

1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 DECOMMISSIONING WORKSHOP

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7 U.S. Nuclear Regulatory Commission
8 Two White Flint, North, Auditorium
9 11545 Rockville, Pike
10 Rockville, MD
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12 Thursday, June 24, 1999
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14 The above-entitled workshop commenced, pursuant to notice,
15 at 8:34 a.m.
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P R O C E E D I N G S

[8:34 a.m.]

MR. NICHOLSON: If I could have your attention, please, we'd like to begin today's meeting.

My name is Tom Nicholson. I'm from the Office of Nuclear Regulatory Research, and I will be today's moderator, along with Jack Parrot.

Jack, would you raise your hand, please?

Jack Parrot is from the Office of Nuclear Material Safety and Safeguards.

There's a few announcements before we begin today's program.

First of all, some of you had some troubles getting up and down yesterday from the snack bar.

We found out that the problem was that, if we have more than four people in the elevator, it breaks down, and when the guard was upset, they said that the elevator broke because there was too much weight, I said, well, don't look at me.

So, if you could try to limit the number of people on those elevators to four, we'd appreciate it.

The other quick items -- outside on the registration desk is a sign-up sheet. Would you please sign it, if you didn't sign it yesterday? We need to have a complete record, and last night, we stayed late and we made copies of yesterday's attendance list. So, there's a copy out there.

We're also trying to get copies of all the view-graphs that were presented yesterday. We have some of them, but there's still one or two that we are still making copies, and we hope to have those before the end of today.

With regard to this afternoon, there is an opportunity for those who wish to make extended comments -- there will be a group

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1 discussion, but right after lunch, those people interested in making
2 extended comments, please come and see me during the break, or Dr. Ralph
3 Cady, the gentleman who ended yesterday's group discussion, and we'll
4 take down your name and your affiliation, and we'll try to put some
5 order to the presentations this afternoon around 1:30.

6 Now, to kind of recap yesterday's events and where we stand
7 today, for those who weren't with us yesterday, yesterday we heard a
8 regulatory perspective from Dr. Bobby Eid, who has joined us now, and
9 then Mark Thaggard gave us a framework, in keeping with NUREG-1549, and
10 then we went through the conceptual models of the conventional dose
11 assessment codes, RESRAD, DandD, MEPAS, and PRESTO, and then, as we
12 progressed through the discussion of conceptual models, we found a lot
13 more about these various codes, and we also heard about
14 publicly-available information, and then we actually had an example
15 where a researcher actually tried to develop a methodology to try to
16 walk through the development of a conceptual model looking at an actual
17 site and using remote data, and so, today, what we're going to do --
18 we're going to try to continue this progression through the
19 decommissioning review with regard to ground water, and we're going to
20 hear from two DOE investigations of looking at performance assessment.

21 This morning, we're going to have Dr. Phil Meyer from
22 Pacific Northwest National Laboratory progress beyond what Glendon Gee
23 talked about yesterday.

24 If you have now looked at the publicly-available
25 information, how do you then begin to look at site-specific parameter
estimation techniques?

So, Phil will talk about that.

Phil?

MR. MEYER: Tom, as you pointed out, I am going to try to
kind of continue in a logical progression from some of the discussion

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1 that was held yesterday, and I am going to be talking about estimating
2 model parameter values but in specific with the consideration of the
3 uncertainty of those parameters and estimating uncertainty in those
4 parameters.

5 I just want to point out an assumption here at the beginning
6 of my talk that I'm assuming in this analysis that I'm going to be
7 presenting that there's no site-specific measurements of contaminant
8 concentrations.

9 So, that means that the option of doing some sort of an
10 inverse procedure with one of these codes is not an option. It's not
11 something that I'm going to consider here.

12 If measurements of contaminant concentrations are available
13 where you can do some sort of formal inverse estimation or parameter
14 estimation using that, those measurements, then by all means I think
15 that sort of approach should be taken.

16 Glendon presented this picture yesterday, and generally, it
17 shows a broad classification of types of information and application of
18 that information in terms of increasing site specificity and reduced
19 uncertainty, and I'm not going to say too much more about that. This
20 sort of organizes my talk.

21 I'm going to just summarize what was on that sheet as
22 follows.

23 Essentially, there are two types of information --
24 site-specific information, which I take to be direct on-site measurement
25 of properties that are directly related to model parameters.

The other type of information is everything else, is
everything that's not site-specific direct measurements of
parameter-related things.

We can put these two types of information to two types of
uses, basically. We're interested in best estimates for parameter

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1 values, and we're also interested in uncertainty information.

2 Now, that uncertainty information can be characterized in
3 various ways, like bounding values, conservative values, formal
4 probability distributions, or just general qualitative information about
5 an uncertainty in a parameter.

6 So, I'm going to spend a few minutes talking about why
7 parameter uncertainty might be considered important. Perhaps this is
8 all self-obvious, but I think it's useful to point it out.

9 Number one, hydrologic properties may be highly variable,
10 though in a spatial sense or a temporal sense, a parameter value related
11 to some property may vary over many orders of magnitude.

12 This is a log of the hydraulic conductivity, and it
13 represents maybe an average sort of a variability you might see at a
14 site, varying over several orders of magnitude.

15 So, that high variability leads to -- can potentially lead
16 to uncertainty in that parameter value.

17 In addition, the parameter values can be based on inaccurate
18 data or incomplete data or just limited data. For instance, if this
19 represents the spatial variability of the hydraulic conductivity at that
20 site and we have three data points that we went out and took maybe small
21 core samples on or some larger sampling, you have to try to characterize
22 the spatial variability at the site or the average value of that spatial
23 variability with three measurements.

24 You could be in trouble, depending upon what those
25 measurements are and how variable the parameter that you're interested
in is.

26 In addition to those two quantities, variability and limited
27 information, we also realize that these -- the models that we're going
28 to be using are quite sensitive to parameter values, and this is just a
29 case from an example using RESRAD, but you know, any of the other models

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1 we've been talking about, or any model, in fact, would show similar
2 variability.

3 This is peak dose in millirems per year for this particular
4 problem as a function of root depth.

5 Now, root depth goes from a little over about half-a-meter
6 to 1.4 or so, and you can see this strong sensitivity to the parameter
7 value.

8 This kind of sensitivity leads to uncertainty in our
9 quantity of concern, which is the peak dose.

10 So, to characterize those three ideas, I drew this little
11 plot, which is just a simple figure representing the relationship
12 between sensitivity and variability plus your lack of knowledge, and the
13 relationship that determines whether or not a parameter is -- the
14 parameter uncertainty is particularly relevant in an analysis is a
15 multiplicative factor of the variability and lack of knowledge and the
16 sensitivities.

17 So, if either the sensitivity of the model to that parameter
18 is very small or if the variability and your lack of knowledge about
19 that parameter is very small, then the parameter is not -- the
20 uncertainty in that parameter is not particularly relevant or is very
21 unlikely to be so.

22 If both those variables or those measures are high, then
23 that parameter is quite relevant to the analysis, and somewhere in
24 between we have a potential -- potentially relevant to our uncertainty
25 analysis.

So, I'd like to talk just for a minute about a particular
aspect of sensitivity, just to make sure that these are clear.

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In my talk, I'm going to be talking about general ideas that
I think -- this is one of them -- that I think should be considered when
you're performing one of these analyses, and here's an important one.

1 Traditional sensitivity measure is a slope at a point. That
2 is, you're evaluating the change in dose with the change in that
3 parameter value, and that's usually at a point, and it typically
4 represents -- or all the other parameters are constant, in general.

5 So, you change one parameter -- in this case, root depth --
6 while holding all the other parameters at their base case values, and
7 the sensitivity measures a slope.

8 So, it's important to realize that, with a relationship like
9 this, the sensitivity is -- can be highly variable in itself. If you
10 measure it down here, sensitivity is very low, whereas not too far away,
11 the sensitivity can be quite a bit higher.

12 There are -- I don't know if this has been mentioned, but
13 RESRAD and MEPAS currently have the capabilities built into them to do
14 Monte Carlo simulations, where you randomly vary parameters and
15 calculate a dose for each realization of those parameter values, and any
16 code can -- you can set up a simple wrapper to do that, that sort of
17 thing.

18 When we do that, we don't see a relationship like I showed
19 in the previous slide, but you could still plot peak dose versus
20 parameter value.

21 In this case, it's the same parameter, it's the rooting
22 depth, and it's the rooting depth over the same range, and instead of
23 seeing that sort of relationship like this, we see the scatter because
24 of additional parameters that are varying also in this problem.

25 I think there's three or four other parameters here that
were varied, and you see sort of this scattered relationship.

 There are various measures, partial correlation coefficient,
partial R-squared values, partial regression coefficients, depending
upon what kind of analysis you're doing, that can measure something
similar to the simple sensitivity but in the Monte Carlo sense, where

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generally these measures are trying to estimate some linear relationship between parameter value and your dose, and one other point I would like to make with this figure is that you can see here that the peak dose in this Monte Carlo simulation goes from around 10 to 20, a lot of these points here are about 18 or so, and goes all the way up to around almost 130 at the largest values of the rooting depth.

If we go back to that previous figure, which is -- has this parameter varying over the same range, but in this case, the rooting depth is the only parameter that's varying, you can see that the lower range is about -- the low number is about the same, but the maximum is only about 65.

So, when we just vary rooting depth, we see a maximum peak dose of about 65. When we vary other parameters in addition to that, the peak dose goes up to almost 130.

This points out that it's important in this sort of analysis to consider interactions between parameters. So, when you just vary it one parameter at a time, you don't see the full effect of possible correlative effects between parameters.

Now I'm going to move on, and I'm going to basically talk about two cases.

The first case is how to estimate parameter uncertainty when you don't have any site-specific data. So, in this case, we have such things like were discussed yesterday, national databases, regional information, that sort of thing, that we can use to get best estimates and uncertainty information.

The best estimates in this case are going to be limited, because there's no site-specific information. We have to understand what the national data represents in this case and what the limitations of that data are. We can't stretch the data any further, extrapolate that data any further than what it actually represents, and we need to

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1 be able to relate the national data to our conceptual model requirements
2 and parameter uncertainty.

3 I'm going to talk just a bit about each one of those things
4 right there, but first, I'm just going to give you an example.

5 This is an example of what we mean by a national database.
6 This is taken from the Natural Resources Conservation Survey. It's a
7 soils database, and each one of these little red dots in here represents
8 a particular soil sample.

9 There are almost 40,000 of these samples, and we've been
10 able to derive approximate soil parameters classified according to
11 texture.

12 So, for instance, we have thousands of samples here for loam
13 soil.

14 We can look at those and derive distributions for a loam
15 soil, and these plots just sort of show what those distributions look
16 like for various parameters, both density, field capacity, residual
17 water content, saturated water content, and these distributions can be
18 used directly in a model such as RESRAD or MEPAS or any other model as
19 long as we understand what they represent.

20 They represent small scale samples from across the country.

21 This is another example of some databases that are
22 available. These are three other soils databases that are more limited
23 in scope. They have fewer samples, but in contrast to the previous
24 database, where very simple physical properties of soils are measured,
25 in these the actual hydraulic parameters have been measured for each one
of these points.

So, that's something a bit more specific in terms of
relating your site parameters to national -- or a national database like
this. These samples of parameters were actually measures, so there's
less uncertainty associated with them in that sense, although there are

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fewer samples.

What is the relationship between a national database and site-specific data in terms of its uncertainty? What do we expect to see?

The national data represents variability of measurements made across the country, in general, or perhaps across a state or across some larger area, a county, something like that, whereas multiple site-specific measurements represent your variability at the site, spatial variability at the site, or temporal variability, and in general, we would expect to see something like this.

This is a plot of the probability density function which measures the likelihood versus the parameter value. The red is the national, and the blue is the site-specific. We expect to see a relationship like this, where the national variability is significantly larger than the variability we would observe on the site.

In general, this is the sort of thing that we expect to see.

I've already mentioned the consideration of scale, but just to hit it one more time, in general, measurements in these databases, soils databases, are made on a very small scale, a scale of centimeters, and this is just a representation of the model, DandD in this case, but we can see this illustrates the relationship between our scale of measurement and the scale of our parameter.

What DandD requires -- and MEPAS and RESRAD are the same way -- is this is our aquifer here, and we need a parameter value for this entire -- that represents this entire area, entire volume, whereas we might have measurements on this scale.

So, we can see that we're talking about an issue there that might be significantly important if our parameter values don't scale directly, which, in fact, they generally don't in most cases.

If we have some site-specific information, then a couple of

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1 issues arise.

2 We want to be able to combine any site-specific measurements
3 we have with the information that we may have gotten characterizing
4 uncertainty based on our national database.

5 We want to do that in a manner consistent with our
6 understanding of the data representation and the conceptual model
7 requirements.

8 So, what exactly am I talking about there? Well, I'm
9 talking about something like this. The parameter uncertainties should
10 represent the uncertainty in an average parameter value at the site, not
11 the spatially temporal variability of the measurements.

12 That's because, like I just illustrated, these models --
13 RESRAD, MEPAS, DandD -- are looking for an average value, some sort of
14 value that represents an effective number over a very large scale. So,
15 if we're talking about the uncertainty of that parameter value, we're
16 interested in the uncertainty of the average, not the variability across
17 the site.

18 So, I represent that concept here, where this red line
19 represents the probability distribution, perhaps, of a parameter value
20 across a site.

21 So, if we took 100 samples from different locations at the
22 site and plotted them up in a distribution, we would see this, but what
23 the model is actually looking for is the average value, and therefore,
24 the uncertainty that we put into it should represent the uncertainty in
25 that average value which is going to have a much more narrower
distribution, much more narrow distribution, in all likelihood.

ADN In some of the work that we have done for the NRC, we've
RIL tried to look at this issue of combining national database information
EY with site-specific information, and we developed a method to do so, and
& ASS I'm just going to put two slides up here to illustrate the idea that
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1 we're talking about here.

2 This method basically takes information on the uncertainty
3 from a national database, which is the blue, so this is a fairly broad
4 -- a broad distribution of values for the particular parameter, and it
5 combines that with site-specific information.

6 In this case, we've got two measurements of this particular
7 parameter value from our site, and it produces an updated probability
8 distribution of the average parameter value at the site, and that's this
9 green line.

10 So, the purple line here represents the actual distribution
11 of the parameter at the site, the spatial variability.

12 So, what the model is looking for is some kind of average
13 value. This would be the expected value right about here for this
14 actual distribution, the purple one, and with two samples, we see that
15 our parameter and its uncertainty look like this.

16 So, we started out with the blue; we end up with the green.
17 It's approaching -- the mean of the green is approaching the mean of the
18 purple, the mean of the actual distribution, but its uncertainty is
19 quite broad.

20 However, the uncertainty is less than the spatial
21 variability that is the distribution of the actual parameter, the purple
22 line.

23 So, we can see what happens if we add additional parameter
24 measurements, additional site-specific measurements of that parameter.
25 This is with two samples. This is with three site-specific
measurements, and we can see the distribution of the green line, which
is our updated distribution, is becoming narrower and more closely
related to the mean of the actual, and if we add four -- if we have four
& randomly-selected samples, these four down here, we see that it gets
even more narrowly distributed.

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1 What's happening is the variance of the updated distribution
2 is being reduced because of the additional information from the site,
3 and we're shifting the mean of this distribution closer to the mean of
4 our actual distribution.

5 So, in this sense, this method is combining the information
6 from the national database and the site-specific data; it's doing so in
7 a way that's consistent with the conceptual representation of the
8 parameters at the site.

9 And I guess I'll just point out that that was a particular
10 parameter, one single parameter value. We can then do calculations with
11 that parameter.

12 In this case, the sort of calculation was for -- to
13 calculate the net infiltration rate, and this more widespread
14 distribution represents the uncertainty of the net infiltration prior to
15 introduction of site-specific values, and after the introduction of
16 site-specific information, we changed our -- reduced our average net
17 infiltration rate and reduced the uncertainty about that net
18 infiltration rate.

19 And just carrying that analogy one step further for this --
20 this is a particular example that we've run. This is total dose at
21 1,000 years and shows the difference between no site-specific
22 information and using site-specific information for particular
23 parameters. You've reduced the uncertainty in this case of the dose.
24 The average dose has also been reduced.

25 I'm going to show a number of slides to complete my talk
that deal with the particular issue that I've heard mentioned here, and
I think it's important to make a few clarifying comments about this
issue.

Essentially, we have two alternatives in the particular
analysis that we're looking at. We can either do a deterministic

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1 analysis in which we end up -- we run a code, we end up with a single
2 value, and we base our regulatory decision upon that single value.

3 So, the procedure here is choose parameter values using your
4 best estimates, and uncertainty information can be taken into account,
5 and some sensitivity analysis performed, perhaps, but you're estimating
6 your uncertainty in the model results based on a sort of a deterministic
7 analysis.

8 Alternative two is to do a stochastic analysis such as the
9 Monte Carlo simulation where you choose the actual parameter
10 distributions and you get a distribution of peak dose but then you have
11 to choose some statistic from that dose distribution with which to
12 compare to regulatory criteria, and do you take the mean value, do you
13 take the 95 percentile, what do you use?

14 So, those are sort of the options that are available, and
15 each one has a limitation or a difficulty.

16 So, I'm going to illustrate one issue related to this
17 decision. I've heard -- well, let me just say that, if you take -- we
18 ran some simple examples just to illustrate a fairly simple idea, but
19 it's somewhat subtle.

20 This is a simple model where we have a single parameter X,
21 and that produces a Y. In this case, the output, what you can think of
22 as a dose, is linear-related to our parameter value X.

23 In this case, X is normally distributed, and this is a
24 distribution -- this is just 100 samples of X, the parameter value, and
25 we get out a distribution for our output, or in this case what we're
thinking of as dose, that looks like this.

ADN If we look at the average value of this distribution, we can
RIL see that that's 5.96. If we take the average X value and simply plug it
EY into this equation, we get a value for Y, or our dose, of 5.96, also.
& ASS
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1 It's very easy to prove this analytically, mathematically,
2 but I wanted to illustrate this issue.

3 So, the -- this illustrates -- among those two alternatives
4 you have, do a deterministic analysis, where you might have information
5 about the uncertainty of your parameter values, you choose the best
6 estimate and you plug the best estimates of your parameters into your
7 model. That gives you the same result as if you do a Monte Carlo
8 simulation and look at the average value from the results of your Monte
9 Carlo simulation.

10 That's the case when the relationship between dose and the
11 parameter value is linear, and that relationship is independent of the
12 particular distribution for your parameter.

13 In this case, X is -- our parameter, our input parameter, is
14 log normally distributed. So, it's quite skewed, and our output, our
15 dose value, Y, is also skewed, but the average value when you do the
16 Monte Carlo simulation is identical to the value you get if you take the
17 average X and simply plug it into your relationship. That's because
18 this relationship is linear.

19 If the relationship is non-linear, then we have a different
20 case. If it's non-linear, then you can see that these values are
21 slightly different -- 5.29, 5.293.

22 That difference is inconsequential in this case because our
23 coefficient of variation -- that is, the ratio between the standard
24 deviation of X and its mean value is very small. So, the variability of
25 that parameter is fairly small with relation to its mean.

 That leads to a very small difference for this non-linear
relationship, which in this case we took just to be a quadratic.

 However, if that coefficient of variation is large -- in
this case, it's 2 -- we can see that the average value from the Monte
Carlo simulation is significantly higher --about 20 percent in this case

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-- higher than if we just take the average parameter value, put it into the model, and solve the model deterministically. We get a different value. That's because this relationship is non-linear.

In this case here, the relationship was non-linear, and X was normally distributed. So, it's a symmetric distribution for our parameter value.

If we take the same non-linear relationship but we use a log normal distribution for X, so that X is -- our parameter is highly skewed, then we see that there is a very significant difference between the Monte Carlo results -- so, this is the average value of the Monte Carlo simulation, and this is the value we get if we take the average value of X and simply plug it into our model and solve deterministically.

So, there's a fourfold difference there in the results.

And lest you think that this is all an academic exercise, this is an example from RESRAD where we were looking at the contaminated zone distribution coefficient for uranium-234. This is the relationship between peak dose and that parameter value, and we can see that it's highly non-linear.

So, even these simple models, such as RESRAD, MEPAS, DandD -- they have non-linear relationships between parameters and the -- our output that we're interested in, peak dose.

So, the issue that I've been discussing is of concern.

If you take that parameter value, assume a uniform distribution, and run the RESRAD in a Monte Carlo manner, this is the distribution for peak dose in 1,000 years that you get, very skewed.

Even though the parameter, contaminated zone Kd, was uniformly distributed, the output, peak dose, is highly skewed, and we see that the average from the Monte Carlo simulation, so the average of this distribution, is 232.

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1 If we take the average peak dose -- rather, the average
2 contaminated zone distribution coefficient, which was about 30, 35, we
3 take the average value, 35, and simply plug it into the model to solve
4 the model, you see that the peak dose -- that that result is 105. So,
5 in this case, some measure like the median, which represents the 50
6 percentile, is more closely related, much more closely related to that
7 deterministic dose.

8 This is an issue that NRC needs to consider. The conclusion
9 that I draw from this is that you have a lot more information if you're
10 generating this complete distribution than if you're simply looking at
11 statistics of the distribution.

12 So, present all that information, develop it and present it,
13 and base your decisions on what -- all the information that you can see.

14 I'd like to just make another point here. This cumulative
15 distribution here is the distribution of the peak dose in 1,000 years.

16 So, in this case, we're solving -- we're running RESRAD 100
17 times -- and it could be in the other model, also -- we're running
18 RESRAD 100 times, and each time we get a peak dose in 1,000 years, and
19 this is the distribution of that, of those 100 results.

20 Now, this is not -- this distribution is not something that
21 is easily obtained from RESRAD. You actually have to go into an output
22 file and extract that information on your own, but I believe this is the
23 distribution that NRC is concerned about and not the distribution of the
24 dose at any particular time, distribution of the dose over 1,000 years.

25 So, you might consider some modifications to RESRAD to make
this information more easily accessible to the user.

 In conclusion, I'd just like to summarize some of the issues
that I brought up here.

 We use national databases for the uncertainty information
and best estimates only in the case when we have no site-specific

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1 information.

2 Site-specific information, in contrast, should always be
3 used if you have it.

4 Don't throw it away unless you think that there's something
5 wrong with it, and I've illustrated a means by which the site-specific
6 information can be combined with some uncertainty information that
7 you've got from a national database.

8 The relevance of the parameter uncertainty is a combination
9 of several things to consider model sensitivity, consider the
10 variability of the parameter, and the lack of knowledge that you have
11 about that parameter, and those operate in a multiplicative sense, so
12 that if any of them is small, very small, then probably that parameter
13 is not particularly relevant to your analysis.

14 Consider in sensitivity analyses the entire range of your
15 parameter values and how those affect dose. Don't just look at one or
16 two values.

17 In this case, again, Monte Carlo approach, I think, is the
18 better approach to take, because you get out a lot more information
19 about the range of your parameter and effect of that parameter on dose.

20 And there's no reason not to use it, since if you're using
21 MEPAS or RESRAD or frames, which Gene Whelan talked about yesterday,
22 these sorts of capabilities are built in, they're easy to use.

23 Be careful to distinguish parameter variability, spatial or
24 temporal, from parameter uncertainty.

25 And I already mentioned this one. We have a tool that we'll
be working on making more easily accessible that combines information
from site-specific source and a more regional or national source in a
consistent manner.

And finally, realize that using average parameter values in
a deterministic analysis doesn't give you the average results of a

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1 stochastic analysis, and that's the point I illustrated at the end of my
2 talk there, and again, the conclusion to be drawn there is that you have
3 more information if you look at the full results of the Monte Carlo than
4 if you're just looking at a statistic effect of the output.

5 So, that's all I have, and I'll take any questions.

6 MR. NICHOLSON: Thank you.

7 Before we begin our questions of Phil, I wanted to point out
8 for those who weren't here yesterday, this is being recorded. We have a
9 courtroom reporter. Today, we have Mike Paulis, from Ann Riley &
10 Associates, is our courtroom reporter today.

11 For those of you who want to make comments, questions,
12 whatever, there are microphones in the aisle. Please come to the
13 microphone, identify yourself and your organization, and speak very
14 distinctly into the mike.

15 Are there questions this morning for Phil Meyer on his
16 presentation?

17 Bobby Eid?

18 MR. EID: Thank you, Phil, for this excellent presentation.
19 You are hitting the points that always we are struggling with and trying
20 to come to a conclusion. My comment is on the first conclusion that you
21 made, the first point on the last slide, and you said -- the first one
22 on the previous slide.

23 It seems to me you are suggesting that, when we use national
24 data such as screening methodology, and we use input parameters all over
25 the United States and using for all radio-nuclides, you are proposing to
use the best estimate rather than the 90th percentile.

That's what you are proposing? I would like to understand
it more.

MR. MEYER: Okay. Yes, that's a good point. Don't
necessarily equate best estimate with expected value. I'm not saying

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1 that the expected value is the best estimate. If you want to look at a
2 conservative value, then maybe something, you know, like the 5
3 percentile or the 95 percentile or something on the tail of the
4 distribution is more of a best estimate for you. That's a relative
5 term, as opposed to the expected value, which is a quantitative
6 mathematical term.

7 MR. EID: So, the definition of your best estimate is based
8 on your judgement or based on your goal?

9 MR. MEYER: Sure.

10 MR. EID: Because the best estimate is not well defined.

11 MR. MEYER: Yeah, right. So, in this example, U-234, this
12 distribution here, the range -- this is the relation between dose and
13 that value, but the range of that parameter we entered here was about .2
14 to 70, which is the range of values observed.

15 Well, actually, some of those observations apparently were
16 way out here, but it's sort of the range about what we saw to be the
17 best estimate for this particular soil type from the paper by Shepherd
18 and Tybo. So, in this case, the best estimate was here, and we want to
19 look at a symmetric distribution about that, but in some other case, if
20 you're worried about conservative value and you see a distribution like
21 this or you see a relationship like this, you know, maybe your best
22 estimate is someplace else, I don't know, but that's a problem-specific
23 -- depends on what your objectives are.

24 MR. EID: But you showed in the distribution curves for
25 these parameters that the tail of the distribution when you take the
data for across the United States versus the regional or the
site-specific data, you will have much narrower distribution, and the
tail of the distribution for the United States is far away from the tail
of that distribution for the site-specific or the regional, whereas if
you look at the mean, it's much closer. So, when you try to compare and

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1 look at the variability and the sensitivity of the -- uncertainty in the
2 parameters and if you take the tail, you are far away from the actual,
3 you know, real case that -- when you compare.

4 MR. MEYER: Right.

5 MR. EID: So, if you go and take the 90th or the 95
6 percentile, this means you are still far away from the actual conditions
7 based on the distribution that you showed on the graph.

8 MR. MEYER: Yeah, potentially.

9 MR. EID: So, if you assume that you took the tail of that
10 distribution at the 90th percentile --

11 MR. MEYER: Yeah. This is the distribution for this
12 parameter we might use in the case where we don't have any site-specific
13 information, and in this case, I have just assumed that this is the
14 actual distribution of that parameter at the site, the actual
15 distribution, spatially variable distribution.

16 So, if you selected -- if a conservative value said you
17 should select -- well, in this case, effective porosity, probably you
18 would be looking at a low value if you wanted to be conservative.

19 So, if you picked a value down here, you'd be selecting one
20 on the tail of your actual distribution, because they happen to match
21 up, but the thing is, you don't know what the actual distribution is a
22 priori, right? Until you get some information on that, you don't know
23 where it is.

24 So, again, it's -- you could end up -- if we were looking
25 for -- if we just assumed in this case that, instead of a small value
being conservative, a large value is conservative, we could be selecting
a value that's significantly beyond the actual occurrence of values at
the site, but we don't have any information from the site.

MR. EID: I'm really trying to get that. If you are trying
to analyze parameter by parameter without looking at the overall

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1 picture, what kind of scenario, what kind of assumptions, what kind of
2 conservatism embedded in that scenario or in the model.

3 So, you are looking at the tail, taking the value for the
4 tail of the distribution. If you take these values and you add it to
5 the assumptions and conservatism in the model, this means you are far
6 away from the real world of having -- you know, of real risk, and the
7 question is where to go, to go closer to the mean or still to go to the
8 end of the tail of distribution at the 95th percentile or the 90th
9 percentile.

10 MR. MEYER: Yeah.

11 MR. EID: What is your perception? I'm trying to get to
12 your -- from your experience, and that is what do you think, how far
13 away you are from the real world when you go and take -- concerning all
14 of these conservative assumptions when you take the tail of the
15 distribution.

16 MR. MEYER: I think -- I mean a lot of people have showed
17 that, with these kind of models, that if you build conservatism into all
18 of your parameter values, you've got conservatism in your model that
19 potentially you could end up with the result as your peak dose, could be
20 significantly conservative.

21 So, in that case, you might argue that a mean value is
22 closer to what you're interested in, but I think that depends upon the
23 -- depends on the model, and in my experience, what's really valuable in
24 these analyses is to look at relationships like this so that you
25 understand, if you think this distribution -- if you think your
parameter varies from .2 to 70, look at this relationship not only for
varying just a single parameter like this but do it in a Monte Carlo
sense, where you can get the correlative effects between different
parameters.

I showed one of those plots earlier, but if you can

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1 understand what those relationships are, then you can understand --
2 that's an example for a single parameter, and that's an example of a
3 Monte Carlo -- sort of a Monte Carlo sensitivity, where you can see the
4 relationship between the parameter, but taking into account all the
5 other parameters in addition.

6 So, doing both of these things, I think, helps you
7 understand how these models react to different parameter values over the
8 entire range of that parameter value potentially.

9 It doesn't mean that you need -- when you go to calculate a
10 dose or you go to calculate the distribution of a dose, that you
11 necessarily need to use this entire range. You know, there could be an
12 argument for saying that that's not the case.

13 Certainly, if it's -- you know, if there's no relationship,
14 then there's no reason to look at that parameter as varying or no reason
15 to use the whole range, whatever, but it's in developing these kind of
16 relationships that I think you can make decisions like you're talking
17 about.

18 But ultimately, it's a matter of policy.

19 MR. NICHOLSON: Other questions or comments?

20 Yes, sir.

21 MR. KOFAR: This is Rick Kofar with Morton Associates.

22 As a point of clarification, did I understand you now --
23 we're using a lot of these models for kind of lump parameter type
24 models, and what you're really interested is a measurement of the mean
25 parameter and not the distribution of the parameter itself, so that what
we should be developing are not necessarily just statistics on the
parameter and the parameter range but statistics on the mean and the
estimate of the mean.

MR. MEYER: Yeah. That is what I'm saying.

MR. KOFAR: Let me extend that a little bit further, then.

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1 If we go to a national database -- and that's what we're
2 primarily using -- let me back up. I'm not a statistician, so I could
3 be -- definitely could be wrong on this, but my understanding on
4 estimates of the mean are largely determined based on the number of
5 samples you have, so that if you were to go to a national database where
6 you have a huge set of samples, that your estimate on the mean would be
7 very good on that -- from a statistical standpoint, because you have so
8 many samples, so that then your statistical parameters for the
9 distribution of the mean would indicate a very narrow range on the mean,
10 and then, if you were to use that type of analysis and actually take
11 your Monte Carlo analysis from that statistic, from that distribution on
12 the mean, which is now virtually a single number because you have so
13 many samples, that you've eliminated the uncertainty analysis in your
14 performance because you have such a large data set.

15 MR. MEYER: Yeah. You've hit on a number of issues.

16 Number one, let me clarify that the approach that I advocate
17 is not the approach that you've just described. You described a
18 classical statistical approach where your statistics are based upon only
19 your observations, okay, and what we're interested in is not -- what
20 we're ultimately interested in is not -- doesn't have anything to do
21 with what's in the rest of the country, right?

22 What we're ultimately interested in is, for a particular
23 site, what's the parameter value that characterizes, for instance, the
24 aquifer Kd or some other parameter.

25 MR. KOFAR: Then this approach is really for site-specific
information more than for like a national database screening model type.

 MR. MEYER: Well, let me just clarify. That's what we're
ultimately interested in. So, what I advocate is that, because you
don't have, typically, very many data points, very many site-specific
measurements, you can't really characterize the uncertainty based upon

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1 the site-specific measurements that you have, because you don't have
2 enough of them.

3 If you actually wanted to characterize the uncertainty in an
4 average value at a site, it might -- you know, depending upon the
5 variability of the parameter at your site, it might take, you know, 100
6 measurements or more, depending on the size of your site, the
7 variability of the site. It could take a lot of measurements.

8 So, what I'm advocating is that you use a national database
9 as an estimate of the uncertainty or the distribution that you might
10 expect in that mean value at the site, and if that's the approach that
11 you want to adopt, then if we think, for instance, that the -- if we
12 think that the aquifer can be characterized as, you know, a sandy loam
13 or a gravely sand, something like that, then that sort of gives us some
14 idea of what the parameter value might be, right, and what the
15 distribution of values we might expect because of what we know about
16 what sandy gravels look like, or sandy loams.

17 We know approximately how they behave, and we know that
18 based upon a lot of experience from across the country, different
19 measurements that have been made on similar soils, so use that kind of
20 information to characterize what you think the parameter range and
21 distribution might look like, and that's your starting point, sort of.

22 MR. KOFAR: Let's bring this down to a more concrete -- so I
23 can understand. Let's just take porosity, okay?

24 MR. MEYER: Okay.

25 MR. KOFAR: You know your material is a sandy loam.

So, you have some porosity measurements, and they indicate a
range, but you also have a national database which is much more
extensive that also indicates a range, but what you ultimately want to
put in this model is still the mean --

MR. MEYER: Right.

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1 MR. KOFAR: -- and a measurement of the mean and the
2 variation -- the uncertainty in your estimate of the mean.

3 MR. MEYER: Right.

4 MR. KOFAR: All right.

5 So, you know you have a sandy loam based on your site data.

6 Now, we go to the national database, and we need to pick out
7 a mean and some estimate of the uncertainty on that mean. Is that what
8 you're saying?

9 MR. MEYER: No, that's not what I'm saying. What I'm saying
10 is, if you want to know the mean value of the porosity of a sandy loam,
11 the mean value across the country, then you could go to the national
12 database, you've got 10,000 samples for sandy loam soil, something like
13 that.

14 The average value has very low probability or very low
15 uncertainty in it because you've got so many samples, but that's not
16 what you're interested in. You're not interested in average value
17 across the country. You're interested in the average value at your
18 site, which you don't know and you don't have very many data points to
19 estimate from.

20 What I'm saying is there's a national database which
21 expresses the potential range of values that you could observe. I mean
22 your site could be characterized by some of the lowest porosities that
23 have been observed in sandy loam soil, but you don't know that a priori.

24 So, assume that that's unlikely, but it's not entirely
25 impossible, that your average value at the site is very low, as low as
has been observed in the national database. But then as you gather
points and you see that your porosity is actually much higher, you
should be eliminating those low values for the average at your site,
& because you're seeing a whole bunch of porosities that are much higher.

So, that becomes -- those low values become much less -- it

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1 becomes much less likely that that's the average value at your site.

2 Am I making sense?

3 MR. KOFAR: Yeah.

4 I think what you're saying is that you can use your national
5 data as to guide yourself in reviewing your site-specific data to see
6 whether it's likely to be truly representative or not, but there is
7 still the risk that, in fact, you really do have a sandy loam or
8 whatever that has a very low porosity based on site-specific
9 characteristics, and if you go out and start gathering a few more points
10 and you randomly hit a couple that are higher, it seems like to me
11 you're starting to bias your site-specific data based on some national
12 database where maybe your site-specific data -- there's a question of
13 statistics, then, on your site-specific data, still, that you have to
14 question whether you're really qualified or should be biasing your data,
15 basically, on national data.

16 MR. MEYER: Yeah, there is always that question, and I
17 compare it to your description where the variance of your data depends
18 upon the number of samples you have. That's sort of a classical
19 approach.

20 The approach that I advocated is what statisticians call a
21 Bayesian approach, where you're not only interested in the observations
22 you make but what sort of prior information or knowledge you have about
23 a parameter, and you want to take both those things into account.

24 So, in this case, where we're updating this blue
25 distribution based upon these samples and the result is this green
distribution, what we're going to see is, if we take more and more
samples, ultimately we're going to see the mean value of this green
distribution is going to be equal to the mean value of this purple one,
which is the actual site-specific mean.

So, the means are going to become the same, and the variance

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1 of this distribution is going to approach the classical statistical
2 variance, as you add more samples, because you're relying less -- each
3 sample you add means you're relying less on your prior information or
4 the national database information.

5 MR. NICHOLSON: Okay.

6 Sir, identify yourself, please.

7 MR. NARDI: Joe Nardi from Westinghouse.

8 I guess it's just a comment. What you have done here is
9 primarily look at -- in the one slide, you had the Kd for U-234. In
10 real life situations, we're going to have a multitude of nuclides, and
11 therefore, we're going to have more than just one Kd, we're going to
12 have all of them, and it concerns me if we start taking a 90th
13 percentile number for every single one of those parameters that's very
14 sensitive.

15 We're going to end up with extremely conservative results.

16 MR. MEYER: Yeah. That's the issue Bobby and I were talking
17 about earlier, is that if you build in conservatism into each parameter
18 value, you end up with a result that's potentially extremely
19 conservative. I'm not advocating that that be done.

20 What I am advocating is that you look at the relationship
21 between your parameters and your dose, understand how the models behave,
22 not just with respect to one parameters but combinations of parameters.

23 If you have multiple contaminants and each contaminant is
24 characterized by its own parameter value, then understand how those
25 potentially interact to give you a dose.

MR. NICHOLSON: Do you want to make a point on that point?

MR. GEE: Previous point.

MR. NICHOLSON: Okay. We'll have Glendon Gee make his
& point.

MR. GEE: I'd just like to say, in the discussion we had

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1 yesterday, we were talking about the limitations of using the national
2 databases, and I think Phil would agree with me.

3 If data were available, say from a county or from a state
4 soil survey, that gave you information like the red distribution, you'd
5 obviously choose that over the national database, because it -- the
6 local information is always the best, but in the absence of that, Phil
7 is pointing out that the uncertainty distribution values from the
8 national database at least gives you a starting point. That's the point
9 we're trying to make.

10 MR. SINI: Phil, my question pertains to your final
11 conclusion, the last conclusion you had on your slide. The
12 relationship, as long as it was non-linear, you said that the average
13 parameter values in a deterministic analysis would not be equal to your
14 average results from a stochastic analysis.

15 Is there any dependency on the number of samples in that
16 broad conclusion? If you had more samples, would there be a closer
17 relationship between your deterministic analysis and your stochastic?

18 MR. MEYER: What do you mean by a sample?

19 MR. SINI: When your average -- it goes back to the earlier
20 question. When your average parameter value -- if you had a more --
21 less uncertain average value, would that change the -- how it correlates
22 to a stochastic analysis?

23 MR. MEYER: Yeah. The example I tried to present, if the
24 coefficient of variation is small, your parameters don't vary
25 significantly in relation to their mean, then the difference is going to
be small. It's a combination. If the non-linearity increases -- you
know, my example is a quadratic -- if it's more non-linear than that,
then the difference will be greater.

MR. NICHOLSON: Thank you.

Thank you very much, Phil.

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1 MR. MEYER: Sure.

2 MR. NICHOLSON: We'd like to now move into a group
3 discussion on parameter estimating for site-specific modeling, and if
4 you turn to your agenda, you'll see these questions listed in the back
5 of the agenda. We'd like to go through as many of these questions as
6 possible.

7 To lead us in the discussion is Mark Thaggard from the
8 Office of Nuclear Materials Safety and Safeguards, and everyone in the
9 audience is encouraged to participate.

10 MR. THAGGARD: Okay. Well, I think Phil did a great job of
11 kind of priming everybody for this discussion. We've actually started
12 hitting a little bit on this first question already, and it has to do --
13 well, we've kind of -- it can be broken up into two questions, really.

14 I think the bottom line is we can recognize that, at the
15 sites for these parameters, there's distribution of values, and one of
16 the questions it has to do with, if you build a deterministic analysis
17 -- I think Phil has done a fairly good job of illustrating that most of
18 these dose analyses -- they are non-linear analyses, and so, I think, as
19 followup to that point that Aby brought up, the last point in Phil's
20 slide, which value of these data should we be using in these
21 deterministic analyses?

22 Is it appropriate to use -- if we've got like three data
23 values for a particular parameter, is it appropriate to use the mean of
24 those data values in the deterministic analysis given the fact that, as
25 Phil has indicated, we may actually be underestimating the dose in some
sense.

So, that's kind of what this first question has to deal
with, and I'd like to get some thought for comments on that.

Yes. Okay. Phil?

MR. MEYER: I'd like to make a comment, just in case I

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1 haven't made myself clear. I would argue strongly that, instead of
2 looking at a single value, that you look at a range of values, because
3 -- simply because that helps you understand the relationship between the
4 parameter value and the model result, and if you understand that
5 relationship, you can understand a lot of things.

6 If you -- if it looks reasonable and you believe that your
7 model is giving you reasonable results, then just understanding that
8 relationship helps you make decisions about what is an appropriate
9 value, and if you see something that looks very strange, then there may
10 be something going on in the model that you should be asking questions
11 about, might mean that the combination of parameters you have is not
12 appropriate and you need to look at something -- either changes in the
13 parameter or changes in the model, look at something else, but you can't
14 understand that unless you understand the relationship between parameter
15 value and dose.

16 MR. THAGGARD: So, you're saying that basically it would
17 depend upon the sensitivity analysis that should be done.

18 MR. MEYER: Yeah. And like I tried to characterize, I think
19 a sensitivity analysis should consider the entire range of the parameter
20 values, not just, you know, one value and take a high one and take a low
21 one, look at that relationship, and there's no reason not to do this,
22 especially if you're using RESRAD or MEPAS or one of these other codes,
23 because the capabilities are already built in; you don't really have to
24 do anything, you just run the model and look at the results.

25 MR. THAGGARD: Okay. So, basically what that's saying is
that you're advocating that people should actually use the Monte Carlo
analysis and that would get away from this whole problem.

MR. MEYER: Yeah, a Monte Carlo analysis, but you don't
necessarily need to look at the -- a formal distribution of the
parameter. If you're just interested in that relationship, you just put

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1 in a uniform distribution just to discern what the relationships are and
2 understand how the model operates.

3 MR. THAGGARD: Okay.

4 MR. BIRKLAND: Rich Birkland, Siemens.

5 I think that, if you look at just a single parameter at a
6 time -- I mean, for instance, you look at the Kd versus dose in here --
7 that that may not be the right thing to do, because there's a whole
8 bunch of other parameters that are in there, and you may see a
9 particular relationship using -- assuming something else for all the
10 other parameters, but if you change those parameters and now you go back
11 and look at your Kd, that relationship may be different. Do you
12 understand what I'm saying?

13 MR. THAGGARD: Yeah.

14 MR. BIRKLAND: In other words, these parameters are
15 interactive.

16 MR. THAGGARD: Well, that's kind of the same thing that Phil
17 is saying, basically, that you need to do more of a Monte Carlo
18 analysis, where you're looking at multiple parameters at the same time,
19 as opposed to doing a sensitivity analysis looking at a single parameter
20 at a time.

21 MR. MEYER: Exactly. I think that it's important to look at
22 individual parameters, but you don't want to limit your analysis to
23 that.

24 You also want to look at combinations like I showed, but the
25 rooting depth example, once you take into account combinations of
parameters, you can end up with doses that are significantly different
because of the effective correlations between parameters and the doses
that are significantly different than what you get when you just vary
the same parameter.

MR. THAGGARD: Okay.

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1 Henry?

2 MR. MORTON: Henry Morton.

3 It seems to me that, at least in my mind, there may be some
4 confusion creeping in here that's related to the construction of the
5 programs, and the difference may be that, in one case, we have
6 probabilistic shelves which the users -- it's kind of expected to define
7 the probabilities on the inputs, and the code is generating single
8 valued outputs, whereas a different construction would have the user
9 entering essentially best estimate values, and the code is doing a
10 probabilistic treatment like Monte Carlo sampling on the models
11 internally and generating a probabilistic output -- that is, an output
12 which is a distribution -- and those, to me, seem to be different things
13 that are coloring the discussion of the inputs.

14 MR. MEYER: I can just clarify that point. These codes
15 don't operate by you entering a single value and then the codes
16 generating probability distributions from those. They only operate by
17 you -- if you want to look at the Monte Carlo simulation, you enter the
18 distribution for the parameter, then the code will sample from that,
19 generate a distribution of results.

20 The alternative is to enter single values or best estimates
21 for the parameters, and the code will then run and give you a single
22 value or result.

23 MR. THAGGARD: Okay.

24 Walt Bayelen?

25 MR. BAYELEN: Yes. Walt Bayelen, Sandia Labs. I just
wanted to support Dr. Meyer's recommendation that the uncertainty in
parameter values be considered, rather than focusing exclusively on a
single value. I think it's an important mechanism for looking at the
overall uncertainty in dose and consideration of the non-linearities and
interactions parameters, the other issues that have been discussed.

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1 MR. THAGGARD: Okay.

2 Why don't we move on to the second part of that question,
3 while we're up here, since there seems to be a lot of advocacy for the
4 use of Monte Carlo analysis. One of the questions that people always
5 ask is -- one of the concerns with using Monte Carlo analysis is that
6 you have to describe the probability distribution function for these
7 parameters, and that's often cited as a limitation to the use of the
8 Monte Carlo analysis, and that may be kind of difficult when you've got
9 a limited amount of data at your site.

10 Do we have any suggestions on how people might do that?

11 Can you identify yourself again?

12 MR. KOFAR: It's Rick Kofar with Morton Associates.

13 I was going to raise a slightly different point, but it
14 sounds like, from what I just asked earlier, that the distributions
15 we're looking for here in these lump parameter models are not the
16 distributions of the parameter themselves and the variability of the
17 parameter but the distribution on your estimate of the mean and the
18 uncertainty in that estimate, which -- my statistics are really not very
19 good but may be an entirely different distribution in itself, your
20 estimate of the mean.

21 I might even venture to guess that that might be normally
22 distributed, regardless of the underlying distribution. I don't know
23 that for a fact, but that's in the back of my mind from eating
24 statistics years ago. So, some of these questions of whether we have
25 log normal or whatnot for some geologic data may not be relevant if
we're really just using estimates on the mean.

MR. THAGGARD: Okay.

Norm Eisenberg?

MR. EISENBERG: I'm Norman Eisenberg from Division of Waste
Management.

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1 I think there are two issues here that are closely related.

2 I would like to suggest -- and maybe Dr. Meyer could tell me
3 if he agrees with me -- that, in many cases, you are interested in the
4 average value for the parameter in these lump parameter models, but
5 perhaps a more apt term might be representative value, because sometimes
6 you don't want just the arithmetic average; what you want might be a
7 harmonic average or some other number that is appropriate for the
8 function that the particular model plays and the role that the parameter
9 plays in that particular model. That's one point that I wanted to
10 clarify.

11 The other is this business about limited site data. You
12 know, if you look at it one way, if you took one data point, well, it's
13 real easy to get the average, and there's very little variance, but that
14 obviously is not the right characterization of how much uncertainty you
15 have, and what Dr. Meyer has suggested, which I think is a reasonable
16 approach, is to use this Bayesian updating method, which starts out with
17 a national database, assuming you know nothing about your site, and then
18 as you get more and more site data, the impact of the national database
19 automatically, because of the way the Bayesian updating works, becomes
20 less and less significant, and the site-specific data and the
21 distribution of that data becomes more significant.

22 MR. MEYER: I just want to thank Norm for bringing up that
23 first point.

24 The idea of a representative value not necessarily being
25 your arithmetic average is entirely correct, and in fact, it's
potentially more serious than just having an average value, because
you're really interested in what's known as an effective value, which
the derivation of that is there's no consensus currently in the
scientific community on the best way to derive an effective value from a
series of measurements, but the effect of that effective value is that

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1 it's just simply going to increase your uncertainty, and I think that,
2 as regards the particular distribution, I think it's less important to
3 dwell on what particular distribution you're going to be using and more
4 upon relationships between parameter values, the model values, and
5 looking at a range of parameter value inputs, and you know, if you're
6 concerned about distribution, then look at the effect of a couple of
7 different distributions.

8 Look at a symmetric form, look at an asymmetric
9 distribution, and see, if they both make reasonable sense, how the --
10 your results vary in using those distributions.

11 MR. THAGGARD: Okay. I think we've basically kind of
12 touched a little bit also on question number two, at least Norm did,
13 where we talk about how can we integrate this regional and national data
14 with our limited site-specific data, and I think the appropriate that
15 Dr. Meyer has been advocating is the use of this Bayesian updating
16 technique, and for some people that don't have a strong statistical
17 background, they may not understand some of that.

18 I'd like to see if there are some other ideas out there that
19 people may have in terms of how we can integrate this national data with
20 limited site-specific data. Are there any other thoughts on that?

21 MR. NICHOLSON: One thing that didn't come up yesterday when
22 Dr. Neuman was talking about his site, instead of looking at national
23 databases, you look at nearby studies that have been done, you go to the
24 land grant universities and you go to the USGS to get open file reports,
25 you find a study that has been done in a very similar geologic and
hydrologic setting and say, well, for my purposes, I want to begin with
that information and database and not do what you're saying, Phil, in
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regard to looking at a national database to come up with these
estimates. What are your thoughts?

MR. MEYER: I agree with you, and I think the approach that

1 the folks at the University of Arizona have taken is good, but they also
2 used the information from NUREG-6565, which was a compilation of a
3 national database to look at values for their parameter starting points.

4 MR. THAGGARD: Okay. Why don't we move on to the next
5 question here? What kind of information are available that licensees
6 can provide to justify their site-specific parameters? I'd like to get
7 a little bit of dialogue on that.

8 How acceptable is somebody coming in just using literature
9 information? What are people's feelings on that? Any comments?

10 MR. MEYER: You're concerned about people coming in with
11 literature values?

12 MR. THAGGARD: Yes. I mean that's just an example.

13 MR. MEYER: Being able to justify those?

14 MR. THAGGARD: Yeah.

15 MR. MEYER: I tend to think the literature values are just
16 another example of something similar to national data. You know, it's
17 analog data that somehow is related to your site but not a direct
18 measurement from the site. It should be treated the same way.

19 You know, there's more uncertainty associated with that data
20 than there is site-specific measurement, so treat it the same way.

21 You've got literature values for use, and you better have
22 some sort of an estimate for what the range about that value could
23 possibly be at your site. Maybe use a literature value as your best
24 estimate, but there needs to be some other information in there, also.

25 MR. THAGGARD: Okay.

Tom?

MR. POTTER: Tom Potter.

I think we need to factor in some way qualitative
information that is available from the site. For example, you were
talking about license terminations here. Most sites have experienced

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1 small releases of radioactive materials at the sites, in the soils
2 around the sites.

3 I think the experience generally is that those releases are
4 quite well confined to the places where they were originally deposited,
5 and over a long period of time, for many of these sites, 30 to 50 years.

6 You might not be able to translate that to a Kd directly,
7 but it does give some indication of substantial retardation potential
8 for the soils around the sites, and there ought to be some way to factor
9 that in to support for selection of site-specific Kd value, something
10 like that.

11 MR. THAGGARD: I think you're saying there needs to be some
12 way to tie it back to the site.

13 MR. POTTER: Or more to the point, some way of using
14 qualitative information to support some selection of quantitative values
15 for important parameters.

16 MR. THAGGARD: Okay.

17 Any other comments?

18 Dr. Wierenga.

19 DR. WIERENGA: I'd like to make an argument for sometimes
20 digging a little deeper.

21 For example, I once did a study for fuel properties of a
22 large fire, and I went back to the person, who was close to retirement,
23 but he did the original soil survey for that fire, and he had a wealth
24 of information about the soils at that site.

25 It was really not considered in the official reports,
etcetera.

So, one could, for example, if one needed more soils
information, go to local soil survey people, and they could often give
you a lot more information about the particular site, especially if you
bring them to the site that you're interested in and that you're working

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1 with and want to know more about.

2 So, I think that is something you won't find on the
3 internet, you will not find in local reports, but that still might be
4 available.

5 MR. BELLINI: Frank Bellini, Duke Engineering and Services.

6 Before I was Duke, I was Yankee Atomic for 20 years-plus,
7 and I'm a geologist by training, and I can tell you that this all
8 becomes a little bit easier when you have a background in geology and
9 soils, and of course, working at the plant sites, there's always a lot
10 of good geologic information available there, although sometimes you
11 need to dig it out or find the right person who can help you into it,
12 because some of it, as you say, is not always as well documented as
13 you'd like to see it.

14 People come to me all the time when you're using RESRAD and
15 DandD and ask me, well, what Kd do we use and how deep is the ground
16 water here?

17 When you're tied into the geology a little bit at the sites
18 -- and I have been at all the New England sites, on a greater or lesser
19 basis over 20 years -- it becomes a lot easier to deal with these
20 questions.

21 Now, it doesn't mean you pull a Kd out of your pocket for a
22 given radio-nuclide, that's tough, but at least you have some insight
23 into soils, you have some insights into maybe 302 studies that have been
24 done at the sites over the years, and see somebody else's estimates on
25 migration rates and values for various radio-nuclides.

So, my suggestion would be find somebody that has some
geologic background at the site.

Even if they're not used to dealing with the nuclear side of
things, if you explain to them what you're trying to do, that help is
out there on a professional basis, and I think it should be fairly easy

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1 to obtain for almost any site and might be a good supplement to just
2 looking at the regional or the national databases cold, without any
3 background.

4 MR. THAGGARD: Okay. I think you're saying, basically, use
5 the expertise that's available. Okay.

6 Why don't we move on to the next question here? How does
7 one assure the consistency between conceptual model assumptions and the
8 selected parameter values? Can default values be used for different
9 sites?

10 In my time here at the agency -- and I've seen a lot of
11 dose assessments -- I've seen a lot of people routinely use default
12 parameter values, and I think the question has to do -- how
13 representative are these default values?

14 I'd like to get a little bit of discussion on that. Anybody
15 have any comments on that? What are your thoughts on the use of default
16 values? I guess nobody here uses them?

17 Tom Potter?

18 MR. POTTER: Tom Potter again.

19 I don't think there should be any controversy about using
20 default values for pathways and parameter values that don't matter very
21 much. I don't think we ought to spend a lot of effort on the pathways
22 that we can easily dispense with.

23 MR. THAGGARD: Okay. I think that's a very good answer. I
24 think that's kind of what we've been advocating over the last couple of
25 workshops. We've tried to encourage people to go through and try to do
some sensitivity analysis, as Dr. Meyer has indicated here, identify
what the important parameter is, and you know, that's where you put your
effort.

So, I think you kind of summed it up pretty succinctly
there.

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1 MR. MEYER: The flip side of that is that, if you have
2 pathways or parameters that are important, then I think that default
3 values are not appropriate.

4 MR. THAGGARD: Any other comments?

5 MR. POTTER: I don't think we ought to rule them out
6 immediately. I think it's possible that you could use conservative
7 default parameters, reasonably conservative default parameters that
8 would be suitable, but I think there are certainly situations where
9 defaults might not be appropriate.

10 MR. THAGGARD: Well, let me ask you, Tom, while you're
11 standing there -- I don't mean to put you on the spot. Maybe somebody
12 else could answer this, but how do you know that the default value is
13 conservative?

14 MR. POTTER: Well, for example, let's take a re-suspension
15 air pathway. There's one fundamental parameter that's highly uncertain
16 but very important, and that's the re-suspension factor or the mass
17 loading, that kind of thing.

18 I don't think there's much doubt that we can come up with
19 reasonably conservative values for that. There's a default parameter.

20 MR. THAGGARD: I've gotten into some discussions on this
21 before.

22 Especially as it relates to Kd, I've gotten -- people say,
23 well, I used the conservative Kd value from the literature, and our
24 argument -- well, how would you know that's conservative for your
25 particular site, unless you've got some data for your particular site to
support that.

Boby, you had a comment?

MR. EID: I would like to say that, for those models, it's
good to have some insight about dose models, because they do have
assumptions, and if you find those assumptions would be very related by

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1 inputting certain parameters, then you may not need to put that
2 parameter. An example of the infiltration rate in the ND screen and the
3 hydraulic conductivity, and you could see the relationship between both.

4 So, there is a specific assumption about the infiltration
5 rate, and if you increase that amount, that infiltration rate is less
6 than the vertical conductivity. This means the model could be violated.
7 Those kind of assumptions -- they need to be revised when you try to use
8 it and you input the parameter.

9 MR. THAGGARD: Okay. I think -- as a general rule, I think
10 I'm hearing people say that you shouldn't just routinely use default
11 values. Of course, they may be appropriate if the parameter doesn't
12 have any effect on the analysis.

13 There seems to be some debate as to whether or not you
14 should use default values if the parameter does have an effect on the
15 result. I think Tom is saying there, well, if you can demonstrate that
16 the value is conservative, it may be appropriate to use.

17 MR. MEYER: I would agree with Tom. My point that it's not
18 appropriate is that it's not appropriate to just accept a default value.
19 If you can justify it as being conservative or as being appropriate for
20 your site, then fine. It's a totally different matter.

21 MR. THAGGARD: Okay.

22 Any other comments?

23 MR. HAMDEN: The one thing that's important to both
24 questions three and four that hasn't been mentioned which should be
25 obvious based on many experiences we have is the sensitivity analysis.

26 This is the most important tool for that, and I think also a
27 sensitivity analysis would be effective, also, for evaluating if all
28 values of parameters are acceptable or if they need to be verified and
29 & so on.

30 MR. THAGGARD: That's kind of what Tom has said. He said

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1 identify the important parameter, and I think one would use the
2 sensitivity analysis to do that, to help guide you in doing that.

3 Okay.

4 Why don't we go ahead and move to our last question here?
5 Should parameter uncertainty be factored into the model input to
6 determine need for more detailed site-specific data, and if so, how?

7 I think we've already kind of covered this to some extent.
8 I mean we could certainly -- okay, Tom?

9 MR. POTTER: I have one thought on this that is important.
10 We do need to factor in uncertainty in some way, but we need to -- I
11 think we need to keep the whole problem in mind when we try to do this.
12 That is to say it's easy to focus on particular little -- we're talking
13 about ground water in this couple of days, and it's easy to get overly
14 focused in one particular aspect of the problem and overly concerned
15 with uncertainties about one particular aspect of the problem.

16 I think a thing that Joe Nardi was making reference to
17 earlier concerned -- that he made -- expressed earlier about piling on
18 of conservatisms and things like that, getting us into another world, is
19 a problem that I think we manage by keeping our eye on the whole
20 problem, on the problem as a whole, which is to say we've got maybe on
21 the order of 100 sites to terminate licenses here by going through this
22 kind of complex analysis.

23 We've set our dose limits quite low, actually, 25 millirem
24 per year. We've identified exposure scenarios that -- even for going
25 beyond the screening basis, are probably going to be unlikely exposure
scenarios.

ADN The assumptions associated with some of those scenarios are
RIL probably not going to be very likely. For example, okay, we assume
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& resident farmer but we also make him drink well water.
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1 drink the well water, he probably won't drink it from the upper aquifer.

2 And then we get down to calculating DCGL values, which is
3 really what we're talking about here, using -- trying to factor in
4 uncertainties in our mathematical model and our parameters, and then we
5 finally go to the final status survey and again impose caution in
6 assuring that our concentrations are not just below the DCGL, but we can
7 prove with a higher level of confidence that they're below the DCGLs.

8 So, really, it's that whole chain of events that we need to
9 factor -- that we need to think about the uncertainties.

10 Ultimately what we want and what the NRC needs and what the
11 licensees need, as well, is a regulatory process that allows us to
12 release these sites in such a way that they're not going to come back to
13 haunt any of us later, and that's about all the uncertainty control we
14 need. How we get that is going to take considerable judgement on the
15 part of all of us, I think.

16 MR. THAGGARD: Okay. That's a very insightful comment.

17 MR. NARDI: Joe Nardi from Westinghouse.

18 I'd just like to add to Tom's comment here that, in addition
19 to all of this, in our situation, we're trying to do that where we're
20 trying -- we have a site with ground water and we're trying to get in
21 this, you know, report that justifies DCGLs within the next week or two,
22 and you know, what we're talking about is doing it with other kinds of
23 Monte Carlo calculations or something else that are not available to me
24 right now, yet I'm trying to do this in the real world with multiple
25 radio-nuclides in a short timeframe.

MR. THAGGARD: Okay. Well, I don't think -- I think we need
to step back and make it clear that we're not saying that people have to
use the Monte Carlo analysis. I mean I think that was Dr. Meyer's
opinion as to what he views, but as an agency, we haven't taken that
position.

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1 John Ellis?

2 MR. ELLIS: John Ellis from Sequoia Fuels.

3 I'd like to suggest that there may be another option for
4 some sites, particularly like the Sequoia Fuels site. We've got about a
5 30-year history that's pretty well geologically documented before the
6 plant was built.

7 We also have a 30-year history of repeated spills of various
8 sorts, and over the last eight or nine years, we have done extensive
9 sampling on that site, a lot more than anyone would probably consider
10 doing under normal circumstances, tens of thousands of sample points to
11 be more precise, but I think there's an opportunity here, with the
12 number of data points that we have, at least, of building some at least
13 qualitative estimations, empirical estimations of things like the Kd
14 values.

15 We have got a lot of soil samples in the unsaturated zone
16 from the surface down to the water table. You can look at the
17 distribution of uranium from top to bottom, get extensive history on the
18 precipitation patterns in the area. In fact, we collect rainfall data
19 on a daily basis.

20 We also know quite a bit about porosities of soils, the
21 percolation rates.

22 So, I think there's some ways of justifying -- actually
23 developing and justifying Kd values, for example, nuclides that we're
24 interested in just based on the data we have.

25 Similarly, for the saturated zone, we have kind of a --
maybe a unique situation at that plant, not only released uranium into
the ground water but significant quantities of nitrate.

Nitrate is attenuated very little in ground water, in the
& system.

So, you can look at the progress of the nitrate plume over

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1 the history of the plant and come to some very good conclusions on
2 ground water flow rate, dispersion, etcetera, then you can look at
3 what's happened to the uranium plume, and I really believe you can
4 back-calculate some values for various parameters that would predict
5 uranium movement that might give you a much better handle on what's
6 going to happen long-term than trying to arrive at it statistically
7 using some of the methods that we've talked about today.

8 MR. THAGGARD: Okay. I think this goes back to what Dr.
9 Meyer said at the beginning of his talk. I think his talk was focusing
10 more on sites where you didn't have existing ground water contamination,
11 where you could do these type of inverse analyses as you've indicated.

12 I would like to say before we conclude, though, that
13 certainly we are not saying that people have to use Monte Carlo
14 analysis. I want to make sure that's clear.

15 I mean I think the -- as an agency, I think that's kind of
16 our preferred method, but certainly, you can use deterministic analysis,
17 and I think all our guidance documents say that.

18 With that, I would like to turn it back over to Tom.

19 MR. NICHOLSON: Thank you very much, Mark. Thanks for
20 leading that discussion.

21 We'd like to take a break now for 15 minutes, and then we'll
22 reconvene, and we'll listen to some test cases from DOE.

23 Thank you.

24 [Recess.]

25 MR. NICHOLSON: If I could have everybody's attention --
Mike, are you ready? Mike's ready. If everyone can please take your
seats, we'll get started now.

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I want to thank very much the United States Department of
Energy for providing two very good test cases that we can discuss with
regard to implementing decommissioning issues in calculating dose

1 assessments.

2 The first talk will be by Sam Lee, who works for the United
3 States Department of Energy, their Environmental Monitoring Lab in New
4 York City. His talk is entitled "Ground Water Modeling Studies of the
5 Characterization of Uranium Contamination at Fernald," and it will be
6 presented by Sam Lee.

7 Sam?

8 MR. LEE: Actually, it's environmental measurements.

9 Before I talk, I'd like to thank Tom for giving me this
10 opportunity to present my studies on Fernald.

11 During 1953 and 1989, nuclear weapon material were produced
12 at Fernald in Ohio, and after 1989, the operation of production was
13 stopped, and DOE re-focused on environmental restorations.

14 During these 40 years, ground water has been contaminated
15 with uranium, and this study is a part of the effort to find out how
16 much contamination and how serious the contamination is at the Fernald
17 site.

18 At the site, a model has been used, such 's the SWIFT model,
19 has been studied many years at the site. However, the SWIFT model is an
20 old model originally designed for saturation zone only, and SWIFT model
21 deals with the linear assumption process.

22 I would like to describe in more detail the linear
23 assumption process.

24 EPA has questioned the SWIFT model result. So, therefore,
25 they are trying to develop a reasonable and defensible ground water
model that can be accepted through EPA.

In the meantime, we are trying to develop an advanced ground
water model that can take into account more important physical/chemical
process, and particularly for the talk, I'd like to emphasize this
process, give the audience a little background.

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Now, I'll give you some background.

I'm trying to use the TRACR3D model, which is developed to model the time-dependent mass flow and the chemical species transport in a three-dimensional, deformable, heterogeneous, sorptive process.

The computer code can calculate water flow or air flow and the transport of radioactive and sorbing species for a variety of flow conditions: steady state or transient state or the one-, two-, three-D geometries, or in saturated or unsaturated zones.

I'll give you more background of the TRACR3D.

TRACR3D was originally developed by the Los Alamos National Laboratories and has a long history of use for DOE projects such as Yucca Mountain, Nevada Test Site, or the Savannah River Site, and was used by Lawrence Livermore and Sandia National Laboratory, and FEMP at the Fernald site.

It has been verified and validated for a variety of flow and reactive transport conditions and has undergone many revisions and updates over a period of 20 years, and recently, the model has added additional modules to calculate the biological and colloidal transport.

It has the capability to do the optimization for pumping operation or inversion data to get -- determine the flow and the transport properties and also has the capability to do the sensitivity analysis.

I think TRACR3D code is the most powerful modeling system available for porous flow and transport.

In order to use this model, I'll just give you some idea what kind of parameter we are emphasizing for the model, but for this talk, I am trying to emphasize what is the thermodynamic parameters such as the adsorption, desorption, and chemisorption.

In particular, yesterday and today, we are talking about the distribution coefficient. I'd like to give you some background on the

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1 distribution coefficient, what we had to use and how we can improve this
2 distribution coefficient K_d , and it gives a little background in order
3 to try to use the model, just like Bobby said.

4 We have to know the model assumptions in order to do the
5 better job. So, now I try to give you some background on how we improve
6 or what kind of distribution coefficient it is.

7 Before I give you a description, I'd like to give you a
8 little background of the model input we require at the site, such as
9 hydraulic conductivities at the site. The minimum hydraulic
10 conductivity can be 120 and 774. So, that is a lot of variation for the
11 site.

12 So, in order to take into account all these variations, we
13 tried to devise a different zone to take into account those spatial
14 variations. This is the Fernald site, the operations site.

15 So, in this zone area, the hydraulic conductivity is 400 for
16 all the layers, and for example, this is -- zone four -- the top layer
17 is -- we are showing 638.

18 So, I'll just give you some three-dimensional view of
19 hydraulic conductivity we input into the models, and so, that is a
20 different area. We have used a different horizontal, the hydraulic
21 conductivity, or the vertical hydraulic conductivity.

22 We take into account all the spatial variation at the
23 horizontal or the depth.

24 How about infiltration rate?

25 At the site, we have a DOE measurement of the precipitation
around 41 inches per year, and we calculate the run-off, probably nine
inches per year, and this evaporation is around 26 inches per year. The
recharge is around 6 inches per year around the site area.

And this is just to give an overview of the infiltration
rate in the spatial variation, and I just pointed out previously, in

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1 this area, this is 6 inches per year, but in a certain area, it has a
2 higher infiltration rate.

3 So, those is a variation of the infiltration rate input into
4 the model.

5 Now, let's talk about the Kd. I'd like to emphasize on Kd
6 distributions, because that is most people's concern for this meeting.

7 First, for the definition of the Kd, most people use a Kd
8 under given conditions, such as the Kd is defined as the ratio of the
9 mass sorbed into the solid and the mass of the solute in a solution,
10 simply put by this equation: $S=KdC$.

11 S is the concentration of sorbing species, and C is the
12 concentration of the solute.

13 So, look at this equation. It's too simplistic. Why is it
14 so simplistic?

15 Using one parameter Kd is very bad for describing the
16 complexity of the process or the areas. For example, for the site --
17 for the specific site, for Fernald, for example, at this area -- we are
18 emphasizing on this area, and we can see that is a variation for the
19 area can be from .76 to .68.

20 So, which volume we should use? That's the question on
21 that, and it can have a serious result.

22 So, therefore, that's why it's -- I point out here there's a
23 variance of the Kd, are very uncertain, from .76 to 68, and also, I'd
24 like point out now that Kd, based on this equation, is linear, is not
25 suitable for the study, for the long-term, for the model run.

We use only one Kd to represent a whole integration time.
That is not correct. So, that's why we have to emphasize -- we have to
know that is a Kd in a model.

So, that is, we have to remember that this is a Kd and may
not be suitable for the time-dependent study.

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1 How do we do it? Do we have another approach? Yes.

2 Another approach is to use non-equilibrium conditions. That is, we have
3 to consider another equation of the kinetic mass transfer among the
4 different species, between the solid and the liquid phase.

5 So, in that case, we have to invoke another equation.

6 So, based on this equation, S is concentration of sorbing
7 species, involves Q_1 , Q_2 , Q_3 , and Q_1 is the adsorption rate, Q_2 is the
8 desorption rate, and Q_3 is the chemisorption rate.

9 So, based on this equation, under equilibrium conditions,
10 previous slide, under equilibrium conditions, this term is zero, and
11 with chemisorption, this term equal zero, then we can come out that the
12 K_d is equivalent to the Q_1 adsorption species and divide by Q_2 , which is
13 the K_d that involves only an adsorption and desorption rate.

14 So, that's what I want to point out to you. Chemisorption
15 is important. If we use a K_d , we have some problem, because we use a K_d
16 without considering any chemisorption.

17 So, that's what I'd like to point out to you and how
18 important is K_d , and we have to know this is -- how important this is at
19 a site.

20 If they have a chemical species and consider any
21 precipitation or anything like that, K_d , no matter what kind of value
22 you use, may not give us the right result, because they do not consider
23 any of the chemisorption.

24 So, that's why I'd like to point out to you not only the K_d
25 value, but we have to know what kind of assumption for the K_d . That is,
 K_d based on this one is only considered an adsorption and desorption
 rate only.

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 I will give you more of the model results, let you look at
 how important this assumption plays. I'll try to give you some model
 simulations.

1 First, I'd like to demonstrate -- yesterday or today, we
2 talked about how important is the dispersion, and because I know that
3 some DandD or the RESRAD did not consider any dispersion, I'd just like
4 to demonstrate in an actual site how important is dispersion
5 calculation.

6 So, in the simulation based on the model, we don't perceive
7 any dispersion, and second, consider, with the transport in dispersion,
8 how much difference, and it really demonstrates how important dispersion
9 is, and then, the third test is a simulation based on equilibrium
10 sorption.

11 That is a condition of K_d , and then is a simulation based on
12 a non-equilibrium sorption with and with chemisorption and really to
13 see how important the chemisorption is.

14 These are the initial conditions of the uranium
15 concentrations at the top layer, and this originally is back to 30, 40
16 years ago. This is contamination only of certain areas, only around
17 this area, but now has been contaminated. So, this is what we use as
18 the initial condition at the site, this top layer, and this value is 20
19 pbb and the maximum up to 2,000 pbb around here.

20 The EPA requires it to be at 20 pbb, and this is the second
21 layer, next to the top layer, and now the contamination goes down to the
22 third layer already, a little bit there, but most contamination is
23 accumulated at the top two layers.

24 This is the initial concentration of the uranium. We used
25 these initial conditions and hydraulic conductivity infiltration rate
input as input to the model and let it run.

Now, let's look at the results for the transport only.

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This is the top layer. This is integration up to six years
later. The initial condition is back to 1997. So, this is after six
years' integration, without considering any dispersion.

1 So, this is very similar to the initial concentration.

2 This is the top layer, and this is the second layer, and we
3 don't see too much difference from the initial conditions after the six
4 years' integration, and now let's look at that, compare with -- this is
5 transport only.

6 This one is -- the top figure is transport and the
7 dispersion, and in this case, we only used equilibrium sorption, and we
8 can see the difference.

9 Next, please.

10 We can clearly see that, in the peak, it has been reduced,
11 after considering the dispersion. Originally here is about 2,000 pbb
12 and now is reduced to 500 pbb, and in here, it's more dispersed than
13 without dispersion. This is for the top layer.

14 Now, let's look into another for the chemisorption. I'd
15 like to describe it and how important this chemisorption.

16 So, this is initial -- the initial condition for the uranium
17 concentration at the top layers, and after the six years' integration
18 without chemisorption, we can clearly see that the uranium plume hasn't
19 changed very much. There's some changes but not much.

20 So, this is without the chemisorption, and the previous
21 slide is for the equilibrium conditions, but now, if we run the
22 non-equilibrium conditions without the chemisorption, we can clearly see
23 that there is not too much difference between the non-equilibrium and
24 the equilibrium conditions, but in this case, we are trying to use Q1 or
25 Q2. Q1 is adsorption, and Q2 is desorption.

 We tried to use the value of the Q1/Q2 equal to the Kd,
which is equivalent to the equilibrium adsorption. So, we don't expect
too much difference, because in this case, we tried to compare with Kd.

 So, that's why we selected the Q1 and Q2, tried to get some
balance based on that equation, get the same value of Kd.

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1 So, we don't expect too much different from the -- from this
2 result.

3 This one is the concentration based on the equilibrium
4 conditions, and we don't see too much difference.

5 Also, we have to think about that that site has been
6 contaminated 40 years. So, during this 40 years, maybe the uranium has
7 been reached through the equilibrium conditions, maybe.

8 So, that's why we don't see too much difference between the
9 equilibrium and non-equilibrium conditions. However, if we use -- add
10 chemisorption into the model for the non-equilibrium conditions, this is
11 initial condition for the uranium, and after six years' integration, we
12 clearly see that the concentration plume has been reduced. That is
13 indicating how important the chemisorption is.

14 So, in that case, this only can be under the non-equilibrium
15 conditions, but with the equilibrium conditions, this chemisorption
16 cannot be considered at all.

17 But we know that site has been detecting some other species,
18 uranium species. That has been discovered, and some chemical
19 precipitation is occurring. So, we have to consider some chemisorption
20 process in the site.

21 So, in that case, based on that transitional K_d , we have a
22 problem too complex for chemisorption, but in this case, we had to use
23 non-equilibrium conditions in order to tackle the chemisorption, and we
24 can clearly see that is a variation from that initial.

25 Look at those two. Those are year two or three with
chemisorption, and this is year two or three without chemisorption, and
we can clearly see that the plume has been changing, with and without
chemisorption.

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So, let me make some conclusions for the talk.

Based on the comparison between the transport and

1 dispersion, we found that the peak concentration was reduced and the
2 plume becomes diffused when dispersion is considered.

3 The second thing is we found that the model -- we tried to
4 use a different adsorption and desorption rate, and we found the model
5 results were not very sensitive to these changes between adsorption and
6 desorption.

7 That's why I pointed out that, because probably uranium at
8 the site has been reached to the equilibrium conditions.

9 And the third thing is the chemisorption process plays an
10 important role in the fate and transport of uranium plumes and enhance
11 the mass transfer process. That is, we have to consider in the model
12 simulations.

13 So, that has been neglected in most of the models. We have
14 to consider that in order to give us the right plume, contamination
15 plume.

16 So, that's why I pointed out additional measurement data is
17 needed to verify how important this chemisorption process at the
18 different sites.

19 If a site has this chemical reaction and precipitation, we
20 have to consider this chemisorption in the model.

21 Finally, I'd like to give some recommendations, and I think
22 that, at the site, Fernald, we have tremendous measurement data of
23 variable and all kind of data we can use for the model test.

24 So, I'd like to continue to use Fernald as a demonstration
25 site or test site to further examine the ground water model related to
dose assessment in the future, how important is the ground water model,
because in that case, we'd like to continue to use this elevated TRACR3D
to identify the important key parameters that have a maximum impact on
& the risk assessment, such as yesterday Carol described some key
parameters.

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1 So, we can use this, TRACR3D, to try to validate, because
2 she pointed out just based on the DandD, but now we can use this as an
3 elevated TRACR3D to try to validate her finding and that kind of stuff.

4 So, in that case, we have tried to continue to identify that
5 as a key parameter and also tried to see how the maximum effect or the
6 geo-chemical or geological condition on transport.

7 That is the end of my talk.

8 MR. NICHOLSON: Thank you very much, Sam. I really
9 appreciate that.

10 Are there any questions for Sam Lee on the Fernald site?
11 Tom?

12 MR. POTTER: Tom Potter.

13 The term "chemisorption" -- we could probably stand to have
14 some elaboration on that. What kind of chemical processes do you --
15 have you described here that result in this -- apparently, it results in
16 a more rapid transport of uranium through the ground water system than
17 we would otherwise get.

18 MR. LEE: I'm thinking that, at a particular site, if we
19 have some secondary species, if we found a secondary species, maybe we
20 have to worry about some of the chemisorption there. That's the main
21 thing.

22 MR. MEYER: I had the same question as Tom, but you didn't
23 really answer what do you mean by "chemisorption"?

24 MR. LEE: Oh, okay. Chemisorption is actually the
25 irreversible process. A sub-species is transformed to the chemical
bonded state. That is chemisorption.

MR. MORTON: Henry Morton.

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I was thinking in terms of the condition in which you might
have chemically-processed material leaking into the ground and, thus, a
chemically-active form of uranium to begin with, but then realizing that

1 the long-term tendency may be toward a more stable form -- iridium
2 oxide-308 is a long-term environmental tendency -- and that from a
3 leakage situation which might be the more active form, a nitrate
4 chloride form of uranium, the nitrate or chloride tends to move on out
5 faster, with the prospect that there is a change in the chemical form
6 from a more mobile to a less mobile form, whether you'd call it a change
7 of compound or precipitate.

8 What term, what parameter would you quantify in your program
9 or in your model to account for that kind of condition? Is that what
10 you were calling -- or what might come under the equivalent term of
11 "chemisorption," or is there a separate term for precipitation?

12 MR. LEE: That term should be -- everything should be put
13 into this as Q3, the chemisorption rate. So, in this case, we have
14 shown that we just take that Q3 is about a three-magnitude order than
15 the desorption rate.

16 But this is the equation. We can have different species,
17 can involve different species, if we have more than one species, and we
18 can have a different Q3 for different species, and all this is
19 precipitated. The chemical can be considered a different value of the
20 Q3.

21 MR. MORTON: Are you developing these -- the values of the
22 parameters that might deal with this in your modeling, for example,
23 considering applying to the Fernald case?

24 MR. LEE: Yes.

25 MR. NICHOLSON: Are they derived from the field?

MR. LEE: I'm taking based on the literature survey at this
point. I need additional field measurement to try to validate the
chemisorption process.

MR. MORTON: So, then, to apply this, for example, in the
Fernald case or to John Ellis' case, where he, for instance, over --

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1 even over relatively short times, may not be seeing actual migration
2 that would be explained otherwise, when applying this to very long
3 time-frames, hundreds or thousands of years, what would you do as a
4 practical matter -- that is, to an applied case -- to gather the data to
5 be able to apply this quantitatively?

6 MR. LEE: For longer than 1,000 years, how do we know this
7 value is validated, that kind of stuff? Is that your question?

8 MR. MORTON: Or even over 50 or 100 years.

9 MR. LEE: At this point, we don't know. Nobody knows what
10 kind of value we should get -- Q1, Q2, and Q3 -- and the only thing we
11 can -- for the short time period, 10 years, if we have some measurement,
12 we can compare that measurement with the model results to get the best
13 judgement of the Q values.

14 MR. NICHOLSON: Okay. We'll stop there. Thank you very
15 much, Sam. We're going to have a group discussion on this after lunch,
16 but I want to get to our next speaker. Thank you very much.

17 Our next talk will be by Ken Renfeldt and Barbara Deshler.

18 Ken is with HSI GEOTRANS, and Barbara Deshler is with IT
19 Corporation, and they're going to talk about the ground water water
20 modeling in support of dose assessment for the Nevada test site
21 underground test area project.

22 MR. RENFELDT: I want to thank Tom and NRC for giving the
23 opportunity to be here. As Tom said, I'm with HSI GEOTRANS. We are a
24 subcontractor to IT Corp., which is where my colleague, Barbara, works.

25 IT is the primary subcontractor to DOE at the Nevada test
site for environmental restoration, and what I want to talk about is
some of the modeling that we're doing at the test site, and I was
thinking about this last night, and in a way, I feel a little bit like
John Cleese, because I think what I'm going to show you now is something
completely different in terms of the magnitude of the problem and the

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1 scale, etcetera.

2 Our problem is actually very similar to yours. We need to
3 predict or assess the risk to receptors posed by radio-nuclides, but the
4 location of our radio-nuclides and the source is a little bit different.

5 We have radio-nuclides in ground water, and it's in the
6 ground water because of 40 years of nuclear testing at the Nevada test
7 site.

8 There are about 828 announced underground tests at the
9 Nevada test site. About a third of those are believed to be either
10 below the water table or close enough that they've directly impacted the
11 water table.

12 If you're not familiar with the test site, it's in the
13 southern part of the State of Nevada. It's this area outlined in purple
14 here. The yellow boundary represents the -- a regional model area that
15 we started out with.

16 We had to put the whole flow system into a regional context,
17 and so, we started out with this area here. It extends down into Death
18 Valley over here. The City of Las Vegas is out to the left here -- or
19 to the right. It's about 70 miles from the test site.

20 What you'll notice here is, geologically, this is all based
21 on the range topography. So, we have just a series of mountain ranges
22 and valleys repeatedly throughout the whole study area.

23 On the test site itself, we've got -- this is the
24 distribution of the 800 or so underground tests, and we've grouped them
25 into different testing areas.

Some of the areas have a relatively small number of points,
such as here, where there was 10 underground tests. Up in Frenchman
Flat, there was about 700 tests.

These tests, to give you some idea of the size of these,
they are cavities underground that were vaporized, that have a diameter

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1 that ranges between 100 and 200 meters, and for source concentrations,
2 tritium, for example, is in the range of 100 million pico-curies per
3 liter, sometimes a little higher, and that's just the tritium.

4 So, we have a very significant source term here, and DOE is
5 concerned about transport of radio-nuclides from these testing areas.

6 In general, what's happening -- and I guess I'll do it on
7 the other scale -- ground water is moving off the test site generally
8 toward the south and west, and we've got population centers, a small one
9 over here, in Oasis Valley, there's people who live down in Ash Meadows,
10 of course you've got the national park in Death Valley down here. So,
11 there's certainly a concern for where these radio-nuclides are moving
12 and how quickly.

13 What I wanted to go over, after speaking with Tom a little
14 bit, were some of the considerations that we had in selecting the kind
15 of ground water model that we would use, and you remember from Dr.
16 Neuman's talk yesterday, the first thing we looked at was our conceptual
17 model.

18 Where is ground water flowing? What are the geologic,
19 hydrologic controls on that ground water flow? What processes do we
20 need to simulate invection, dispersion? Matrix diffusion is a big issue
21 for us because of fracture flow, radioactive decay, and of course, what
22 are our sources of contamination?

23 And we also looked at the complexity of the geology and the
24 fact that we have three-dimensional flow, which is a big issue.

25 The other thing that we considered in our choice of modeling
is what available data do we have? We certainly have water levels, some
discharge measurements, at least at the land surface, Death Valley and
other places.

Recharge is an estimate, at best. We do have flow and
transport parameters, and the hydrologic source term -- as I mentioned,

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1 we have some very high tritium concentrations. That's based on some
2 limited measurements.

3 Once you go beyond that to the 50 to 100 other
4 radio-nuclides that may be important, we have considerably less
5 information.

6 Complexity was a big issue for us. The Nevada test site is
7 the size of the State of Rhode Island. The regional study area, which
8 included that yellow boundary of the model and a slightly larger region,
9 is about 11,000 square miles.

10 Test cavities range in elevation from 500 meters up to 2,300
11 meters. Study area elevations go up to more or less around 12,000 feet
12 down to below sea level in Death Valley. So, we had a huge range in
13 elevations and source locations.

14 Depth to ground water is up to 700 meters below land
15 surface, and of course, in discharge areas, it's at the land surface.

16 Last time I counted, we had about 250 different geologic
17 units to worry about that range from pre-cambrian quartzites to
18 quaternary alluvium, and then, on top of that, in the tertiary, we had
19 a volcanic caldera complex that developed which made a mess of
20 everything that was left.

21 This is a schematic cross-section from the north to the
22 south through the whole study area. In this case, the test site would
23 be a region roughly in here.

24 We've got underlying basement rocks of very low
25 permeability, down about 4,000 meters, a large carbonate aquifer system
here and here that is the major flow system throughout southern Nevada
and is the primary aquifer of concern because of transport off-site.

 This system -- there is a series of older thrust faults in
the carbonates that move it around in juxtaposition to other older
clastic rocks.

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1 In the middle of this, you've got the tertiary volcanic
2 complex in here, which has some confining units, some aquifer units, and
3 then sitting on top of those in the valleys, of course, are the
4 alluvium.

5 Within a portion of the test site -- this is the southeast
6 corner, a place called Frenchman Flat -- we have a situation where
7 there's a shallow aquifer, which is alluvium.

8 It is the location where we have underground tests here and
9 here, and we have what appears to be almost a radial flow system in that
10 alluvium, yet the carbonate aquifer below it is flowing to the
11 southwest.

12 So, we have places on the test site where we've got ground
13 water going in 180 degrees opposite direction.

14 In terms of available data that we have, again speaking
15 regionally now, there were 2,400 locations for water levels.

16 A primary source of water level data is the U.S. Geological
17 Survey, but it's supplemented by a number of other organizations,
18 including the Desert Research Institute, Bechtel, Nevada, IT Corp.,
19 Yucca Mountain Project, Livermore and Los Alamos national labs, and
20 Nevada State Engineer.

21 The thing to point out here is that we have a very
22 non-uniform distribution of water levels.

23 In the testing areas on the test site, they are very dense
24 areas of wells. Off the test site, to the south, in the Amargosa area,
25 where there's irrigation, there's a lot of water-level data.

 There are other places where you can go 200 miles and
there's no wells. It's a very dispersed data set.

 Same thing with hydraulic conductivity data.

 When we get to transport parameters, it gets very difficult.
We have some tracer test data for dispersivities, but generally rely on,

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1 quote, "the literature."

2 There was a study done by Lynn Gelhar where he summarized
3 dispersivity values. Shlomo Neuman did the same thing. We tend to rely
4 on those where we don't have specific data.

5 Matrix diffusion -- there is -- just now we're getting
6 site-specific data at a field scale on diffusion, and then, in general,
7 though, we tend to rely on expert elicitations from NTS experts, from a
8 variety of organizations, and so, we rely on them to help us bound not
9 so much mean values but a range of variability.

10 So, what -- all of these factors drove our model selection.
11 We have a very complex geologic system, very complex flow system, and we
12 do have data, somewhat limited in many cases, but three-dimensional
13 data.

14 So, at the regional scale, we're doing three-dimensional
15 relative flow using mod flow to help us bound input and output through
16 the test site, and then, when we go to smaller scales -- for example,
17 when we want to simulate a testing area such as Yucca Flat -- we go to
18 more complex codes such as SWIFT or FEHM or something of that genre.

19 We bring in factors such as temperature dependence because
20 of the heat, of course, created by the underground tests, plus it's a
21 geothermal area, so we have temperature effects that may be important.

22 At this point, we're considering them but haven't actually
23 brought those into the models, but both of these codes have that
24 capability.

25 We have some unusual or maybe different regulatory drivers
than you may be familiar with. Right now, of course we have to worry
about DOE orders. DOE has certain requirements to protect their own
people on-site. There are drinking water standards, because we have
on-site water wells.

 But the primary driver for our modeling is something that's

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1 called the Federal facility agreement and consent order, and that's an
2 agreement signed between the State of Nevada, DOE, and Department of
3 Defense, and what we do is we define a contaminant boundary region, and
4 that's a region which is a lateral boundary in the deepest affected
5 aquifer for which the dose may exceed 4 millirem per year at any time
6 within 1,000 years, and schematically, what that looks like is we have a
7 source, which could be a single underground test, it could be a whole
8 series of tests, and first of all, we look at what's our expected region
9 where composite dose would be above 4 millirem, but beyond that, we're
10 also looking at a region on the outside of it which includes
11 uncertainty, data uncertainty, spatial variability, etcetera, and what
12 I've put in here is 95-percent probability that it won't be exceeded
13 beyond this boundary.

14 I don't know that we'll ever get to 95 percent, but what
15 we're aiming for is a high degree of confidence that we can define a
16 boundary beyond which we're quite sure concentrations will never be
17 above -- or the doses will never be above 4 millirem per year.

18 The 4 millirem per year is actually a proposed dose that DOE
19 has proposed to the State of Nevada, and it has not been agreed to yet
20 by the two parties. Where it came from was the State Drinking Water Act
21 is the maximum dose rate for beta-photon radiation.

22 So, that's currently what we're proposing as our dose
23 boundary.

24 The conversion of concentration data to dose comes from an
25 exposure scenario which is a drinking water ingestion of 700 liters per
year for 70 years, and the way we calculate that is we use that
ingestion rate of 700 liters per year, for each isotope we calculate a
concentration in our models in terms of pico-curies per liter, we use a
dose conversation factor which came from Federal Guidance Report No. 11,
sum these up for each of the nuclides, and that gives us a composite

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1 dose rate.

2 Now, we do this at each location, at each point in time.
3 So, my expectation is that we are over-estimating the dose through this
4 process, because that dose calculation assumes a 70-year ingestion time,
5 and we're actually using it in an instantaneous mode.

6 I'll quickly go through the modeling process.

7 We calculate this 4-millirem boundary based on a testing
8 area scale model -- for example, Yucca Flat or Frenchman Flat -- but
9 these models are sitting in the middle of a much larger flow system, and
10 we don't have any flow boundaries within any of these desert basins. In
11 other words, Frenchman Flat has no natural discharge. Its discharge is
12 30 miles away.

13 So, we use that regional three-dimensional model that I
14 showed the yellow outline earlier to provide boundary conditions for a
15 smaller-scale model.

16 So, we've nested a model in here, and on top of that,
17 because our source information is so uncertain, colleagues at Lawrence
18 Livermore National Lab have developed a source term model which, again,
19 is three-dimensional, and it's nested inside of our testing area scale
20 model.

21 The regional model brings in many different factors into
22 consideration. The conceptual model, of course, where is water moving
23 from, where does it go to -- I mean that's essentially our target, and
24 once we've decided on a conceptual model, that's what we're trying to
25 match with the regional model. There's a geologic model which describes
all the different geologic units and their position relative to each
other, then hydraulic heads, discharge parameters, etcetera.

That regional model is calibrated to heads and discharges.

We did two things with it -- one, we did one-dimensional
transport along pathways from the regional model, just to give DOE an

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1 initial sense of what kind of risk are we dealing with, how far away
2 might these radio-nuclides go, and second of all, it provides the
3 boundary fluxes for our testing area scale model.

4 The source term model starts with a radiologic source term.

5 This is known reasonably well to people at the national labs
6 who have clearances because of -- whether people are familiar with it or
7 not, anytime there was a nuclear test, nearly all of them had
8 drill-backs, they went back and drilled into these and sampled cavity
9 material at the bottom for diagnostic reasons.

10 So, they have a pretty good estimate of what the total
11 radioactivity would be, but that's not what's available for the ground
12 water.

13 Then you incorporate mineralogy, phenomonology, which is
14 essentially cavity physics, what happens underground after one of these
15 tests is detonated, local ground water conditions, and then they have a
16 very large thermo-dynamic database.

17 Essentially what Livermore is doing is a coupled reactive
18 transport ground water flow model, and they calculate the release rate
19 of radio-nuclides from the cavity materials from the melt blast into the
20 ambient ground water flow system, taking into account all of the
21 different reactive transport mechanisms between the nuclides and the
22 geologic materials, and what they provide to us, then, at the testing
23 area scale is radio-nuclide flux, so many moles of tritium-3 or so many
24 moles of plutonium, etcetera.

25 Model calibration -- we spent a great deal of time
calibrating our regional model using hydraulic heads and discharge
information.

When we get to the testing area scale model, we still use
hydraulic heads, because we've got water-level measurements, but because
there are, in almost all cases, no natural discharge in the testing

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1 area, we cannot calibrate to anything. So, we use the boundary fluxes
2 from the regional model which has been calibrated to provide that for us
3 here.

4 The source model is, by and large, un-calibrated. There is
5 some limited information on concentrations in ground water. I don't
6 think there's anyplace on the test site where I can map a plume. I know
7 where there are radio-nuclides that exist in the ground water at a few
8 selected locations.

9 The cost of collecting radio-nuclide information near these
10 cavities is enormous. The depth to ground water is very large, 700
11 meters in some cases. These holes typically cost us a million to two
12 million dollars apiece, and it's simply infeasible to map plumes from
13 these underground cavities.

14 So, we do some limited calibration of these source models to
15 whatever existing data we've got, but wouldn't be fair to say that these
16 are calibrated.

17 So, we look at uncertainty, certainly, in the input
18 parameters, and all of that gets back into our testing area models.

19 We do have uncertainty that comes from a large variety of
20 sources. We have alternative conceptual models. In an area as complex
21 geologically as the test site, you have different geologists who have
22 different interpretations, and so, we look at those and try to determine
23 what uncertainty that provides us in our predictions.

24 Parameters themselves are uncertain because of measurements,
25 and finally, we've got just the whole issue of spatial variability.

We handle these things through a limited number of Monte
Carlo realizations of our models, but basically, all we're trying to
come up with is can we bound where the contamination is likely to exist
so that we can go to DOE and DOE can go to the state and say here's a
region, here's a circle on a map, and we don't believe there's

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1 contamination outside of that.

2 The last thing that we are starting to work with now is the
3 question of what I'm calling model acceptability. Once we're done with
4 our predictions, these predictions have to be acceptable not only to
5 ourselves but to our client, which is DOE, and then to the State of
6 Nevada.

7 One way we do that is to carefully document what we're
8 doing, which I think is just standard practice. We look at
9 corroborating data and try to do a reality check on our predictions.

10 We'll look at geo-chemical data, observe parameter ranges,
11 anything else that we can do, see if our predictions seem to make sense,
12 and finally, just recently, we've convened a review panel.

13 There's actually two review panels. There's an internal
14 panel, which is NTS, knowledgeable experts, particularly the national
15 labs, the USGS, etcetera, and then we've also convened a panel of what I
16 call imminent experts, and Dr. Neuman is one of our panel members, and
17 they are there to provide us some oversight in terms of the approach, is
18 our methodology reasonable, are we using the correct tools, are we
19 analyzing our data correctly, etcetera, and that's all I've got, if
20 there are any questions.

21 MR. NICHOLSON: Thank you very much, Ken.

22 Are there questions for Ken and Barbara?

23 Sam?

24 MR. LEE: Just a comment. You just pointed out that you use
25 a map flow for the flow and the SWIFT model for the transport. I'd just
mention, just comment that those two models is designed only for the
saturated zone only.

MR. RENFELDT: Oh, absolutely. We only worry about the
saturated zone. It's not that there isn't a great deal of radioactivity
in the unsaturated zone, but at this point in time, since we know we've

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1 got several hundred tests that are below the water table, that's our
2 primary concern right now, and so, we're restricting ourselves to the
3 saturated zone.

4 At some point in the future, 20 years or so, we may worry
5 about the other tests, but right now our primary concern is saturated
6 only.

7 MR. ALLARD: Dave Allard, State of Pennsylvania.

8 Have you seen any tritium or other soluble radio-nuclides,
9 chlorine-36, off-site?

10 MR. RENFELDT: No. As far as I know, there has never been
11 any detected radioactivity in the ground water off-site.

12 MR. ALLARD: Are you guys looking at any of the off-site
13 test areas?

14 MR. RENFELDT: Those would be --

15 MR. ALLARD: Off-site test areas.

16 MR. RENFELDT: Yes. We have looked at other sites. There's
17 the salmon site in Mississippi, several sites in Colorado and New
18 Mexico, yes.

19 MR. ALLARD: Right.

20 MR. RENFELDT: That's a separate project from the one I'm
21 working on. There's another group looking at those.

22 MR. ALLARD: Okay. Thanks.

23 MR. NICHOLSON: Sam Nallaswami.

24 MR. NALLASWAMI: Sam Nallaswami, NRC.

25 Your limit was 4 millirem per year. What is the maximum
dose you got?

MR. RENFELDT: I'll try to think. If I look at the
cavities themselves -- I mean I don't remember the exact conversion, but
converting 100 million pico-curies per liter of tritium, probably 1,000,
2,000, maybe 10,000 millirem per year, I don't remember, and that's just

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1 tritium.

2 MR. NALLASWAMI: Okay. Thank you.

3 MR. NICHOLSON: Norm Eisenberg.

4 MR. EISENBERG: Norman Eisenberg from NRC.

5 In calculating the 4-millirem limit, do you assume that the
6 receptor drinks the concentration that's in the aquifer, and do you make
7 any allowance for the likelihood that, in such a dry area, in order to
8 get usable quantities of water, you would have to pump in fresh water,
9 as well as -- or draw in fresh water, as well as the contaminated plume?

10 MR. RENFELDT: Do you want to answer that one, Barb?

11 MS. DESHLER: The State of Nevada considers the ground water
12 to be the receptor. It's kind of a strange concept. So, no, we don't
13 include any other ground water than that.

14 The water that's ingested is the water we're modeling.

15 MR. NICHOLSON: Any other questions?

16 [No response.]

17 MR. NICHOLSON: Okay. What we'll do, then, is we'll break
18 for lunch.

19 When we reconvene, if the people at the table now would come
20 back and sit at the table, Dr. Ralph Cady will lead us in a group
21 discussion. If we could all get back here promptly by 1 p.m., we'll
22 start the group discussion, and then we'll have a break and we'll have
23 another group discussion.

24 Those people from industry that want to make some statements
25 this afternoon, extended comments, please come and see me or Dr. Ralph
Cady during the lunch break. We'll meet together at one o'clock.

Thank you.

[Whereupon, at 11:45 a.m., the workshop was recessed, to
reconvene at 1:00 p.m., this same day.]

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A F T E R N O O N S E S S I O N

[1:10 p.m.]

MR. NICHOLSON: We're ready to start now.

For those of you who have been paying attention to what's out on the desks, we have quite a bit of material out there, but we're trying to make more copies.

For those of you who have been keeping track of the hand-outs, we have run out of a few, so we're making some more, and hopefully we'll have all those by the next break, and then we have two presentations, Ken's and Shlomo Neuman's and also Sam's. We're making copies of those. So, we haven't gotten any of those yet, but those should be available also during the break.

So, if you just have the patience, we'll get those for you.

Also for those of you who have been paying attention, there has been a publication out there -- I don't know how many of you have picked this up. It's some information from the NRC, and I asked Bob Nelson to talk to you just briefly about what this document is.

Bob is Chief of the Special Projects Branch, Decommissioning Branch, Division of Waste Management of the Office of Nuclear Materials Safety and Safeguards.

Bob?

MR. NELSON: Okay. If you haven't picked this up yet, this is the first 10 modules of 16 for our Standard Review Plan for decommissioning materials facilities. We're publishing it for review and comment, and it's out on the table. Please pick up a copy. We're interested in your comments.

It's not complete. As I mentioned, there's only 10 of the 16 modules. There was out there also a one-pager on the status of the modules and when we expect to complete it.

The other six we hope to have up by the end of July. We

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1 probably would have made the end of June if it hadn't been for some
2 vacation schedules. So, we're pretty close to complete on the SRP, with
3 one exception.

4 I want to just discuss a few of the modules with you, so you
5 have some background on this.

6 First of all, the Standard Review Plan is intended to
7 provide guidance to the staff on what they need to do in reviewing a
8 decommissioning plan or other decommissioning submittal, and clearly, it
9 can be used by licensees in preparing a plan, because it pretty well
10 lays out what we expect to see.

11 As I mentioned, the 10 modules we have up are on this sheet.
12 If we need to make more copies of this, we'll have that done.

13 The two that I'll talk about briefly, that we've already
14 developed, are the facility description, which is module three, and the
15 alternatives to decommissioning, which is module six.

16 Module three, if you read it, requires a rather large amount
17 of information, but if you read the explanatory note, it's really a
18 worst case requirement.

19 It is tailored to those sites that have contamination at
20 depth, that have ground water contamination, and are going to require
21 some pretty extensive site-specific modeling.

22 So, if you're in a -- ultimately, when we publish the -- go
23 final on the SRP, we'll have a little bit more guidance in there about
24 what you need to supply if you're not in that case, but as you're
25 reading that module, the SRP, understand that it's kind of a worst case
situation.

26 The other module I wanted to explain briefly is module six,
27 which is alternatives.

28 Now, this module will only apply if you're applying for
29 restricted release. So, if you're in an unrestricted release mode, you

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1 can ignore module six.

2 Module six is intended to supply us with the additional
3 information that we would need to develop an extensive environmental
4 assessment or, if the need dictates, an environmental impact statement,
5 without coming back and asking you for a separate environmental report.

6 So, the combination of module six in conjunction with the
7 other information that we've outlined in the SRP should suffice for
8 meeting both our safety requirements in Part 20 and our environmental
9 review requirements in Part 51.

10 So, that's a short explanation of those two.

11 What we haven't released yet is the dose modeling module.
12 One of the reasons we haven't is because we're still discussing that,
13 but we will have a preliminary module on that out by the end of July,
14 but it will only address screening.

15 You might ask why do I have to do any modeling if I'm going
16 to meet screening criteria. Well, you don't have to do any modeling,
17 but you will have to justify your source term and the fact that your
18 site conditions meet the conditions for screening. So, it's pretty
19 simple if you're in a screening situation.

20 The complete module, dose modeling module, won't be
21 available until sometime next year, after we've concluded all these
22 workshops and gone back to the table and decided what's needed for
23 site-specific modeling.

24 Any questions on the SRP?

25 Yes, sir. I think I know what yours is going to be, but go
ahead.

MR. GENOA: Yeah. Paul Genoa with NEI.

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There was some confusion on our part as to whether it was
applicable for reactors or whether portions of it would be, and I guess
-- my sense is 1700 covers our license termination plan, and we have

1 other guidance, but looking at final surveys and dose modeling, I mean
2 do you envision that there will be guidance in here that we should pay
3 attention to and comment on?

4 MR. NELSON: I'd say yes. Exactly which pieces I'm not sure
5 of. Probably the two that you've mentioned are good ones. Of course,
6 you won't see the real dose modeling piece until, you know, next year,
7 but the survey module is -- if you're familiar with Marsum, it's just --
8 it identifies the various types of surveys, and it references Marsum.

9 We've tried to not duplicate information in the SRP, use
10 other standing documents, and refer you to those, rather than pull stuff
11 in and make the SRP even larger than it already is.

12 Yes, sir.

13 MR. WHITNEY: Mike Whitney from Maine Yankee, just following
14 up on Paul's comment. I was wondering how this SRP for things like the
15 survey compare to the 1700 and the 4006 stuff for reactors.

16 MR. NELSON: I'd say that they probably get into more detail
17 than -- I'm not as familiar with 1700 as I am 4006, but clearly, it
18 provides a lot more detail than 4006 does, and it's intended to be that
19 way, and I suspect it probably provides more detail than 1700.

20 If you don't remember to pick up a copy, it's on our
21 web-site, and the web-site's also identified on here, as well.

22 While I have the floor, I'm going to put in a plug for
23 another topic. If you've been following us on the -- our work on the
24 clearance rule-making, we are in the very preliminary stages of a
25 rule-making to establish clearance levels for residual radioactivity and
equipment and materials.

We're going to have our first workshop on that topic on
August 4th and 5th in Chicago. We have just published an issues paper.
It's now on our external web-site. It just went up today, I think. So,
we encourage you to pull that down and read it over.

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1 That's going to form the basis for our discussions at the
2 workshops. Also, we're going to put out a administrative letter, which
3 will forward the issues paper to the licensees, and also have a Federal
4 Register notice out by late next week.

5 So, if you're interested in that topic, I encourage you to
6 take a look at that issues paper and come to our workshops.

7 The other workshops will be in San Francisco and Atlanta,
8 and if you're interested in those dates, I can get them for you, and
9 then our final one will be here in November.

10 Any questions on that?

11 MR. NICHOLSON: Thank you very much, Bob.

12 MR. NELSON: Thank you.

13 MR. NICHOLSON: Really appreciate it.

14 Okay.

15 What we plan to do this afternoon is -- the people who gave
16 the talks, the presentations this morning, are at the table, and we
17 would like to go through a series of discussions.

18 It's called group number five, and you have in your program,
19 at the end, if you look at discussion group five on page -- let's see --
20 it's on page six. Dr. Ralph Cady will lead this presentation.

21 We'll spend about 45 minutes or so going over these
22 questions and asking the speakers and people in the audience if they
23 could give us some insights into these questions dealing with ground
24 water modeling related dose assessments in which we looked at real case
25 examples using things like TRACR3D or other codes to look at detailed
ground water flow and transport and putting into dose concentration.

 Then the other thing we're going to do is, after the break,
we'll then call on Henry Morton to say a few words, and then we're going
to go through the remainder of the questions that we weren't able to
cover in sessions one and three.

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1 So, that's the game plan, and we hope that, by the end of
2 the break, we'll have all the documents, all the hand-outs out on the
3 table, and hopefully then we can adjourn as planned for at five o'clock.

4 So, I'll turn it over to Dr. Cady.

5 MR. WHITNEY: Would you be willing to entertain a question
6 before you start? I was just wondering if it would be possible to put
7 the answers to these questions in context, perhaps in two ways.

8 One, how would the answer be interpreted by a licensee who's
9 trying to decommission today, using the tools available today, and
10 second, what part of your question is more of theoretical, we should do
11 more work in the future, so that we understand, you know -- we're able
12 to put your answers in context in a usable way.

13 DR. CADY: Okay. In order to do that sort of thing, the
14 sort of tools that are being used today are RESRAD and MEPAS. So, do I
15 have that luxury? I hate to disappoint these fine people.

16 MR. NICHOLSON: I think what we will do is we will let the
17 speakers try to answer the questions to the best of their ability, and
18 then I think Ralph can call on people like Gene Whelan and Walt Bayelen
19 and other people to also bring the issue back to home with regard to
20 what we consider the more conventional dose assessment codes, but we
21 will try to give that perspective in our answers, if possible.

22 MR. WHITNEY: Thank you.

23 MR. NICHOLSON: Okay.

24 DR. CADY: Okay. I'll start out probably with Sam, because
25 his -- the TRACR3D stuff sounds, to me, relatively new. Is that
correct? With the chemistry, the more sophisticated chemistry in there.
Has all that stuff been benchmarked and so on and so forth?

MR. LEE: Okay.

 You want to see, particularly for number one, what kind of
testing is appropriate for the ground water model using dose assessment,

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1 and for this kind of problem, first one, it seems to me I remembered
2 yesterday that is -- Carol, EPRI, was talking about based on DandD and
3 RESRA, and she identified some of the key parameters in the ground water
4 model, and so, in that case, I'd like to continue based on TRACR3D, can
5 we identify the same kind of key parameters used for the -- just like
6 she identified.

7 I think that's probably very useful to try to identify
8 similar -- or identify the parameter used for the dose models, and I
9 think that is very crucial to see which parameter is important, and the
10 second question is -- I don't know -- do you want me to answer all the
11 questions?

12 DR. CADY: No, just question number one.

13 MR. LEE: Okay. I think that's it.

14 DR. CADY: I got from your response that you sort of expect
15 these people, the licensees, the users of these codes, to be doing this
16 sort of benchmarking or testing. Is that a correct interpretation of
17 your response?

18 MR. LEE: I think so. Probably TRACR3D, at this moment, I
19 think is one test that our ground water model -- we can use that as a
20 benchmark testing, that's true.

21 DR. CADY: Okay.

22 How about Ken? Can you address --

23 MR. RENFELDT: Yeah. I guess I'll come at this from a
24 different perspective.

25 When I think of, you know, pedigree or benchmarking, what
I'm thinking of in my mind is that the code is doing what you expect it
to do, and my expectation is that that would not be the licensee's
responsibility, that if RESRAD is being proposed as the tool, that
somebody has already checked and compared its ground water predictions
against analytic solutions that are appropriate, same assumptions, and

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1 show that, in fact, it does what you're asking it to do.

2 Now, you can argue whether the assumptions are appropriate
3 in the model or whether they go far enough or they're too restrictive,
4 but as far as just testing or benchmarking, at least from my
5 perspective, just demonstrating that it's operating properly, and that
6 should be the code developer's responsibility.

7 DR. CADY: Okay. In the case of the code that you selected
8 for the NTS work, there's a clear history. Not only have you used it
9 before, but there also has been an established pedigree in some fashion.

10 MR. RENFELDT: One of the restrictions we placed on any code
11 that we use is that there is a long history and a pedigree. SWIFT has
12 gone through many generations of testing against analytic problems. So,
13 we won't use a code that hasn't been through a careful documentation,
14 testing process.

15 DR. CADY: Okay. Let's say, for your site, you want to have
16 something tweaked in that code. Towards the end of the question, what
17 sort of criteria would you use to establish this pedigree? Is there
18 something that comes to mind?

19 MR. RENFELDT: Well, if you're going to go in and modify a
20 code, then at the very least, you have to go back and run the test
21 problems that have previously been run to show that any modifications
22 made don't change the outcome, and then, if you've added a particular
23 feature, then you'll want to test that feature against some other
24 benchmark, typically an analytic solution, but if that's not available,
25 then you could go against another numerical code that has previously
been benchmarked.

ADN But any time you make a change to a code, you really do need
RIL to go check that you haven't inadvertently changed something else.
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& DR. CADY: Okay. I may take this question and interpret it
ASS a little bit different from Barbara.
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1 I assume that HSI GEOTRANS is working for you. Is that
2 correct?

3 MS. DESHLER: Yeah.

4 DR. CADY: Well, I'm trying to put a different hat on you,
5 then, or at least put a hat. Somehow you are relying on a pedigree, I
6 would guess. Since I don't know what your role has been in this, I'm
7 putting the hat of being the contractor and them being the subs.

8 So, you've got some sort of an established -- if you wish to
9 play that role, then not only is the code benchmarked, pedigreed, but
10 the contractor is -- also has a pedigree of some sort, and certainly,
11 GEOTRANS has been around for a number of years, and has an established
12 pedigree.

13 What sort of things do you look for as meeting these
14 criteria?*

15 MS. DESHLER: Well, I think you had a good point there about
16 the pedigree of the contractor, because that's why they're on the team.
17 Their reputation was one of the reasons we got the contract. So, that's
18 a good beginning point.

19 The entire project has a huge review process. Ken talked
20 about the internal and external peers. There's also a technical working
21 group with experts from the national laboratories and USGS.

22 So, there's a constant process, not just for this model but
23 for everything that's done on the project, and a lot of feedback on
24 whether or not we're doing the right thing. Certainly, none of those
25 people are shy about letting us know.

DR. CADY: Oh, yes. I mean I know that, in the models that
I've used, you can certainly misuse a model quite easily. So, the
modeler's pedigree is critical, also.

MS. DESHLER: Right. There isn't any such thing on this
project as a modeler being able to do some kind of review and get away

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1 with it, because there are enough other people.

2 DR. CADY: Okay. Good.

3 MR. LEE: And another thing I'd like to point out to the
4 audience -- for example, at the Fernald site, we did have another -- a
5 contractor who used another kind of model, called a 13DF, and I did
6 compare with -- those model with the 13DF model result and the TRACR3D
7 result, and we did a very good comparison, very similar result.

8 The only thing the 13DF cannot tackle is the unsaturated
9 zone. They only treated a waterfall only at this point. So, even we
10 get a very good agreement between the model result, but the model
11 itself, the TRACR3D, is a little bit more superior than the 13DF, but my
12 point is, at a particular site, we shouldn't be restricted to only one
13 model.

14 If we can have more models to do the same type of thing,
15 that is more appropriate to see which model is really doing a good and
16 better job.

17 DR. CADY: Okay. Thank you.

18 Manuel, would you care to address this question relative to
19 --

20 MR. GNANAPRAGASAM: Right.

21 DR. CADY: How about RESRAD off-site?

22 MR. GNANAPRAGASAM: Okay. RESRAD off-site is still in test
23 mode, so it has not been verified against anything else.

24 DR. CADY: Okay. Could you address the steps that you're
25 going through?

MR. GNANAPRAGASAM: Well, typically, verification, we don't
do it ourselves, because we need somebody who is not already involved in
it to do it. So, when the time comes to do it, we contract it out to
somebody else over whom we have no influence, so that they can test it
out and see if it is wrong and it is right.

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1 So, that's what happened with RESRAD, it was given out to
2 somebody else, and they compared our results against the other
3 independent results, hand calculations, singular models, whatever, and
4 when there were discrepancies, they came back to us and said, okay, how
5 do you explain this, and they had to say, well, you did the wrong thing
6 or there was something wrong with our model and change it.

7 I think, for RESRAD off-site, that's still some ways off,
8 it's not going to be happening right now.

9 DR. CADY: Okay. Can you give our colleagues some sense for
10 when that will be completed?

11 MR. GNANAPRAGASAM: I really don't know.

12 DR. CADY: Okay. Do you care to address RESRAD on-site as
13 far as the ground water model?

14 MR. GNANAPRAGASAM: Yes. As I said, that was benchmarked --
15 verified. It was verified, I think, three or four years ago. I'm not
16 sure of the exact time. They checked to see that we were doing what we
17 said we were doing, not necessarily whether it was right or wrong, just
18 to see whether our coding was doing exactly what we said we were trying
19 to do, and I think that's all verification is. It's not saying right or
20 wrong.

21 And we have done a fair amount of benchmarking, and all that
22 said is we are doing the same thing that somebody else is doing, again
23 not whether we are right or wrong.

24 I think that's a caveat that applies to everybody. We can
25 compare models and say this or that, but it doesn't say that we are
 right or wrong.

 DR. CADY: Okay.

 Gene, would you care to address MEPAS?

 MR. WHELAN: Gene Whelan.

 MEPAS -- we have a certain protocol that we follow with

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1 MEPAS. The first thing we do is we develop a requirements document
2 which states exactly what the model or system is going to do. Then we
3 have a design document that we develop that identifies exactly how this
4 system is going to meet the requirements, and then we develop a
5 specifications document which states exactly how we're going to meet the
6 design, and then if we have to develop a new code or make modifications
7 to a code, for example, those modifications are implemented based on
8 those three documents.

9 We then go through a detailed testing procedure by the
10 people that do the development.

11 That's then turned over to independent people in our lab,
12 who had nothing to do with the development, and they go through a
13 testing procedure themselves, and as Manuel noted, they usually come
14 back and say you did not meet this requirement or you say it can do this
15 and it doesn't do this or there is some sort of discrepancy and that has
16 to be worked out, and all of that now gets documented.

17 We also go through a benchmarking procedure with other codes
18 or similar code or results that have been published in the literature by
19 other codes that are similar.

20 It's fairly extensive, to a certain degree, very much like
21 some of these other models.

22 DR. CADY: Okay. So, the testing procedure with outside
23 folks, the lab, that's iterative?

24 MR. WHELAN: We actually use people within the lab but who
25 -- people who are not associated at all with the development of the
software or the development of the requirements, design, or
specifications.

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26 DR. CADY: Okay. If I find a problem, if I'm one of those
testers, I find a problem, I annotate it, send it back to you, you tweak
the code, do you send it back to me for final testing?

1 MR. WHELAN: Yeah. If you were one of the testers, yes, we
2 would send it back to you to see if it met with your approval, that is
3 correct.

4 So, that is -- and we have put together that particular
5 protocol we started last year in terms of -- because of the frames-type
6 work that we were doing with multiple models, etcetera, and it seems to
7 be working very, very well.

8 DR. CADY: Okay. Good. Thanks.

9 Walt?

10 MR. BAYELEN: Walt Bayelen, Sandia Labs.

11 For the DandD code, we do have in place a QA program that
12 includes a document of requirements, definition, test plan,
13 specification of test problems, and documentation and execution of those
14 tests and also a version control for the code and a mechanism for
15 notifying users of updates and capturing any problems that they identify
16 with the code and then notifying them of modifications to the code that
17 might result from that.

18 I'm interpreting, I think, question one as being primarily a
19 QA issue, and as far as just the thoughts on what level of pedigree or
20 benchmarking are appropriate, again, that seems an NRC policy decision
21 to some extent, but it seems that a version control is perhaps a
22 critical part of that, so that it's possible to identify the specific
23 code that was used to do a specific calculation.

24 So, it would seem that that would be a minimal requirement.

25 DR. CADY: Okay.

In yesterday's session, I mentioned something about Shlomo's
un-ease with codes that don't provide sort of concentration at a certain
point or whatever, and DandD certainly does not spit that sort of stuff
out so that he could get that ease for concentrations in ground water at
-- within, let's say, the aquifer, if we want to call this bucket an

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1 aquifer.

2 In your testing, was that sort of stuff done internally?
3 Because as a user, I don't see that stuff, and I really can't see it, so
4 I can't test it.

5 MR. BAYELEN: I guess, as a software question, it seems to
6 me the critical question is does the code implement the equations that
7 are claimed to be implemented, and I guess the sort of validation
8 question is a very interesting question but perhaps a separate question,
9 do the equations that you have implemented, in fact, reflect the system
10 in a way that's appropriate for the decision you're trying to reach?

11 So, there are no recommended calibration procedures, for
12 instance, with the DandD code, as its intention is not to reproduce
13 ground water concentration.

14 DR. CADY: Okay. Thanks.

15 Is that the sort of response that you were looking for from
16 the user codes? Okay.

17 MR. THAGGARD: I think it gets back to, again, justifying
18 the model for your particular site. Obviously, one model is probably
19 more representative of your site than the other, and so, from our
20 perspective, I think we would be mainly interested that the code that
21 you use has the proper pedigree.

22 So, obviously, if you're developing some new code, then
23 you're going to have to make sure -- we're going to have to have some
24 confidence in that code, but assuming that it has the proper pedigree,
25 then the question is does the models in that code represent --
appropriately represent your site, and so, it gets more into, you know,
justifying the code versus your particular site, the features of your
site.

MR. EID: I would like to add to this, too. It is -- the
difference is not just only the model. The differences also will be in

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1 the input parameters for the model. It depends on what kind of
2 parameters you have.

3 One of the reasons that we find differences between DandD
4 and RESRAD is because of the input parameters. The approach for DandD,
5 for example, takes -- it force the code to select certain parameters,
6 and if you look at those parameters, you will find they are very highly
7 conservative. If you go to RESRAD, then you input the same parameters.

8 So, these great differences that we saw yesterday will be
9 minimized drastically, and the difference will be not as great as we
10 think.

11 So, the parameters, they are so important, and these
12 differences that you find maybe is not, indeed, in the model, maybe,
13 indeed, in the input parameters. That's one thing you need to be sure
14 about.

15 If DandD conceptual model does not fit your site, there is
16 no reason to use DandD code; you could use other codes.

17 Also, we'll entertain using -- for site-specific analysis,
18 we will entertain using any code that you select, but you need to
19 defend, of course, use of the code, the conceptual model of the code, is
20 it compatible with your site and the input parameters that you have, are
21 they compatible with your site-specific conditions.

22 MR. MEYER: I can make a further comment there. From a
23 modeler's perspective, if I was running one of those or both of those
24 models and got different results, the thing to do, the approach to take,
25 is to ask yourself why the models are producing different results.

Is it because of the implementation, is it because you use
different parameters or the parameters are represented differently?

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If you can't explain the difference, then you're in trouble,
but if you can explain the difference, then you can resolve the
difference. But in order to get to that explanation, you have to be

1 able to understand how the models are making their calculations and what
2 exactly they represent.

3 MS. POTTORFF: Elizabeth Pottorff, State of Colorado.

4 Coming at this from being a ground water modeler, you
5 actually need to be able to defend your model in a legal sense should it
6 ever go to court.

7 Every single part of that code should be defensible and
8 documented and tested. Otherwise, you could be, you know, up the creek
9 without a paddle with your estimates.

10 DR. CADY: Thank you.

11 Gene.

12 MR. WHELAN: Gene Whelan.

13 I'll just note that I've been involved in a number of
14 benchmarkings, and I know Emmanuel has, too, and some of the other
15 people here, and one thing that we recognize in these benchmarkings is
16 we can input to the models all the same data, we can look at the
17 formulations and think that all these models are the same, but what we
18 find out is that they end up with different results, because the
19 modelers themselves, when they wrote the code, inherently build into the
20 code the things that they feel are representative of what the model
21 should do, and many times, that's not included in the documentation.

22 So, it doesn't surprise me at all that you could take two
23 separate codes with the same mathematical formulations, which I've done,
24 and run them and get two different results, several orders of magnitude
25 difference, and then when we went in to ask the question, as Phil noted,
why, it was because the model developers had inherently put in some of
the things that they wanted to see or have that code do, thinking that
everybody else was doing it, too, and in fact, people did it
differently.

So, if you get different results, I would seriously consider

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1 asking the question, why am I getting different results?

2 DR. CADY: But if Gene Whelan wasn't out of breath, he'd
3 probably also say does it make a difference in your final decision?

4 All right.

5 We already talked about unnecessary conservatism or
6 inappropriate optimism yesterday, I believe, but there may be some
7 elements of the ground water model that, as Gene alluded to, there's
8 stuff that's hidden within these models that may introduce or contribute
9 to inappropriate either conservatism or optimism.

10 How about our panel?

11 Ken?

12 MR. RENFELDT: This is particularly difficult, I think.

13 One of the approaches that we're using on the NTS is to
14 bring people in like Shlomo Neuman, look at our models, not at the
15 coding, necessarily, but at the kinds of assumptions we make to
16 implement the models, and ask them, as our external peer reviewers, does
17 that make sense to you?

18 Sometimes it's very easy to get caught up in the modeling
19 process and begin to make assumptions so that you can make progress, and
20 it's always helpful to have somebody coming in behind you, looking at
21 those.

22 So, that's, in part, one approach that we've used, and also,
23 I think, as someone else mentioned, some of the questions of whether the
24 conservatism is unnecessary or inappropriate comes from the regulators.
25 It may not necessarily be a modeler's decision.

DR. CADY: Okay. You also mentioned that you're only
dealing at this point with the saturated zone.

MR. RENFELDT: Yes.

DR. CADY: You've made a fairly explicit statement that this
is what you're ignoring and you have a logic and a rationale for doing

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1 that.

2 MR. RENFELDT: Yes.

3 DR. CADY: Sam, how about at Fernald?

4 MR. LEE: Yes. Based on my talk, I did very clearly mention
5 that the simplification of the K_d , in this moment, that most people use
6 an equilibrium assumption, and so, that is -- we have to carefully --
7 that kind of simplification is appropriate or not. It depends on the
8 site.

9 If the site is very complicated, involving chemical
10 precipitate species, then the classical simplification or the K_d ,
11 equilibrium assumption may not be appropriate.

12 So, that is -- we have to carefully to see that -- what kind
13 of approaches we are dealing with, and it depends on the site, and so,
14 at this point, we have to justify how complicated of a site and what
15 kind of species we are dealing with.

16 MR. NICHOLSON: Sam, when you made your presentation, I
17 thought it was fascinating. You were looking at 40 years of record.
18 You were looking at actual monitoring data to some extent. Is that
19 correct? To compare these simulations?

20 What kinds of insights do you have with regard -- to
21 determine what was appropriate?

22 I mean do you want to look at a site in great complexity, or
23 do you want to try to simplify, and then how do you determine, based
24 upon your comparison with monitored data, whether that simplification or
25 going into greater complexity is warranted?

MR. LEE: At this point, for the Fernald site, we've found
that we have to use complexity as our model in order to really identify
that decommissioning, how many years later we can clean the site.

Based on the equilibrium assumption, we have to take forever
to clean the site. So, in that case, based on the non-equilibrium

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1 assumption case, and we can see that within 15 years, probably, we can
2 clean the site, and so, that kind of approach, we had to know ahead of
3 time to meet the criteria, the cost, how much we have to spend to clean
4 the site.

5 DR. CADY: Okay. So, that moves us into question number
6 three.

7 MR. LEE: That's correct.

8 DR. CADY: You've got a few years of record, I assume, of
9 operations at Fernald.

10 MR. LEE: That's right. Question three -- that is what kind
11 of independent data we have to have. So, that's why it seems to me we
12 have to -- additional data to identify if chemisorption is important or
13 not.

14 If it is important, then we can see that the non-equilibrium
15 assumption is appropriate for the site. So, that's why I think that is,
16 even for this moment, the data we have is still not good enough.

17 We should have continued to monitor that data we have in
18 order to identify how important is chemisorption at the site.

19 DR. CADY: So, am I correct in assuming that they are
20 pumping currently at Fernald?

21 MR. LEE: That's correct. They continue pumping the -- at
22 the site, and they continue to -- based on the model result, they'd like
23 to identify where we have to drill, how deep we have to have and how
24 many wells we have to have in order to continue pump and inject back to
25 the well.

So, that is -- we both continued doing the modeling study
and the decommissioning remediation, and both continue to do the
back-and-forth engineering to see, okay, this is a place we have to
drill another well in order to stop the plume continue to move forward,
that kind of stuff, that's right.

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1 MR. BIRKLAND: Rich Birkland, Siemens.

2 I'm a health physicist, and I deal more with dose to people
3 than I do with environmental-type things, but -- and realize we have a
4 bunch of modelers here, but to me, if you use a model and you expect it
5 to predict the right answer, I'd be real skeptical of that.

6 You take any one of these internal-type doses and people
7 will differ from that remarkably, and I would suspect that none of these
8 codes are really going to work. So, I don't know exactly how you verify
9 them.

10 What you're doing is giving your best estimate.

11 MR. LEE: Yeah, but in order to answer that, we have to
12 continually compare our model result with measurement data. That's why
13 we request at the site for the engineering to continue to get new data,
14 and then we can compare with our model result and how this model is
15 doing. I did not show that comparison in my talk, but I did some
16 comparison with the model result with the measurement, and a certain
17 site, certain location, we did a very good job for the modeling
18 comparisons.

19 DR. CADY: Walt.

20 MR. BAYELEN: Walt Bayelen, Sandia Labs.

21 I'd like to just suggest that, in general, the answer to
22 question three is no in that you cannot collect data to confirm a
23 particular ground water model. I mean it's an endless process. There's
24 no way that a specific ground water model, I think, could be confirmed
25 to some arbitrary degree.

So, it seems it's more a question of dis-confirming
alternative models.

So, the question is, is there a viable alternative to the
calculation you're doing that causes you to reach a different decision,
and if the answer to that question is yes, then you can ask the specific

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1 question, what data would allow me to distinguish one model from
2 another, but as far as pursuing a confirmation of a specific model, that
3 problem will not stop.

4 I mean there's no stopping condition for confirmation of a
5 single model in general unless there's a specific alternative that leads
6 to a different regulatory decision.

7 DR. CADY: Okay.

8 Gene, do you want to address that? No. Okay.

9 Well, we've nailed one, two, and three, unless the licensing
10 colleagues have anything to add.

11 MR. THAGGARD: I would just like to point out that, strictly
12 from a ground water standpoint, if we're only looking at the ground
13 water analysis, I think there's certainly some data that could be
14 collected to confirm the ground water analysis.

15 If you're talking about doing a ground water flow analysis,
16 there's a lot of work that's been done in terms of validating ground
17 water flow models.

18 If we look at that question from the standpoint -- only from
19 a ground water standpoint, I think the answer would be yes.

20 When you start taking it into the realm of doing dose
21 analysis, especially when you're talking about dose analysis way out in
22 the future, then the answer is probably no.

23 So, I think it depends a little bit upon how you ask the
24 question and what timeframe you're looking at.

25 MR. EID: I would like to add that I think, when you answer
this question about validation of the ground water model, you need to
ask a question about the purpose of that model.

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If you know in advance that the purpose of that model is for
screening, you should not expect that the results will be always, you
know, realistic, could be some conservatism, but then the question is

1 how much conservatism in that specific model to serve the purpose.

2 If you find it's excessively conservative for your purpose,
3 this means you need to think about other alternatives, and also, we need
4 to think about these models, to look at the dose.

5 You do not look specifically at the ground water model when
6 you use the dose in terms of the health physicist and in terms of
7 compliance with the regulations.

8 That is why you need to -- also to think about what is
9 embedded in them model, also, variability of the sites.

10 So, for screening models, variability of the sites plays a
11 significant role in what you select and what kind of parameter is
12 selected for that specific model, and they will, of course, impact the
13 results of that specific model.

14 MR. WIERENGA: This is Pete Wierenga, University of Arizona.

15 Maybe I didn't understand Walt's response completely
16 correct, but I thought that he said that independent data should not be
17 collected to confirm ground water modeling.

18 Is that what you said, Walt?

19 MR. BAYELEN: Walt Bayelen, Sandia Labs.

20 Yeah, I guess I was saying that, in general, the answer to
21 that question cannot be yes, because it -- I guess for two reasons.

22 There has to be some stopping condition, some sufficiency
23 condition, because the process of modeling confirmation can just go on
24 forever, and I guess the second argument was that it is not possible to
25 uniquely confirm a specific model, that the question of model
confirmation is really disproving a propose alternative, and so, it
seems a more important question is not confirming ground water modeling
but dis-confirming, if you will, an alternative ground water model.

So, it's not that -- I didn't mean to suggest that it's
never necessary to collect data for a ground water model, but the

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1 general answer to do we need more data cannot be, in general, yes.

2 There's no way of terminating the data collection process.

3 MR. WIERENGA: That seems to me somewhat of a vague answer.

4 I would, to some extent, disagree with that, because no
5 matter whether it's for a specific model or for a group of models, as we
6 heard before, in many cases these models are used in the courtroom and
7 in other situations where you deal with stakeholders, and it's my
8 experience that stakeholders, people in the courtroom generally do not
9 have that much confidence in a model or a group of models if it hasn't
10 been tested in a real situation, field situation, and backed up with
11 actual data, and it's also my feeling that we have a great deal of
12 models, not just the ones that you're talking about, also the ground
13 water models, etcetera, and very few have been tested in the field under
14 adequate and controlled conditions, and there is a great deal of room
15 for improvement of adequately testing models before we use them in
16 situations of predicting, let's say, long-term or short-term events, and
17 so, in general, Walt, I would think my answer to that question is yes,
18 you need independent data to confirm, test ground water modeling, in
19 general.

20 MR. RENFELDT: If I could interject something here, also,
21 we've worried about this a great deal at NTS, and I agree with Walt, you
22 can never verify a model deterministically, for example, and I don't
23 know if you recall, but my last slide was model acceptability, which
24 means that we will go through a process to determine amongst ourselves,
25 with our regulator, etcetera, whether the predictions are acceptable to
them or whether we have given them enough confidence to accept our
results. That doesn't mean we're asking them to say the model is true,
it's verified. It's does the appropriate stakeholders agree that this
is acceptable.

One method that we have thought about -- in our predictions,

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1 we include what you've talked about as a mean case or an expected case
2 and then a range of variability. We intend, I think, that we're going
3 to have to go out and collect some additional data after the modeling.

4 One way to do that is to collect information, either key
5 model assumptions, such as conductivities were supposed to be within
6 this range or hydraulic gradients are supposed to be in some range
7 somewhere else, we have a range of predictions, we go in and we collect
8 data, and before we collect that data, we go in and sit down with our
9 regulators and say I said conductivity is going to be between one and
10 four, and you've seen my predictions at one and four, if those are
11 acceptable and I go in and measure a value of three, we're okay. If I
12 go in and measure a value of 10, I'm outside of my range, and we would
13 reconsider what I'm doing.

14 So, I don't ever verify to a particular value, but if I've
15 bounded my calculations and then can show by appropriate data collection
16 that data points fall within the bounding range, I get greater
17 confidence.

18 At some point, it becomes a negotiation. It is iterative,
19 and you end up negotiating with the regulator or whoever to say, you
20 know, when am I going to have enough data? I've shown you six times now
21 that I fall within my predicted range. How many more times do I have to
22 prove it to you?

23 But you'll never prove to anybody that I can tell you the
24 concentration 75 feet away. I can bound it for you, if that bound is
25 acceptable.

MR. EISENBERG: This is Norman Eisenberg from NRC.

First of all, I want to, with all due respect, take issue
with Walt Bayelen.

The NRC staff has spent a lot of time thinking about the
issue of how much confidence is needed in modeling and how you go about

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1 achieving it, and I think our approach would be very pragmatic, and
2 although I think what Walt said, in an absolute sense, is true -- that
3 is, no scientific theory can ever be proven, all we can ever do with
4 scientific theories is disprove them, and you get more confidence in a
5 scientific theory if you disprove alternatives, that's not necessarily a
6 real practical way to approach things here.

7 We have written a recently published NUREG with the Swedish
8 regulator, SKI, on confidence building in performance assessment models
9 and approaches to it, and that tends to also be very pragmatic.

10 There are really two issues here, I think.

11 One is should you use additional data to help confirm the
12 validity of ground water predictions, and it depends, of course.

13 If you have a very simple situations and you use
14 demonstrably bounding or conservative estimates, then you probably don't
15 need to do that.

16 If you have a very complex situation and you're close to the
17 regulatory limit, additional information that helps build confidence in
18 the result that you have obtained is, of course, useful, and I don't
19 think, for example, in the case of Fernald, that if you could use the
20 model to predict what has happened so far as a way to confirm your
21 predictions for the future -- that would be a good thing to do.

22 That would help give confidence that the regulator needs
23 that you should proceed on that course.

24 The separate question is, at a particular stage, do you need
25 to go out and get this additional data with the corresponding expenses,
is a much tougher issue, and I'm not sure -- you know, that would have
to be decided on a case-by-case basis.

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But I guess my bottom line is I don't see the NRC staff
rejecting this kind of information. In fact, I think we would welcome
it, but I'm not sure that we would demand that it be obtained.

1 MR. LEE: But another comment -- more data is better for
2 modeling, no matter what. If you can use that data, additional data,
3 and it's good for the validation or good for the input, the model.

4 So, I always encourage to have additional data, even
5 independent of any other kind of data. I think that always is useful
6 from the model point of view.

7 MR. NICHOLSON: If I could make a comment on that, we were
8 involved in an international project called InterVal, and your comments
9 are appropriate if the data is extremely relevant.

10 We had test cases in InterVal in which there was a
11 tremendous amount of data collected, and during the course of it, even
12 more data was collected, and unfortunately, people became confused, and
13 there was so much information you really lost the point of what was
14 going on.

15 So, when you collect the data, it has to be focused on what
16 your objective is and what those relevant parameters are.

17 You can use -- as Dr. Neuman said the other day, you can use
18 many different models or even the same model with different
19 interpretations to come out with the same results.

20 If you collect tons of data, it doesn't necessarily narrow
21 it unless the data is collected using a special design to help do the
22 comparison that Walt Bayelen discussed or to develop the confidence that
23 Norm is trying to elaborate on.

24 So, I don't think more data is necessarily correct, but a
25 focused confirmation program in which that data helps to develop
confidence is extremely valuable.

MR. LEE: Yes, I totally agree with you. That's right, yes.
I pointed that out in the talk. Specifically for the chemisorption, we
like to have that from the model to know which specific data we want to
collect.

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1 MR. GEE: Glendon Gee, PN&L.

2 I think there's a danger in the plug-and-play modeling that
3 we've heard about the last two days, and that is, since there are
4 readily available surrogate data, to simply grab it and use it, and that
5 danger leads people to surprises, and the ground water often is full of
6 surprises, and the case in point is observations at Hanford, where
7 contamination of cesium was deeper than expected and led to wild
8 conclusions that the french fries growing along the river would be
9 contaminated with cesium in future generations because somebody found
10 cesium at 120 feet when it should have been -- if they had used the
11 available data sets in predicting cesium distribution coefficients,
12 Kd's, of any kind of normal expectancy, if you had used PDFs or other
13 kinds of distribution and picked the most extreme, you would still not
14 have predicted the observed cesium distributions, and so, all the
15 plug-and-play models, all of the screening models, all of the models
16 that were used in the EIS statements for the waste remediation
17 under-predicted the cesium distributions, and it was largely because
18 there were not data, site-specific data for the cesium.

19 There are other stories. It turns out that, with some
20 additional geo-chemistry, that it's a unique situation and that the
21 cesium actually is tightly bound, and it isn't going to course through
22 the ground water to the river and end up in your McDonald french fries.

23 I don't think that's the answer, but it led people to look a
24 little more carefully at processes and other things that put the cesium
25 where it was, and there were a number of reasons for that. It's still
being sorted out.

But I think to -- the tendency is to take default parameters
and use them simply because either we're too lazy or we're not sensitive
to the site-specific issues, and it's often that maybe a combination of
both, but the readily available plug-and-play models tend to allow you

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1 to go to these default parameters, which often are not reflecting the
2 site-specific physical chemical processes that are actually moving the
3 contaminants through the ground water, and I think that's the danger,
4 and I think that's the reason that you have to have -- maybe NRC
5 shouldn't specify the number of data points or when to stop collecting
6 data, but it should at least require the licensee or whoever else is
7 collecting the data to justify the use of the default numbers.

8 I think that's one of the issues that ought to be emphasized
9 repeatedly.

10 MR. EID: I would like to add to this, you are absolutely
11 right.

12 I will assure that that's what we'll be looking at, is the
13 rationale for selection of the parameters, and we do not assume that the
14 licensee will use a code and input directly whatever the parameters
15 there without looking at their site-specific conditions.

16 We have two cases.

17 A screening case, we do assume, you know, some assumption,
18 conservatism in the code, so we will not look at the parameters for
19 screening cases. That's why I would like to see if somebody comes to us
20 and say the current code is not substantially conservative in certain
21 cases, would like to let us know about it.

22 For the site-specific cases, definitely we will not accept
23 just the parameters to be input, you know, based on the default unless
24 they are explained, unless they are justified.

25 MR. HAMDEN: It seems to me, you know, everybody here must
realize the lack of confidence or the uncertainties that we have with
models, and that's clear, everybody knows that, and what's puzzling to
me is that nobody is making a distinction between new sites and sites
that are already contaminated.

With new sites, it's appropriate and, in fact, necessary to

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1 use models, because it's the only tool that we know at this time, like
2 performance assessment of the high-level waste program, for example.

3 But for contaminated sites, why are we so much into models?
4 The standard involves a point of compliance and a concentration in the
5 ground water.

6 It is a ground water standard, yes, but nothing's wrong with
7 it, because in this way we avoid all these uncertainties about models,
8 and if you don't like the compliance at the more difficult sites, the
9 problematic sites, you can move your point of compliance further, but
10 still, it's a point of compliance, it's a concentration of ground water,
11 and you have to deal with the uncertainties that you have with models.

12 In decommissioning, I find surprising that, at
13 decommissioning sites, which, by definition, are already contaminated,
14 you are so much into modeling.

15 MR. LEE: Can I just comment on this question?

16 At the Fernald site, for example, we are using a
17 pump-and-treat. So, in that case, we have to know how much pumping rate
18 we'd like to have.

19 So, in order to answer that, we have to use a model to
20 determine what kind of pumping rate we use in order to meet the criteria
21 to pump, the actual pumping rate.

22 So, that is the way we have to use model. It doesn't mean
23 that, if it's contaminated there, we don't use model.

24 So, that, it seems to me, is not the way to avoid the model.
25 It depends on the site. In the model, we do have the pumping rate to be
input as a very important parameter to determine where and how much --
how many wells we have to use in the model.

So, those things -- we have to consider that. That's why we
have to continually -- during the decommissioning period, we still have
continued to use our model to do the things we want.

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1 MR. HAMDEN: Sam, I grant you that, but that's a very
2 limited use of models, and what we have been hearing today, the
3 uncertainty about models, you know, about another aspect of modeling,
4 the prediction and what's going to happen, the dose in the future, and
5 whether it will meet the standard or not.

6 It's not so much, you know, the things that you mentioned.
7 That's fine. That's justified and fine, but what we are talking about
8 is the dose and meeting the dose standard at these sites. That's the
9 problem, right here.

10 DR. CADY: I think we've beaten this to death.

11 Henry, do you have something you'd like to present? And
12 then we can continue with this after the break.

13 MR. MORTON: My comments, I think, will be fairly brief and
14 will deal with the implementation.

15 Basically, we've just had a good discussion, in general,
16 that relates to the first question, and after this general discussion, I
17 think this question basically boils down to one of essentially then
18 asking, in essence, what will be the Standard Review Plan for
19 acceptability of an alternate model and the application of that
20 alternate model in a particular site-specific case.

21 The second point basically is that -- the point would be
22 that, when we recognize that the user will always be responsible or
23 burdened with showing that the conceptual model, his conceptual model of
24 his site, and the mathematical model are compatible or that the
25 mathematical model represents the conceptual model reasonably well --
given that, it would be helpful, over time, as the agency works these
cases, if you could come to recognize or kind of let us know which of
the mathematically coded models or programs and models you consider to
be generally acceptable given the licensee's burden to show that the
conceptual model and the mathematical model are compatible.

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1 Beyond that, something that is perhaps a little bit more
2 functional or housekeeping or mechanical in nature is that, once the
3 ground water modeling is done -- that is, the estimates of the future
4 ground water concentrations -- then we need mechanically to carry this
5 through with the remainder of the pathways analysis to get the dose
6 estimates for all pathways, and there's mechanically some things that
7 are needed there.

8 First, when we think in terms of RESRAD and DandD as the
9 vehicle for the remaining pathways, we need mechanically a way to be
10 able to enter these predicted or estimated future ground water
11 concentrations and nuclides into those codes so that they can be
12 combined with the remaining pathways, so the total estimates for all
13 pathways can be made.

14 Now, the good news here is that DandD has been coded in such
15 a way that you can get soil concentrations and can get drinking water --
16 concentrations from the drinking water pathway, and the question -- and
17 the apparent additional need is to be able to turn or toggle on or off
18 the ground water -- I'm sorry -- the remaining pathways downstream of
19 that point at which we're predicting the concentration, so, for
20 instance, that we aren't necessarily forced to estimate the dose from
21 irrigation water or dose from fish if, indeed, those pathways don't
22 exist downstream of the point at which the alternate ground water model
23 estimates the concentration, and so, I'm not aware that RESRAD will
24 handle this kind of thing, and so, that would be a need for RESRAD to be
25 altered to allow one to input nuclide concentrations in water that are
calculated or estimated from some different approach, even if they might
be environmental measures and not necessarily predictions from modeling.

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Overall, in order to better understand what's going on in
the modeling, I think we need to be able to toggle each of the pathways
on or off in RESRAD, as we're able to do with -- I'm sorry -- in DandD,

1 as we're able to do with RESRAD, and that would let us be able to study
2 what's going on and learn more of what these models are telling us on a
3 pathway basis and not have to try to unravel them from some kind of
4 sensitivity study that forces us to look at one dose for all pathways,
5 and then, finally, in order to understand what's going on better, DandD,
6 particularly, needs to list, whether it's tabular or graphic, more of
7 the values of intermediate variables so we can see what these models are
8 telling us.

9 For instance, it would be helpful if DandD would produce for
10 us ground water concentrations or some other intermediate values.

11 That is the essence of what I had to say. Basically, it's
12 to recognize that licensees, because of existing license commitments or
13 because of the timeliness rule, have these needs now, and they are not a
14 year away, they're not two years away.

15 So, we need to have the tools now to exercise and to do the
16 decommissioning plans and the analysis to support them.

17 MR. EID: For the first question, what will be required to
18 gain approval to use a mathematical model for ground water, and the
19 question is what are the other models that you have. It depends on the
20 site-specific conditions, and it depends on the scenario.

21 If you assume the receptor will be located off-site and you
22 have a large site and you are trying to use, for example, DandD code, we
23 know that this possibly is not applicable and you need to use more
24 advanced model.

25 So, if you have somebody on-site, maybe RESRAD could be
appropriate, but if it is off-site and a large site, it is very clear,
we need to use other kind of tool, more advanced tool, like, for
example, RESRAD off-site, but it's not well-tested, but it could be
another equivalent code.

If there is a code that's specifically designed for off-site

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1 analysis -- I do not want to mention now the names, and whereas the
2 analysis should be done for on-site, the former scenario, this means you
3 are off the mark, you are not considering, you know, withdrawal directly
4 from the site.

5 So, you need to assess -- those are the issues I talked
6 about my previous -- in my presentation yesterday. The receptor
7 location is very important, and the scenario should be considered in the
8 ground water modeling.

9 So, all those together, they have to be accounted for when
10 you decide on what kind of ground water model to be accepted or not.

11 MR. THAGGARD: I think, as a general rule -- and obviously,
12 I think the Standard Review Plan is going to provide more guidance on
13 this, Henry, to specifically answer this question, but I think as a
14 general rule, I think we've talked about some of this today.

15 Obviously, it would be helpful if the code has some degree
16 of pedigree. Otherwise, you're going to have to convince us that it's
17 an acceptable code.

18 So, if, you know, the code has some degree of pedigree, that
19 kind of helps out, and then the other obvious thing is it needs to be
20 appropriate for your particular site, and so, that gets back into the
21 models, the mathematical models being appropriate for the conceptual
22 model at your particular site.

23 So, it needs to appropriately represent the features and
24 processes at your site, and I don't mean to be vague about this, but
25 that's the bottom line. I mean that's kind of what we've been saying
over these two days, I think, here, is that it is important to
understand a little bit about the features and processes at your site
and understand a little bit about what these codes are doing, and so,
& other than that, I mean that's all I can say in a general sense for that
first bullet.

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1 MR. MORTON: I think this is as much or more than I
2 expected. Since this question was prepared in advance, the good news is
3 that this most recent discussion has really dealt with these issues.

4 Kind of the thought concept here, in raising the question,
5 is to being this dialogue of what are we looking for, and the general
6 discussion addressed things like pedigree or general industry
7 acceptance, generally recognized as an industry code.

8 The discussion addressed things such as how much
9 verification are you looking for, what kind of QA package, if it's an
10 original code that's not, quote, "industry accepted."

11 The discussion began to raise the issues, how much
12 benchmarking or how appropriate, how much site-specific information.

13 These are really kind of the thought processes that I
14 basically wanted to distill in one question here, and the good news is
15 you've discussed it in this last session. So, I really don't expect
16 anything more at this point in terms of an answer, but since it was
17 prepared in advance, it's the kind of question to trigger the fact that
18 the licensee and the agency will have to entertain these kinds of
19 questions.

20 MR. ROBERTS: Rick Roberts, Rocky Mountain Irradiation
21 Services.

22 I'd just like to amplify on one of the points that was just
23 talked about.

24 In selecting any ground water model, I believe you really
25 have to know and define your receptors.

Now, a lot of work has been talked about about looking at,
say, an on-site well for a residential receptor, but there are many
cases where that will not apply at a site, and instead of having a
dialogue between the licensee and the NRC, is there any way that, in the
Standard Review Plan, that the NRC could put in there the types of

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1 receptors, not only the residential on-site drinking water well but the
2 other receptors that they would expect to see assessed, if maybe an
3 on-site drinking well were not applicable, things like fence-line doses
4 or ground water to surface water, those types of things, so that we
5 could have a set number of receptors that may be possible for
6 assessment?

7 MR. EID: This is a very good suggestion.

8 We are working on that, and we will include in the SRP
9 modification of the pathways and modification of possibly all the
10 scenarios, the possible conditions that we are quite sure about, and of
11 course, this will be related to the receptor location, and this should
12 be included in the SRP.

13 I do not promise that we will go into depth or detail to
14 address every specific case, but we will try to include as much as we
15 can that we believe could be legal and also is acceptable, and we have
16 some background to justify what we are saying.

17 MR. ROBERTS: Thank you.

18 MR. MORTON: Isn't it going to also be the case that the
19 licensee or the site owner will have some opportunity and some burden to
20 define what it thinks are reasonable receptors and justify why others
21 are not?

22 MR. NICHOLSON: Chris Daly from the Office of Research.

23 MR. DALY: I just want to make a couple of clarifications on
24 some of Henry's point and the question that came up there.

25 In the statements of consideration for the rule-making for
decommissioning, it's mentioned that you need to look at the critical
group, and there's no distinction between they have to be on-site or
they have to be off-site.

So, if your critical group is off-site, you have to use a
tool that's appropriate for estimating dose to that group.

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1 A couple of things on your slides, Henry.

2 We make statements in Draft Guide 4006 and several times in
3 1549 that DandD is not required to be used. It's offered as an option,
4 and there's also a requirement in 1549, a list of requirements for what
5 you have to demonstrate in order to use DandD.

6 MS. DALY: Have you looked at one of the output files for
7 D&D that gives you intermediate concentrations and other information at
8 each time step?

9 MR. MORTON: Yes.

10 MS. DALY: And you need more information than that?

11 MR. MORTON: Yes.

12 MS. DALY: What additional information would that be?

13 MR. MORTON: I don't know that I can define all the things
14 I'd be interested in right now, but basically when I've used D&D and,
15 separately, when I've used RESRAD, work through a problem and one may
16 look at the information you have and wonder what is responsible for the
17 dose from this nuclide being prominently more from that nuclide, and do
18 I understand what's going on here or do I understand what this model is
19 doing to have produced those differences that I may or may not have
20 expected.

21 So what I want to do is work back through the intermediate
22 calculations, the intermediate output, to see if I can tell what it is.
23 And going back, historically, sometimes you'll say, well, that looks
24 like it must be due to concentration factor, a transfer factor. It
25 might be due to some change in the intake-to-dose factors and this
recent set that was not reflective of the last time. It might be due to
the waiver, maybe -- maybe we or this code is interpreting whether Kd is
-- whether the Kd values are different, or it might be that issue of in
the way this is functioning, is the leachability governing or being
overridden by whatever this value of Kd is and the way this thing is

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1 coded.

2 The more output we can get, intermediate values, the better
3 we can study our case and try to understand then whether or not these
4 programs are really the right ones for our site.

5 MS. DALY: I guess I'm still a little confused, because we
6 provide information for each calculational time step,
7 radionuclide-specific, and by pathway. So that's a fair amount of
8 information that you have there in terms of intermediate results.

9 MR. THAGGARD: Is that in the FORTRAN output file you're
10 talking about, Chris?

11 MS. DALY: No. It's the report that you can toggle on and
12 off when you first execute --

13 MR. THAGGARD: The summary report or the FORTRAN report?

14 MS. DALY: Neither one. There's a third report.

15 MR. THAGGARD: Okay.

16 MS. DALY: When you first start the code, there is an option
17 for toggling on and off, if you want to keep the intermediate results,
18 basically. And since it's such a massive file, it's defaulted to not
19 being checked.

20 But you can check it, and volume two, which has now been
21 published, fortunately, does explain these different functions and the
22 format for that file.

23 The other thing is all of the equations that we're using and
24 how they're put together are available and, on request, the testing that
25 has been done is available. So I guess if you could be as specific as
possible, if you want to think about it and get back to us, that would
be very helpful.

MR. THAGGARD: Okay. Sure.

MR. NICHOLSON: We really appreciate your answering
questions. And as with anyone here, if you have more information or

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1 suggestions, contact the staff.

2 MS. DALY: Unfortunately, I still have some comments to make
3 on his second slide that we hadn't gotten to.

4 MR. NICHOLSON: Okay. I'm sorry, Chris. I thought you were
5 done. Go ahead.

6 MR. MORTON: Sure. Okay.

7 MS. DALY: Your second slide.

8 MR. MORTON: I'm sorry. Okay.

9 MS. DALY: You can toggle pathways on and off in D&D. It's
10 not a simple check box. You have to do it by pieces. But you are able
11 to do that, so you're not forced to always calculate dose from all
12 pathways.

13 MR. MORTON: It seems to become by blocks.

14 MS. DALY: You have to deal with the parameters that affect
15 that pathway and we left that not as a box to give you more flexibility,
16 because sometimes there's certain inputs to a particular pathway that
17 you want to remove, but the pathway itself is not completely eliminated.

18 MR. NICHOLSON: Thank you for the clarification. Jack
19 Parrott, from the Office of Nuclear Materials Safety and Safeguards.

20 MR. PARROTT: That's right. Based on the discussion that
21 Henry and Chris just had, I have a question for Walt Beyeler. I've seen
22 recently that both Argonne National Lab for RESRAD and PNNL for MEPAS
23 are offering workshops, hands-on type of workshops for their codes, for
24 a fee, but they have these workshops. I was wondering if there was
25 anything planned for D&D screen or something like that.

MR. BEYELER: I was just told by Chris that the answer is
yes. I'm not sure if I can wait for some elaboration.

MR. EID: I would like to add more.

MR. NICHOLSON: Wait a minute, let Walt finish.

MR. BEYELER: I actually had no more to contribute.

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1 MR. EID: We did request officially the Office of Research
2 to provide training for NRC staff. I think there is a need also for
3 training for licensees, if they can pay for it, on D&D. So I guess we
4 are talking about it and there will be some kind of schedule for the D&D
5 training.

6 MR. NICHOLSON: We'll let Emmanuel make a comment.

7 MR. GNANAPRAGASAM: Yes. I was trying to understand the
8 second slide, the first request. You want to be able to input water
9 considerations for each nuclide. Is it at one time or a function of the
10 time? Currently, RESRAD allows you to put water considerations for one
11 time.

12 MR. MORTON: I think that's one of those that it depends.
13 It depends on what one has really estimated for your case. But if you
14 have a case in which, for instance, the maximum or the peak dose for
15 ground water occurs at a different time from what the time the peak dose
16 occurs from some other pathways, and you may need to make them time
17 dependent.

18 If, in some other way, you've resolved the time, then maybe
19 you would only need to put in one. But if I were asking for the
20 flexibility --

21 MR. GNANAPRAGASAM: As a function of time.

22 MR. MORTON: -- I'd want to be able to put in several time
23 steps or concentrations, several different concentration times.

24 MR. GNANAPRAGASAM: For water and for everything else or
25 just for water?

MR. MORTON: I think what one has to do is to look at it and
say for what other medium intermediate medium might we have data.

One of the things we've never really discussed, for example,
in these workshops, that I'm aware of, is the fact that for the external
radiation pathway, we seem to be dependent or relying totally on

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1 calculations.

2 We may have a situation in which we can simply go measure it
3 and in that case, it would be helpful to be able to enter exposure rate
4 or some measure of the radiation intensity.

5 MR. GNANAPRAGASAM: Okay.

6 MR. NICHOLSON: Walt, you were the next person. We'll go to
7 Tom, and then go back to Walt.

8 MR. POTTER: Tom Potter. I think I can elaborate. I've
9 actually had a situation where I used measured exposure rates to
10 calculate direct dose and then had to combine that with RESRAD output
11 off-line. It would be nice to be able to do that in the RESRAD
12 framework.

13 From the standpoint of nuclide concentrations in media, I
14 believe if we could basically run RESRAD by inputting the concentration
15 file, that would be a nice flexibility. The concentration file that
16 RESRAD currently puts out is intermediate output.

17 MR. NICHOLSON: Walt?

18 MR. BEYELER: Yes. To return to the question on the
19 training for the D&D code. Just to remind everyone, as we discussed in
20 an earlier workshop, we're currently working on version two of D&D,
21 which will include the Monte Carlo sampling and also the ability to
22 specify initial concentrations in media. So it would seem reasonable to
23 have training on conjunction with the availability of that version of
24 the code.

25 MR. NICHOLSON: When do you think that will be?

MR. BEYELER: I believe that's scheduled for delivery to NRC
in, I believe, October of this year, as a beta to NRC in October of this
year.

MR. NICHOLSON: Thank you. Well, I think we've discussed
this quite a bit and I really want to thank Henry for coming forward

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1 with his suggestion.

2 What we'll do is we'll take a 15-minute break. Then what
3 we're going to do is we're going to go back, if you have your agendas,
4 there were some questions remaining in discussion group number one and
5 three, we'll go over those, and then we're going to provide an
6 opportunity for people from industry, the states and elsewhere, if you
7 want to make some statements at the end of the meeting, we'll provide
8 you with that opportunity. Then we'll have closing remarks.

9 So let's break for 15 minutes.

10 [Recess.]

11 MR. NICHOLSON: Two bits of clarification before we begin
12 the final home stretch here. There are two outstanding viewgraphs that
13 people haven't gotten yet. One was from Professor Neuman. Those copies
14 are being made and hopefully they will -- they will definitely be done
15 by 4:30, so hopefully they'll be out there.

16 The other one, that is not available and probably won't be,
17 but we will make sure that it gets into the public record, along with
18 the transcripts, and that will be the ones from Argonne National Lab. I
19 talked to Emmanuel -- he must have just stepped out -- he assured me
20 that we had downloaded -- he had used PowerPoint and we downloaded them.
21 He wasn't happy with the hard copies that came out.

22 So he has assured me, he has promised me that he will send
23 us a copy and then we will make sure it gets into the public document
24 room.

25 So those are the only two outstanding ones.

What we're going to do now, I'm calling on Dr. Ralph Cady to
go through the remaining questions that weren't fully discussed in work
group or discussion number one and number three.

When we get done with that, then we're going to open the
floor up and I will call on people, if they want to make any final

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1 statements or comments, and then we'll adjourn.

2 So I will turn it over now to Dr. Cady.

3 MR. CADY: So I guess the game plan is to read these
4 questions and if nobody is jumping up anxious to answer then, we'll
5 proceed to work our way through.

6 So for question number three in this first session, the
7 first group discussion, can one use current ground water monitoring data
8 to supplant modeling of future doses. I think that was something
9 initially that Henry had raised a while back, and so we put that in as a
10 question. I'm actually going to call on Gene to see if he's willing to
11 give a response to this.

12 MR. WHELAN: There are two types of assessments that I
13 generally work with. One is a comparative assessment and one is a
14 predictive assessment.

15 In a comparative assessment, basically what you do is you
16 identify the situation that you're going to simulate with a given model
17 and then you vary the parameters and then you compare the results.

18 So in fact, you may not have any monitoring data to work
19 with, but if you have different conditions and different situations, you
20 can see what the ramifications of changing those conditions, what they
21 are relative to one set of results to another.

22 In a predictive assessment, what we do is we actually try to
23 estimate or predict what might actually occur in the real world and when
24 we do that, what we need to do for our modeling, I believe, is to try to
25 anchor the modeling exercise back to the real world and the way we do
this is we use monitored information and with that monitored
information, we can go and calibrate the -- in this particular case, the
ground water models, such that the predictions we come up with, at least
in the timeframe and the location of that monitored data, our models can
recreate, to a certain degree, what's happening in the real world.

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1 Again, that goes back to the question of do we have a
2 certain degree or level of confidence in the results from these models.
3 So with respect to this question, I believe if you have monitored
4 information, you should try to factor that into any modeling exercise.

5 And it's just as important with the complex models or
6 numerical models as it is with the more simplified semi-analytical
7 models.

8 MR. CADY: Thanks. I think this also has implications to
9 the licensing process.

10 MR. THAGGARD: Actually, I did want to comment on this
11 particular question. This kind of gets back to the question that Latif
12 Hamdon raised and, unfortunately, he left, in terms of why are we doing
13 this modeling for decommissioning, when we should have data, since most
14 of these sites are contaminated. I think that was his question.

15 I think you could certainly use ground water data, and you
16 should probably use ground water data, to some extent, to help with your
17 analysis. I think this gets back to what Phil Meyer was saying about
18 being able to do inverse analysis, in terms of being able to determine
19 the appropriate parameters for the analysis.

20 If you've got that kind of data, you certainly should use
21 it. The problem is you can only use that data to a certain extent.
22 We're doing an analysis out in the future, so that data only can carry
23 you only so far.

24 You've got to worry about additional contamination occurring
25 from the soil, stuff that hasn't gotten to the ground water yet that may
 still get there, and the only way to assess that is basically to use
 models.

 So I think the answer to the question is you certainly
 should use data to the extent you can, but I think they're only going to
 carry you so far, especially if you've got a source that's still sitting

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1 there, where you may have additional contamination occurring in the
2 future.

3
4 MR. CADY: Thanks. Yes?

5 MR. NARDI: Joe Nardi, Westinghouse. As I've mentioned, we
6 have a site where we have ground water contamination and we have
7 monitoring data and followed it since '84. So we actually have quite a
8 bit of data to look at the past of what the concentration in the ground
9 water has been.

10 But if you try to use that into the future, you run into a
11 couple problems. In the past, we have been doing pump-and-treat to
12 control the ground water situation and we want to do the remediation and
13 then not do pump-and-treat to follow.

14 If you try to look at a RESRAD type modeling, which is what
15 we're doing, you can't match those two. You've already got a ground
16 water contamination. In our case, it's a ground water contamination in
17 fractured bedrock and our remediation is not going to touch that. It's
18 beyond our reach.

19 So our approach right now is trying to decouple the two from
20 the standpoint of analysis and look at the ground water modeling, like
21 MODFLOW, I think it is, I forget what the model they used, to deal with
22 that segment of ground water contamination and project that into the
23 future, and then to -- because RESRAD looks at a contamination of ground
24 water for ground, and then the transport adding to it, look at that
25 separately.

Then you have to take, in my view right now, in trying to
deal with this, is break your criteria up into two elements, a fraction
of it for the MODFLOW in what exists now and a fraction of it for what
we'll add later.

That's the approach we've been trying to do, because we

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1 don't know how to take the models and link them directly.

2 I'd like a comment -- well, I'm going to get a comment
3 sooner about that approach, but that's what we've been fighting with.

4 MR. EID: I have no comments into. It needs to be looked
5 into in more detail, to be fair. It is unfair to answer you on this
6 part directly one way or the other. I think we take a look at your
7 approach and most likely it will come to the PA group to take a look at
8 this approach, if it is innovative and if it is not, it is slightly more
9 complex than the normal case.

10 MR. NARDI: With respect to question one, I just don't know
11 how you use it to project into the future; past data to project into the
12 future. That's a very difficult thing to do, particularly when past
13 data has been modified by practice, such as pump-and-treat.

14 MR. THAGGARD: I think, clearly, if you've only got a ground
15 water source and you remove the surface contamination and you're only
16 dealing with ground water source, the answer to this question is you
17 should use the data, because that's better than any modeling you can do.

18 Certainly, if you can monitor how fast that contamination --
19 that plume is moving, how fast it's migrating, you can get a much better
20 estimate on what the concentration is going to be in the future based on
21 the monitoring information than you can ever do with modeling.

22 Unfortunately, most of the problems -- we have this dual
23 problem where we've got not only existing contamination, but we still
24 have a source or potential source where we can get additional
25 contamination in the future.

So it becomes a problem of coupling those two together and
integrating the analysis.

MR. NARDI: But my point exactly was that we have 15 years
worth of data of using pump-and-treat to shrink it. That has nothing to
do with movement away.

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1 MR. CADY: Gene.

2 MR. WHELAN: I had one additional comment, and that is that
3 at many of the sites we deal with, the difficulty I'm hearing here is
4 that we have two situations. One, we have current contamination that
5 exists due to past practices and then when we want to do D&D, we have
6 the potential of the contamination that may occur because of the D&D
7 process.

8 What we have done in the past with that situation is we have
9 used the past contamination to help us identify the hydrogeologic,
10 hydrodynamic parameters that would then be used in the D&D assessments.
11 For example, if I had nitrates or something that didn't absorb well to
12 soils, it would provide me with an idea of what the flow velocities
13 were, the direction of flow.

14 Other contaminants could give me ideas of suggested values
15 of Kd, et cetera. And that information could then be used for the
16 second stage analysis; that is, the license termination analysis.

17 So although it may not be the same contamination, the same
18 potential contamination or exactly the same situation, it could provide
19 information that makes that analysis much more accurate and more
20 palatable to the regulators.

21 MR. CADY: Thanks. All right. How about the fourth
22 question, when is it necessary to go beyond one-dimensional ground water
23 models, and do two and three-dimensional models? Any takers? Nobody
24 from licensing is doing anything other than smiling.

25 MR. EID: I think for the cases I'm familiar with, it is
very difficult to define many cases to say, yes, you need to use more
than a 1-D model. In decommissioning, it is very difficult to go to
ADN complex modeling because of the need of the data and the extra expenses
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and because that already the models that we are using, whether 0-D or
1-D, they are already conservative, and we are trying to be a little bit

1 more conservative, to have confidence, while we are protecting the
2 health and safety of the public.

3 If somebody wants to go and use 2-D and 3-D in order to
4 reduce such kind of level of conservatism already in the 0-D and 1-D
5 models that are available, I would say I would leave it up to the
6 licensees to use it. But to say that you must use 2-D and 3-D model and
7 to give a specific case, I think, it's very difficult for me as a
8 regulator to define this kind of case.

9 MR. CADY: Yes, Henry.

10 MR. MORTON: Henry Morton. Isn't there also a kind of
11 corollary question here? When is it advantageous to do 2-D or 3-D
12 modeling? And part of those -- the factors there are -- at least
13 immediately, I think it's when is dispersion particularly making a
14 difference here.

15 Then, secondly, do we have the data to feed or support the
16 more complex model or is it worth the expenditures of the money to get
17 the data to support a more complex model, or, on the other hand, is it
18 necessary to get the data, if we don't have it, that support the more
19 complex model.

20 MR. CADY: I think this question has embedded in it some
21 assumptions and some of those are that some of these existing are not
22 multi-dimensional. The ground water flow model in MEPAS, it's my
23 understanding that it's at least two-dimensional, right?

24 MR. WHELAN: Three-dimensional dispersive, one-dimensional.

25 MR. CADY: Right, 1-D advection and 3-D dispersion. Okay.

Moving on to number five, when it is appropriate to model a
site as a simple unified layer as opposed to several distinct soil
horizons and/or rock units above the water table. So we're talking here
primarily about the vadose zone or the unsaturated zone. Anybody?

MR. NARDI: Joe Nardi again. In our specific situation, one

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1 of the areas that we have is a buried basin that was buried in the '60s
2 and we are going to go back and dig that up. That's going to
3 essentially require us to dig down to bedrock, and bedrock, in essence,
4 is the ground water interface.

5 When we put it all back together, we're going to basically
6 backfill with one media and, to me, that would be an appropriate time to
7 do exactly that, where you just have one horizon, if you want to call it
8 that, of uniform properties, because for practical purposes, that's what
9 will exist.

10 MR. CADY: Thank you.

11 MR. THAGGARD: I think another issue is how complex do you
12 want to get with trying to analyze the migration through the unsaturated
13 zone. It may be somewhat dependent upon what it's doing in terms of
14 buying you anything, because most times, the way we are modeling the
15 migration through the unsaturated zone, it's almost like a delay
16 function.

17 So trying to model the unsaturated zone to a very fine
18 degree may not be all that important when all you're doing is buying
19 yourself something in terms of additional decay. And if you've got a
20 long-lived radionuclide, you're probably not even going to get much in
21 the way of that.

22 So I think there needs to be some consideration in terms of
23 how important that unsaturated zone is to the analysis.

24 One other point I'd like to make, though, is one of the
25 things I think PNNL has found out in looking at the D&D code was that
the D&D code uses that one box for the unsaturated zone and by using
that one box for the unsaturated zone, we're basically assuming infinite
dispersion, and that could be very non-conservative.

So there is some recommendation that you need to break that
unsaturated zone up into multiple zones, and I think that's put out in

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1 the report by PNNL and we're certainly going to encourage people to do
2 that, because that's a very non-conservative situation.

3 I don't know if Phil wants to say anymore about that.

4 MR. LEE: I would just like to add another comment on that.
5 From the ground water modeling point of view and from the --
6 particularly, from the numerical point of view, because the ground water
7 modeling we saw in these two says is trying to solve the differential
8 equations.

9 So in that point of view, we have to use a fine grid.
10 Instead of one layer, we have to have just a few layers in order to
11 treat the numerical diffusion, try to avoid that numerical diffusion.
12 That's from the numerical point of view.

13 So I still insist I'd like to have more than one layer, yes.
14 If you only treat the analytical solutions, yes, we can use only one
15 layer, that's good enough. But if you want to solve for the
16 differential equation, we have to have more than one layer in order to
17 avoid the numerical diffusion.

18 MR. THAGGARD: That's not quite the same as -- I mean, the
19 number -- you mean in terms of the number of grids, breaking the grid up
20 in terms of -- yes, I agree. In most cases, you can't get by with a
21 grid of -- having a single grid for the unsaturated zone. If you're
22 doing a numerical analysis, but I think in most cases, what we're
23 talking about here is not numerical analysis, but yet if you're doing a
24 numerical analysis, you do have to have -- find enough resolution so
25 that you don't get numerical dispersion, which is kind of what I had
touched on with the problem with the D&D code, where we're assuming that
single zone for the unsaturated.

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If you assume a single zone for the unsaturated zone without
breaking that up, you, in effect, are going to get a lot of numerical
dispersion there, because you're getting infinite dispersion. So we're

1 recommending that people break that up.

2 MR. EISENBERG: Except there are some numerical algorithms
3 that avoid the problem or the numerical dispersion. Particle tracking
4 algorithms would avoid it. So you don't have the same limitation.

5 MR. CADY: All right. How about modeling water table
6 aquifers that have multiple sources? Gene, how would you do that?

7 MR. WHELAN: Well, we've done it. We've done it kind of for
8 1,200 waste sites at Hanford, and what we've done is we've used a
9 super-position of the contaminants from multiple waste sites and the
10 flow paths intersected in the saturated zone, some location, down
11 gradients, and those were superimposed to come up with the combined
12 concentrations for like constituents, like strontium-90, for example.

13 So a super-position has been used in the saturated zone.
14 We've also used it in the vadose zone, where we have varied the flow
15 field; that is, an approximation to transient flow, even though these
16 models assume steady-state hydrodynamics.

17 So super-position actually works fairly well. It's
18 approximation, but it's not a bad approximation.

19 MR. CADY: Thanks. Yes, sir.

20 MR. KUHLETHAU: Rick Kuhlthau. I'd just like to make a quick
21 comment on super-position. If you have plumes coming from two different
22 sources and the likelihood that they actual commingle at some point in
23 the distance, is that really the representation of reality? Would they
24 really commingle or come close to each other?

25 In other words, this mixing of a plume downstream with
another plume, they're from different sources, I really question if
that's physically what would happen, because they all have their own
separate flow lines.

These flow lines aren't going to come together and merge.
There may be a concentration of flow lines and maybe it's a matter of

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1 scale, but in the end, I doubt, except as dispersion would account for
2 it, that you could get mixing like that.

3 MR. WHELAN: The way which the flow lines were defined were
4 by these three-dimensional numerical models and the concentrations in
5 these more simple models, the way we handled them were we identified
6 around nodal points certain volumes, if you will, and the -- it's really
7 the contamination that is associated with that controlled volume.

8 Again, the technique or approach that you use depends upon
9 the questions that you are asking and as I noted, do the numbers match
10 exactly? No, they do not. But in these particular instances, because
11 we then went back and compared them, the concentrations, although they
12 were not exact, they were in the ballpark and in the ballpark of risk
13 assessment, we're talking well within an order of magnitude, factor of
14 two.

15 So for our analyses, it was good enough for the questions
16 that we were asking. For other analyses, it may not be good enough for
17 the questions that we're asking.

18 MR. CADY: Thanks. Norman? Never mind. Any additional
19 complicating factor would be at the well. If you're actually simulating
20 the well, then you'll have convergence and it would be possible to
21 induce portions of multiple plumes.

22 MR. KUHLETHAU: I guess it's like I ought to offer a warning,
23 particularly for the regulated community, that that is not -- it is very
24 -- it can be a conservative assumption, it can work against people when
25 they're trying to add these plumes together. In some cases, it may not
represent their situation and it may definitely not be to their benefit.

MR. CADY: How about the final question, if the ground water
model considers dilution of the radionuclide sources, what site-specific
and pathway scenario features -- for example, ground water wells -- and
processes -- for example, dispersion -- warrant consideration in making

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1 the dilution calculation? Should the ground water well be treated as a
2 pumping well?

3 I think we've heard points over the past few days for
4 considering the ground water well to be a pumping well and
5 approximations to that.

6 Does anyone have anything further to add?

7 MR. NICHOLSON: One point that was made yesterday, and I
8 don't know if anyone wants to discuss it, but with regard to the
9 scenario, where is the well screen, not only is it a pumping well, is
10 that well being used for a single family or a community and, also, where
11 is the well screen located within the aquifer and its relationship to
12 the anticipated or projected contaminant plume.

13 MR. RACINO: Roy Racino, NES. In regard to pathways and
14 scenarios, I want to back up a little bit to a question that was before
15 one of these. Specifically, in justification for elimination of
16 pathways.

17 I think we've covered pretty well some of the justifications
18 for eliminating drinking water pathways or things like that for
19 shorter-lived isotopes, but when you get into the long-lived
20 radionuclides, like a few people here are dealing with uranium and
21 thorium sites, what would be the justification for or would there be a
22 justification for eliminating pathways?

23 I know Dr. Neuman touched on the fact that in a relatively
24 short amount of time, there can be drastic change. So if you use past,
25 present and future population data, land use data, water use data, is
that really going to be a justification when you're going out the full
thousand years, as far as the criteria?

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I was just wondering if you had any feeling on that, if
somebody submitted something, if there is any feeling.

MR. THAGGARD: I think what I said yesterday is that that's

1 what we're considering right now. We haven't reached a position on that
2 yet, but these are the kind of arguments that we're in right now and I
3 think the gentleman from NFS mentioned about -- talked about his problem
4 yesterday and they're raising some of the same issues at their site.

5 So this is a broad-reaching generic issue that we're going
6 to have to provide some guidance on, and we haven't gotten to that yet.
7 We haven't reached that point yet.

8 MR. RACINO: Thank you.

9 MR. EID: I believe I gave a vivid example yesterday in my
10 presentation, that the classification of the aquifer is quite important
11 and if the aquifer is classified as not used for irrigation or for
12 drinking, this could be sufficient justification for elimination of the
13 ground water pathways, as a clear example.

14 Again, for using the soil, if the soil currently and in the
15 future is going to be soil not useable for agricultural purposes, also,
16 you could eliminate that pathway. If you are to bring water for
17 irrigation from somewhere else, typically you do not bring contaminated
18 water from somewhere else, you will bring clean water. In this case,
19 you could eliminate the ground water pathways. Meanwhile, you could
20 deal with the long-term planning if the soil could be useable for
21 agricultural purposes, then you maintain the agricultural pathways,
22 considering irrigation with clean water.

23 Another example I could give for elimination of pathways, if
24 you are living in a highly populated urban area, where you know that
25 nobody is going to be a residential farmer in that specific area, it is
a big city, you are in the middle of the city. At worst condition, you
may have a gardening scenario, if you have very large land. If you have
a small site, this means this could be even you could have somebody just
occupying a building without doing gardening.

So using this kind of analysis and approach, you need, of

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1 course, to give some supporting information to justify eliminating those
2 pathways.

3 So those are the examples now. We'll be, of course,
4 developing this further, giving it more thought, and then putting it in
5 the SRP.

6 MR. THAGGARD: I'd like to clarify something that Bobby made.
7 I think as a position right now, clearly, if you can argue that there
8 are physical limitations to the use of that pathway, then I think those
9 are the kind of arguments that we would probably look at very -- you
10 know, there wouldn't be much in terms of arguing about physical
11 limitations.

12 When you get into these other forms of justification, for
13 example, current land uses, I think that's where we are still trying to
14 figure out the specific guidance that we want to give people for the
15 type of arguments, because there's a lot of issues that need to be
16 resolved in terms of how long of a time period you want to use and what
17 area you want to consider.

18 So we haven't resolved any of those issues yet, but clearly
19 if there are physical limitations -- for example, you can't get the
20 yield or the ground water is salty, salinity arguments, I think those
21 are reasonable arguments that can be made even today.

22 But when you get into these more cultural type of
23 justification, we really haven't resolved those yet.

24 MR. EID: Some of those, they have legal implications.
25 That's why we are hesitant to say for sure those are the ones. Of
course, we have to go through the legal process to be sure what we are
saying is legally acceptable.

MR. KIRK: Scott Kirk, NFS. I would just like to raise the
point that in the current guidance, DG-4006, it talks about use of
specific site information. It states that you can use or consider as

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1 reasonable current land uses for the period of the dose assessment,
2 which is a thousand years.

3 I can understand how that may not be all inclusive for all
4 scenarios, but at least for determining land use scenarios, whether it
5 be a resident farmer, suburban resident, that that particular guidance
6 that exists now should apply to the licensees at present.

7 MR. EID: I think this is a consideration factor, but it
8 will depend on the site conditions. This is just broadly stated, but
9 you need to analyze what other factors also.

10 MR. KIRK: Thank you.

11 MR. CADY: For session number three, I believe we touched on
12 the first two questions. Was it necessary to modify the ground water
13 model to make it compatible for linkage to the dose assessment module?
14 Please explain.

15 MR. EID: I will give it a shot on this. I believe, yes, it
16 is necessary to link it because it is very important factor, which is
17 the decay factor. If you try to calculate the transport for the ground
18 water model without linking to the dose assessment model, maybe you will
19 be ignoring the decay factor in the process of the transport.

20 Another one, linking the time when you try to pump the water
21 for the other pathways, for the resident farmer to pump the water at the
22 same time. So the timing is very, very important in this case. This is
23 an example of where it is important to link the ground water pathway
24 with the dose modeling assessment.

25 However, there are certain models that you could derive the
concentration, input it in the code, and they can be linked, and just I
caution that we need to be sure that they are compatible with each
other.

You do not sometimes -- these models, you may do the process
twice, like you have the pathways could be overlapping on each other.

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1 You need to be sure you are not, for example, having two pathways at the
2 same time, or, vice versa, eliminate certain pathways.

3 For example, the ground water model in D&D assumes the
4 concentration in the pond is the same concentration in the aquifer.
5 Now, if you do not properly link that scenario with the ground water
6 model and you eliminate the fish pathway, whereas under typical
7 conditions or a complete residential scenario, you would need to
8 consider the fish pathway.

9 This is for initiation of the dose modeling process. This
10 means you could have eliminated a significant pathway, and that
11 significant pathway could be applicable to some radionuclides or
12 significant to some, like carbon-14, whereas for some other
13 radionuclides, it is insignificant.

14 So in linking the ground water model to the dose assessment
15 is quite significant because of the decay, because of the time factor,
16 because of the compatibility of the pathways together with the ground
17 water pathways.

18 MR. LEE: I'd like to add a comment on that. I agree, it's
19 very important. We have to link the ground water model with dose
20 assessment, because the reason I say that, because the ground water
21 model really can give a lot of the different distribution of the
22 concentration and a different depth or a different time zone and
23 everything, that's right.

24 That is quite different from that currently taken for the
25 ground water model. So from that sense, I think that it's very useful
to link a ground water model with dose assessment.

That is why I try to continue to pursue in that direction.

MR. NICHOLSON: Could you say something about what your
& thoughts are?

MR. LEE: Probably, I'm thinking that -- yesterday, I with

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1 Gene. Probably I ought to continue to work with Gene and we link with
2 the model with the dose assessment. That's right. I think that is a
3 way we have to pursue.

4 MR. NICHOLSON: Thank you.

5 MR. EID: Also, to add more linking with the scenario itself
6 is very important. As we explained, the receptor location. So you need
7 to link the scenario in the dose assessment model with the ground water
8 model, the ground water pumping, location of the well, and so on.

9 MR. CADY: Yes, Henry.

10 MR. MORTON: Henry Morton. Gene explained yesterday his
11 dealing with FRAMES, in a global manner, and what I was trying to
12 describe earlier today, an interest in a more immediate matter of this
13 kind of linkage of the output from, in this case, ground water modeling
14 to the input for the programs like D&D and RESRAD.

15 It seems to me that at this point in the near term and as a
16 practical matter, we need to think of both what is needed perhaps to
17 modify the ground water model or the coding of a program that produces
18 that to get the right information out, and, at the same time, think of
19 what kind of input -- that is, what modification might be best and most
20 nearly universally compatible in the dose assessment programs, like D&D
21 and RESRAD, more to let these two mesh with the least pain in the near
22 term.

23 MR. CADY: Thank you. Norman?

24 MR. EISENBERG: I'd like to ask Henry a question. It seems
25 to me there are some codes out there, that if you input concentrations,
they will calculate doses, and we haven't talked very much about how to
just get out of the whole mode of D&D and RESRAD and move over to that
suite of codes.

Could you say a few words about those?

MR. MORTON: In actuality, I've continued to mention these

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1 two, for the reason of experience and the sense that, both from the
2 regulators' viewpoint and the licensees' viewpoint, this is where the
3 experience is and the sense then on my part that this might be the most
4 acceptable way for us to deal with this in the near term.

5 I have a sense from previous workshops that justification of
6 using some other program -- that is, mathematical -- coded mathematical
7 models for all pathways and models that then go on to take the intake,
8 calculate organ doses, do the organ dose weighting, produce the TEDE,
9 that is the dose equivalent, these two codes do that in a way that seems
10 to be generally acceptable and for which I have a sense that we won't
11 have to go through a great deal of discussion to justify to one another
12 that that's an acceptable way to do this part of the arithmetic.

13 So that's why I keep mentioning these two programs as what I
14 think are now the most nearly acceptable ones. It's a matter of how
15 much defense, how much verification, benchmarking, inter-comparisons
16 with other programs might be needed.

17 MR. EISENBERG: But the catch is that D&D, for example, was
18 intended to be a screening code and was not necessarily designed to
19 accept inputs from complex ground water and transport models so that it
20 could then calculate dose from that and some other codes.

21 I think -- I'm not an expert on all this, but I think we're
22 talking about things like the GINNI code and possibly other codes like
23 that. Those kinds of codes might be more easily adaptable to some of
24 the complex ground water flow and transport codes. And I'm not sure
25 that the staff a priori is going to say you shouldn't do that.

26 You are right, there will be some burden for justification
27 of the use of those codes, but I'm not sure that we should just
28 automatically rule it out.

29 MR. MORTON: In concept, I would agree that that's true. As
30 a practical matter, there are some questions then that need to be

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1 answered as I consider other coded mathematical models for this program.
2 The question then is who would do the modification in order to enable
3 this linkage to be done, who would do the modification? Well, that may
4 depend on who is supporting it and there is a key question.

5 If the owner of the code will not contribute the source code
6 for someone else to do the modification and the verification, then we
7 can't do that physically.

8 To my knowledge, first, I have asked historically for the
9 source code from GINNI. No. To my knowledge, from what I've heard in
10 workshops here in the last year or two, source code would not be
11 available to me for either RESRAD or D&D. If that is the case, which it
12 seems to me it is, then I can't do it. I would have to depend on the
13 owner of the code to do it, and that's an uncertainty.

14 We basically, I think, from an industry viewpoint, have to
15 stand here and basically ask for what I've asked for today; that is, if
16 the owner has configuration control, then we have to depend on the owner
17 to provide the modifications that will enable us mechanically to get
18 these things done, be able to have this mechanism that most conveniently
19 does the arithmetic and combining the different pathways into one
20 eventual one, as a practical matter, that seems to be the case.

21 So the two likely candidates, I think, remain RESRAD and D&D
22 for the reason that there are two agencies who are continuing to support
23 the maintenance and development of those codes.

24 As a practical matter, to take other codes and adapt them
25 somehow to basically produce an output that will become the input to
those in whatever way, we can do that only if the owner of that code
accommodates us.

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MR. EID: I would like to reiterate, again, as a general
policy, the licensee could submit any code that he wished for
site-specific analysis. Of course, there will be more burden on both

1 the reviewer and the licensee to provide more information on the code
2 and justification of the code if the code is not well known.

3 Like, if it is in-house, developed by a single person and he
4 thinks this code fits the process, this means it will require more
5 information to look at the code and the QA/QC of the code and to look at
6 the equations by both, by the, of course, licensee, if they submit such
7 kind of code, and also by the regulator to review the process for
8 deriving the dose.

9 So in other words, if you have more common codes available
10 and they are used more commonly by the licensee community and by the
11 technical community, they are using dose assessment, it would be much
12 easier for you to establish more confidence.

13 Of course, also, we need to look at the cases. I disagree
14 with you that only because they are available, just only D&D and RESRAD,
15 I think you need to look at a specific case.

16 For example, if you come with RESRAD and say I use RESRAD
17 for on-site analysis, I may give it some argument and say is it really
18 indeed the best code that you could use for on-site analysis -- I mean,
19 for off-site analysis.

20 So in this case, we have a specific case now, a
21 decommissioning case, where RESRAD was used for on-site analysis and
22 MEPAS was used off-site. So I think this is an example where depending
23 on what you are analyzing, where is the receptor, is it on-site or it is
24 off-site.

25 For on-site, for example, if your site is about a diameter
less than 100 meters, it would be very difficult to justify a gallium
plume, for example, for the inhalation pathway. So this is a fact that
you need to take into consideration.

So a gallium plume, for on-site analysis, if the site is
very, very small, I'm giving the example of 100 meter, it could be --

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1 somebody could argue it's 50 meters, this is the example where we could
2 use on-site and the suitable code for that case or condition and
3 off-site, and in this case, I would say it's not just only two codes.
4 There are other codes available on the street and they could be good and
5 suitable for that condition.

6 MR. MORTON: I would agree with that. There will be cases
7 in which we'll look at the case and we'll realize that there are other
8 codes that may be more appropriate. I think with respect to ground
9 water, that's the whole workshop here.

10 Then when we get to that point, then come the practical
11 considerations of one of the questions I raised, which is, in effect,
12 the nature of justification to be able to use an alternate code and the
13 value of doing that versus the cost.

14 MR. CADY: And I'd like to clear up one misperception. The
15 FORTRAN code for D&D is published in the most recent 5512 volume. So
16 that is available to you.

17 MR. MORTON: Basically, there is a difference between having
18 the FORTRAN code and being able to read it and do some things with it,
19 and then having a program that will execute it on a computer. Short
20 item, how much effort to type in seven or 8,000 lines of FORTRAN code or
21 however many thousand lines it may be.

22 These things, theoretically or conceptually, may well be
23 true. As a practical matter of execution, it may be simply too much or
24 inconvenient to do.

25 MR. THAGGART: While Walt is standing up, let me just say
that I think what Norm was trying to point out is that there is a
practical limitation to how much you can modify codes that are designed
primarily for screening purposes.

When you start getting into real complex analysis, where
you're talking about having to do detailed ground water modeling, you're

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1 really starting to fall outside of the limitations for some of these
2 screening codes. So you're going to probably have a burden on your
3 hands anyway at that point in terms of justifying what you've done.

4 So there's some practical limitation as to whether or not
5 you want to modify these screening codes or these simpler codes to
6 handle every one of these little isolated problems or put more of the
7 burden on that particular individual to deal with that particular
8 problem and keep the -- you know, so there are practical limitations on
9 however you do it.

10 Sorry, Walt.

11 MR. BEYELER: No, that's fine. I just wanted a response to
12 Henry's question about the source code. If the source code is listed as
13 part of volume two, then it should be available on our FTP site and if
14 it isn't, I will look into that and get back to you on making that
15 available to you electronically.

16 MR. CADY: Part of the problem is that there are elements
17 within D&D, commercially available libraries, where we clearly can't
18 give you the source for this charting package and so on and so forth.
19 So there are some problems with distributing elements to this.

20 MR. MORTON: I think, to be clear on it, I'm really not
21 standing here asking you to do it, to give us the code to change it.

22 Clearly, what I'm really asking for is provide some plug-ins
23 where the best mesh of input of data can be done so that we can enter
24 data without having to go modify the code ourselves. That would make it
25 most nearly compatible for a broad range of users.

So that then you have a definition of what the inputs are.
And there is this now, there is that ability, in a defined file, where
input of drinking water and it's that kind of thing that I'm interested
in in order to make, in this particular case, the best mesh between the
output of some of the ground water models that we've talked about today

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1 and the input to the code that will handle the rest of the arithmetic.

2 MR. CADY: Thank you.

3 MR. MORTON: I'm not making any effort here to wrestle away
4 the source code and let them keep the source code and keep configuration
5 control, but --

6 MR. EISENBERG: But what I'd like to ask is, is this a
7 general view of the licensee community that they would like to see D&D
8 modified in this way because NRC gets its money from the licensees. So
9 if we're going to do it, you guys are going to pay for it.

10 MR. BURKLIN: Rich Burklin, Siemens. I think that most of
11 us in either the reactor community or a fuel fabrication facility or
12 business are going to use RESRAD and, therefore, all these modifications
13 that are proposed to D&D really don't do us any good.

14 So just speaking for myself at least, I don't see putting a
15 lot of money into making a lot of changes into the code that we probably
16 aren't going to use.

17 MR. KIRK: Scott Kirk, NFS. I think what Dr. Whelan said
18 really hit home; that we use the codes that we're most familiar with.
19 We're most familiar with D&D and also RESRAD. Some of us do have a need
20 to decouple the ground water pathway and to do more detailed analysis,
21 but currently there is no link, without us doing a lot of innovations,
22 so that we can estimate how much daughter ingrowth would occur at
23 various periods of time within the water table, and also to use that
24 information to calculate dose.

25 And if that linkage was provided, it would be very
beneficial to us really right now.

MR. CADY: Thank you.

MR. BURKLIN: Rich Burklin, Siemens. I'd like to make
another comment in here. As I understand it, what we need to do is
we're going to choose a code and then we're going to justify that code

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1 to you. We're not going to be in the business of saying we chose that
2 code, but we didn't choose these other five codes in here, even though
3 someone may argue that they're better. Is that correct?

4 MR. EID: That's fine. That's acceptable, yes.

5 MR. BURKLIN: And one other thing that I noticed today in
6 here and which has some concerns for me is that in Phil's talk earlier
7 today, he had two points of data and I think -- I'm sure that we're
8 going to get more than two points of data for lots of these things.

9 But then he drew a distribution using Bayesian techniques,
10 which I'm unfamiliar with, in here, which was skewed to one side of
11 those two points here.

12 In one case, it may be conservative; at another point, it
13 may be not conservative. But that distribution is different than you
14 would get if we just had those two points and used classical statistics.

15 Again, I am concerned about having to go in and explain,
16 well, why didn't use Bayesian here. Do you understand what I'm saying
17 in here? You can get different distributions, and I don't want to
18 really explain to -- going through the explanation why I didn't use a
19 different set of statistics.

20 MR. THAGGARD: That came up during my discussion point and
21 that's why I said that you can use any method you want. I think Phil
22 just basically presented his idea, his tool for how he thinks it could
23 be done, and that's why I was trying to solicit to see if there were
24 some other ideas out there for how people can do it.

25 But certainly if there are other ways to do it, you can
certainly use whatever method you want.

MR. CADY: The final question in this session would be how
does one test the modifications and linkages to determine whether errors
and/or uncertainties are being introduced in the dose calculations.

I think essentially we touched on that when we were talking

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1 exclusively about the ground water models. Is there anything that
2 anyone has to add? Henry?

3 MR. MORTON: Yes. That's where, at least in my broader
4 concept, keeping this interface clean, defined, will help to do that.
5 That is, if we define this interface somewhat in the way that, in one
6 case, D&D has done it, let the owners of that code be responsible for
7 that side of the interface and let the owners of the other code be
8 responsible for the other side.

9 Then it's a matter of matching input and output. That
10 interface then becomes cleaner and you don't get the crossover.

11 MR. CADY: Thank you.

12 MR. NICHOLSON: Are there any more comments or suggestions
13 on that last question?

14 [No response.]

15 MR. NICHOLSON: Okay. Well, we've reached the end of the
16 program, and now it's time for closing remarks. I just want to say, for
17 the record, that there will be, as I said earlier, an official
18 transcript that we put in the PDR here in Washington. We are hoping to
19 put together a proceedings of this workshop six months later.

20 We have passed out the viewgraphs to all of the
21 presentations except for one. All of them, including the one from
22 Argonne, will be in the public document room with the official
23 transcripts.

24 The last thing is I want to personally thank all the
25 speakers and the Federal agencies that support them. We had
presentations from the national labs. A lot of that work in EPA was not
supported by the NRC and we want to thank the Department of Energy and
the Environmental Protection Agency. We also want to acknowledge all
the speakers that came from all over the United States and the effort
you people put in preparing those presentations. We really appreciate

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1 it.

2 I'd like to now see if there is anyone who would like to
3 comment before the final remarks from industry. Are there any comments?
4 Yes, sir.

5 MR. ROBERTS: Rick Roberts. Through these last two days of
6 talks, I thought there would be one issue talked about that was never
7 brought up.

8 In your decommissioning rule for building surfaces, you
9 decommission your building surfaces to a building occupancy scenario and
10 buildings obviously will not be there for more than, say, 50 years, they
11 have a useful lifetime. But we have to assess does over a thousand-year
12 period.

13 And one thing that has come out in the last few sessions is
14 that we're going to have to assess the dose to building rubble over a
15 thousand-year period, we can't just stop at the 50 years. We have to
16 look out into the future, as well. And I don't know if it's -- where
17 this will be discussed or where in your plans this will be put, but
18 somewhere it needs to be discussed and really put down how you would
19 assess radionuclides that are left on building surfaces in the timeframe
20 from 50 to 1,000 years.

21 And I think, in bringing this up now, my feeling is that
22 really the ground water pathway may be a very applicable and probably a
23 predominant pathway in looking at radiation doses to building rubble in
24 the future.

25 I was wondering if you could comment on that dose assessment
and where those issues may be discussed.

MR. EID: I believe the purpose of this workshop is ground
water modeling. In the regulation currently, we have a Federal Register
notice for the surface contamination levels for the most common
radionuclides, for beta and gamma; also, D&D screening test the release

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1 values or the limits that you could release a building.

2 In the EIS that supports the rule, there were analyses to
3 show that if you comply with the surface contamination criteria for the
4 building, if you comply with it, this means you are home free. You do
5 not need to do any further analysis.

6 So the ground water pathway, in this case, if you comply
7 with the surface contamination criteria, it does not apply. There is no
8 ground water pathway.

9 However, some licensees, they may propose they cannot meet
10 the criteria and they would like to rubble the concrete. This means the
11 scenario in this case is not any more a building kind of scenario. It
12 will be another kind of scenario, which the ground water pathway could
13 be an important pathway.

14 For that specific condition, where the licensee comes and
15 says I do not meet the criteria for the building scenario, this means we
16 may need to add this to the ground water pathway.

17 So for surface contamination, the licensee demonstrates
18 compliance with the surface contamination levels on the building
19 scenario, you do not need to issue a ground water pathway.

20 MR. ROBERTS: I guess it sounds like there's -- at some
21 times, you may need to assess it, and other times you may not. Is there
22 some way you could give guidance in your standard review plan on when
23 you would need to assess building rubble in the future, after a building
24 is put down, and when you would not have to assess it?

25 MR. EID: Again, if you meet the criteria, you do not need
to assess the ground water pathway. If you do not meet the criteria,
this means the scenario is not any more a building scenario, it would be
another kind of scenario, and we will provide more guidance on that.

MR. ROBERTS: Okay. And just for the record, what you just
said, I think, is contradictory to what was said in the last workshop.

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1 So I think -- I don't know. Maybe --

2 MR. EID: I do not recollect if we said something different.
3 We said always building scenario does not have a ground water pathway
4 and if you comply with the surface release criteria, this means you are
5 in compliance with the dose criteria.

6 But if you select to have -- if you have higher
7 concentrations and then you say I'm going to rubble the building and
8 then the scenario in this case will be different.

9 MR. EISENBERG: Norm Eisenberg. I just wanted to say
10 something left over from yesterday regarding some of the remarks from
11 Professor Neuman, regarding the need for 3-D modeling and site
12 characterization.

13 From a ground water hydrology point of view, I'm sure that's
14 something that is important, but the NRC staff is interested in
15 protecting public health and safety and having sufficient information to
16 make those kinds of regulatory decisions.

17 And I don't think the staff has any interest in requiring
18 the licensees to engage in any more site characterization or complex
19 modeling than is needed to prove the regulatory point.

20 Certainly, our screening code is a very simple code and can
21 be used for screening, unless site conditions rule out its use.

22 So we are quite willing to accept lesser forms of modeling
23 and site characterization. All we need is what you need to prove the
24 point.

25 MR. MEYER: Phil Meyer. Since Dr. Neuman is not here to
speak to that issue, I thought, since I have spent most of the week with
him, that I would just respond to that. And he can always take a look
at the record later and see if I represented him correctly.

If you recall his framework, working from a contextual
framework for the analysis of the site down through the actual

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1 quantitative numerical analysis of the problem, he pointed out that you
2 get down to a point where you're developing -- you've developed a
3 conceptual model of the site and you're preparing to translate that into
4 a mathematical and implement the mathematical model.

5 His assertion was that there was no reason not to represent
6 the site or conceive of the site in less than three dimensions, up to
7 the point where you are formulating your mathematical model.

8 From that point on, if you feel that it's justified to go to
9 2-D or a 1-D implementation of a model, then do so, but start from a
10 three-dimensional framework, since we know that the real world is three
11 dimensional, and then formulate it correctly. Formulate your 2-D or
12 your 1-D implementation in a manner that is consistent with that sort of
13 averaging.

14 MR. NICHOLSON: Any other comments?

15 MR. MEYER: Can I just finish up one? I just wanted to make
16 a point. He was not advocating that three-dimensional numerical
17 modeling is required at every site.

18 MR. EISENBERG: I think sometimes it was easy to conclude
19 that just from listening to him and I think we're not really that far
20 apart in what we're saying.

21 It's just a slightly different approach. You would go to a
22 certain point and make an assessment as to whether you needed 3-D
23 modeling. I think you need to look at the site and decide perhaps from
24 a minimal amount of site data whether you need to even get into that
25 game.

It's just a question of, I think, the sequencing.

MR. NICHOLSON: Any other comments?

[No response.]

MR. NICHOLSON: Okay. Before I turn it over to our last
closing remarks, I want to make a point of thanking Jack Parrott, Boby

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1 Eid, Mark Thaggart, Ralph Cady, and all the other people that helped out
2 from the NRC staff. I think it was a real team effort on the part of
3 both Research and Licensing and I really appreciate it.

4 With that, I would like to turn it over to John Greeves, the
5 Director of the Division of Waste Management in the Office of Nuclear
6 Materials Safety and Safeguards. John?

7 MR. GREEVES: Thank you. I know who's got the real stamina
8 now. Take the names of all these people.

9 MR. NICHOLSON: We have their pictures, as well as their
10 names.

11 MR. GREEVES: Wonderful. I want to -- I made some opening
12 remarks, with Tom King, and I'm sure Tom would like to be here. I don't
13 see him, but for both Tom and myself -- did Tom come back? Tom and I
14 agreed that whoever was here would convey comments from both of us.

15 So I want to thank all of the workshop participants for
16 helping to make this a successful workshop and exchanging your views. I
17 was able to sit through almost the better part of a day. So there were
18 some good exchanges, and we all profit from that approach.

19 The Licensing Office, that I represent, wants to thank the
20 staff of the Office of Research for helping organize and run this
21 workshop. Tom and I really appreciate the effort that you all have gone
22 through. I'm not going to go through all the names, because I'm sure
23 I'll forget somebody, and I don't want to do that. I think you
24 mentioned the main players yourself, Ralph Cady and others. So I really
25 thank you for doing that. It had all the markings of a successful
exchange.

ADN We especially appreciate the input and the data that you,
RIL the licensees, the stakeholders, provide and input to our deliberations,
EY to assist the staff in drafting the standard review plan. Those remarks
& I made during the first day in response to a question, well, how do we
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1 know what we can use; well, we need to write that in the standard review
2 plan and lots of the material that you're providing in these workshops
3 is the sort of thing that we can deliberate on, capture it, write it
4 into the standard review plan, saying this is what we're going to be
5 doing at the staff level.

6 So these inputs have been very valuable in past meetings and
7 those received during this meeting. They are quite valuable to all of
8 us.

9 One thing I want to emphasize, I was thinking about it, I
10 spent about a half a day yesterday and went back to the office, based on
11 some of the things I was listening to.

12 I don't agree with everything everybody said in the last two
13 days. I'm sure you don't either. But what's going on with the staff?
14 And this is our responsibility. We have to explain, present what our
15 vision is in decommissioning, and the two opening speakers, Bobby and
16 Mark, went through the process, talked about the NUREG-1549, that's a
17 good road map of how you walk through decommissioning, from simple to
18 complex.

19 It's what I call a graded approach. If you can get out
20 early with a simple approach, we want that to happen. We don't want to
21 spend scarce regulatory resources on cases that just don't warrant
22 additional work.

23 So whether you are able to work on the simple approaches or
24 you need to do a bit more complicated approach, some of these 3-D
25 models, it really is case-dependent. We use D&D, we use RESRAD. In
fact, we're investing in RESRAD. There are some enhancements we'd like
to see. I hope somebody mentioned that in the last two days. And
you're going to find that those are written into our standard review
plan.

And we don't want any particular licensee going to any

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1 length greater than necessary to demonstrate that you meet the rule.

2 There was a lot of discussion the last couple of days about
3 complicated approaches. The labs have tremendous resources to develop
4 these codes. I think that's useful. The context is good. The
5 experience is good. But there is not an expectation that the majority
6 of our licensees would have to approach that level of analysis. So
7 we're going to make that clear in the standard review plan.

8 And I think that sort of summarizes what I thought were the
9 important comments. With that, thank you all for coming.

10 MR. NICHOLSON: Thank you.

11 [Whereupon, at 4:15 p.m., the workshop was concluded.]
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