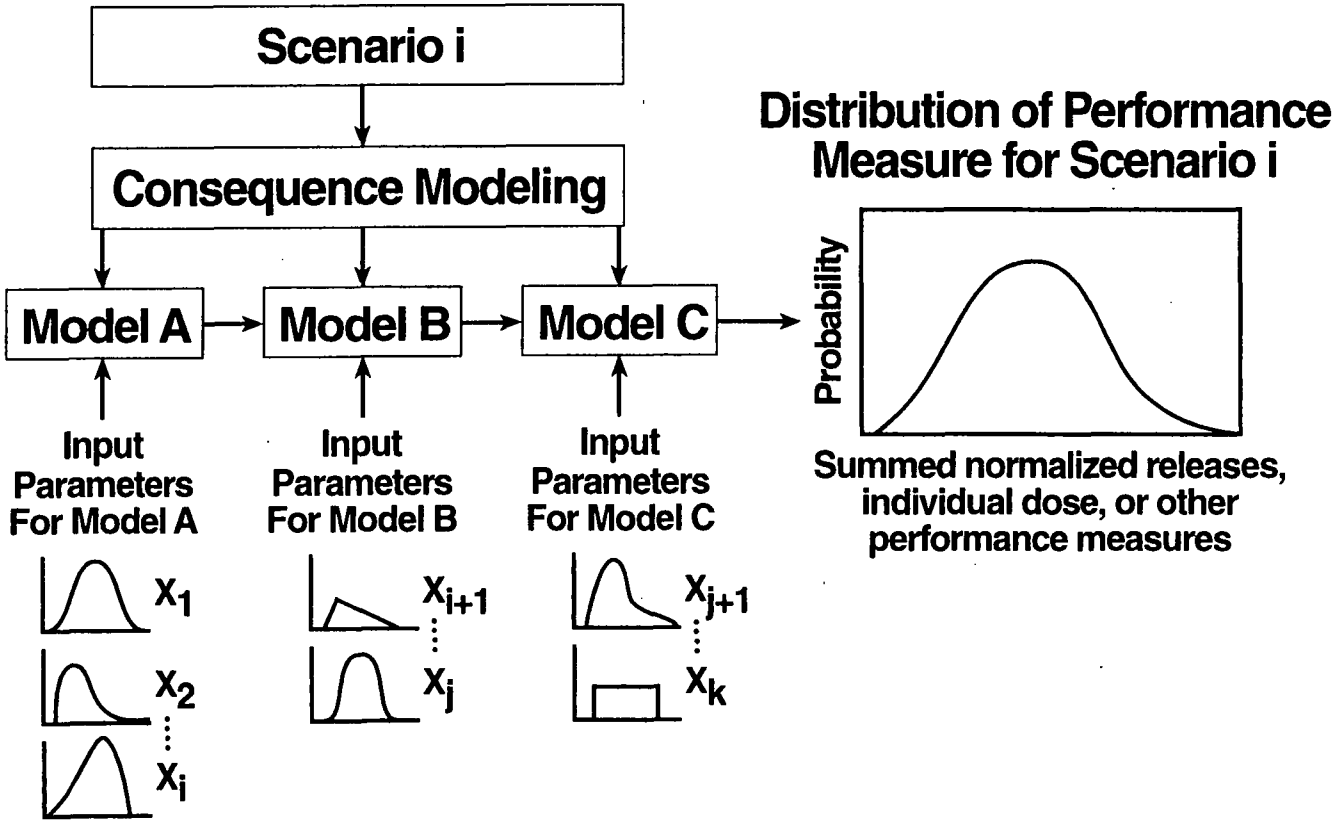
PRA & PA ANALYSIS SEQUENCES

PRA ANALYSIS SEQUENCE



PA ANALYSIS SEQUENCE

PROPAGATION OF INPUT PARAMETER UNCERTAINTY IN PA



EVOLUTION OF PA AS A PROGRAMMATIC TOOL

- Method development for HLW (1976-84)
- Demonstration of capability (1985-92)
- Application to HLW (1992-now)
- HLW tools and methods adapted for other waste applications

PA SUPPORTS DWM MISSION

DECOMMISSIONING:

Analyses evaluate remediation and decommissioning options

- Simple analyses for most decommissioning
- NEPA analyses for complex sites

LLW:

Methods, guidance, and technical support for state regulatory authorities; development of NRC review capability

HLW:

Performance assessment of the proposed Yucca Mountain repository:

- Analyses for HLW regulations
- Viability Assessment, Site Recommendation, Licensing

DECOMMISSIONING PA: SCOPE

- Fit analysis method to the problem:
  - simple cases: bounding, deterministic analyses
  - significant issues: complex tools
- Probabilistic treatment, to the extent appropriate, of:
  - source term
  - environmental transport
  - dose calculations
- Considers chemical, as well as radiological, impacts for NEPA analyses

DECOMMISSIONING PA: RECENT PROGRESS & PLANS

- Methodology developed for PA in support of SDMP
  - Draft Methodology - January 1997
  - ACNW briefing on Draft Methodology - May 1997
- Very preliminary analyses of no-action alternative for Sequoyah Fuels Corporation facility - April 1997
- Publish Draft EIS for Shieldalloy Site - July 1996
  - Public meeting - September 1996
  - Preliminary FEIS - July 1997
- Preliminary analysis for Parks Township
  - Preliminary EIS June 1996
  - Publish DEIS - July 1997
  - Publish FEIS - March 1998

LLW PA: SCOPE

- Developed methods to treat uncertainty
- Developed process-level models and codes to describe performance of various system components
- Flexible overall performance assessment methodology
- Individual dose is compliance measure
- To date, applied to hypothetical sites and designs

LLW PA:
RECENT PROGRESS & PLANS

- Draft BTP on LLW PA for public comment
- Assisted in review of Nebraska and Texas LLW state regulatory programs
- Provided technical assistance on particular issues, as requested by state regulatory programs

HLW PA: SCOPE

- Undisturbed repository performance and disruptive events and processes, with associated probabilities
- Consider the entire chain of consequence models
- Probabilistic treatment for model parameters and future states
- Focussed on performance of proposed Yucca Mountain repository
- Potential regulatory changes may reorder the importance of subsystems and issues; reemphasizes need for a flexible, quantitative performance assessment tool.

HLW PA:
RECENT PROGRESS & PLANS

- May 1996 Technical Exchange on DOE's TSPA-95 resulted in agreement on (e.g.):
  - Importance of infiltration
  - Establishing basis for mixing depth in dilution analysis
- General agreement with DOE on use of expert elicitation
  - Expert Elicitation Branch Technical Position (November 1996)
  - DOE adopted BTP for their work
  - NRC/CNWRA staff observing expert elicitations on volcanism, seismic hazard, unsaturated flow, etc.

HLW PA: RECENT PROGRESS & PLANS (CONTINUED)

- Provided analyses to EPA for evaluating implementability of draft rule
  - Information exchange meetings (2/14/96 and 3/20/96)
  - Some summary analyses in *NRC High-Level Radioactive Waste Program Annual Progress Report* (1/97)
  - Analyses to be fully documented in 1997 NUREG
- More user-friendly Total System PA code
  - Facilitates use by broader segment of staff
  - Beta-testing version (delivered March 17, 1997) under review
  - Currently running Total System PA code on Sun workstation; formerly only run on CRAY supercomputer

SUMMARY AND LOOK FORWARD GENERIC POINTS:

- Guidance on the use of PA (PRA) methods will consider complexity of the safety issues, the availability of data, and the capabilities of licensees.
- Will continue a program of PA training for NRC staff
- Experienced PA analysts, teamed with new hires, and suitable tools are essential ingredients to provide technical basis for risk-informed regulatory decisions in the waste management program
- Declining funding is a challenge which is being addressed by the use of more powerful computing tools and enhanced staff training

SUMMARY AND LOOK FORWARD
SPECIFIC PROGRAMS:

DECOMMISSIONING:

- Achieve optimization by applying staff experience in PA to complex decommissioning sites
- Under current regulations and current schedule, PA is providing analyses for about one-third (1/3) of complex sites requiring a site-specific EIS

LLW:

- Response to comments on BTP and finalization, as resources permit, pursuant to DSI - 5

SUMMARY AND LOOK FORWARD SPECIFIC PROGRAMS (CONTINUED):

HLW:

- PA has moved from demonstration phase to utilization
- Will continue cost-effective improvement in capability
- Near-term focus:
  - Developing technical basis for new HLW rules
  - Early feedback to DOE on PA for Viability Assessment
    - Staff attendance at DOE Abstraction Workshops and Expert Elicitations - 1996 - present
    - Technical Exchange - July 1997
    - TSPA-VA - September 1998
  - At requested budget level plan to use PA to help to prioritize Key Technical Issues