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NUCLEAR REGULATORY COMMISSION

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Friday, April 1, 1994

The Commission met in open session, pursuant to notice, at 10:00 a.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
E. GAIL de PLANQUE, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

JOHN HOYLE, Assistant Secretary

MARTIN MALSCH, Office of the General Counsel

JAMES TAYLOR, Executive Director for Operations

ROBERT BERNERO, Director, NMSS

JOHN GREEVES, Deputy Director, Division of Waste Management, NMSS

FRANK COSTANZI, Deputy Director, Division of Regulatory Applications, RES

MARGARET FEDERLINE, Chief, Performance Assessment and Hydrology Branch, NMSS

MICHAEL BELL, Chief, Engineering and Geosciences Branch, NMSS

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

10:00 a.m.

CHAIRMAN SELIN: Good morning, ladies and gentlemen.

This morning the Commission will receive a briefing from the staff on the status of the low-level radioactive waste performance assessment development plan. Before I got this document, I didn't even know what the words meant and now it's so clear I feel like I'm an expert. But I'm sure this discussion will disabuse me of such a notion. But it's really quite a good document, very clear and very interesting. So, my interest is quite whetted at what will be done and it's also very clear the staff has been extremely responsive to the original SRM and has kept up a long and difficult process with both perseverance and some ingenuity. So, we're very interested in hearing your report and the progress, the activities of the program, where it's going and how do we know when we're done.

Commissioners? You don't want to follow-up?

Mr. Taylor?

MR. TAYLOR: Good morning. As you may know, this effort in this area is a cross office

effort and therefore we have staff from both Research and NMSS here at the table this morning. Frank Costanzi from Research, Mike Bell, Bob Bernero, John Greeves and Margaret Federline from the Office of NMSS.

This is a timely briefing. First we believe there are some important products to talk about which will be described by staff this morning. And second, the planned reorganization within the Office of NMSS and the combination of the high-level waste and low-level waste performance assessment activities combining in a single branch within the Division of Waste Management also adds to the timeliness of this. Margaret will be in charge of the Performance Assessment Branch and this will be her field.

CHAIRMAN SELIN: I gather her dowry is one work station computer that the low-level waste folks have been dying to get.

MR. TAYLOR: Mr. Chairman, I can assure you her dowry is well taken care of. But we will sum up the accomplishments of what has been going on in this area under the previous organization also.

So, with those opening thoughts, John Greeves will commence the briefing.

MR. GREEVES: Good morning. Thank you.

(Slide) I'm going to start with chart 2. It's just an overview of the items that I'll be touching on during the briefing, some background material as to some of the interactions we've had in the past requesting this kind of work.

CHAIRMAN SELIN: John, I should tell you, levity aside, I am really serious about not just what the progress is but what the objectives are and how will we know when we've met these objectives? That wasn't in the paper and that is a part I hope you will discuss this morning.

MR. GREEVES: Yes.

CHAIRMAN SELIN: Okay. Fine.

MR. GREEVES: Okay. As I wanted to point out, the principal piece of the briefing is going to be the branch technical position and the test case. They're the real products as part of this process. We've learned some lessons in going through this process and I've got some of those outlined. We've got some ideas on how to develop this further, so that will be discussed in the additional guidance development. And, as you're aware, we've interacted with the other federal agencies in the states. So, I'll be going over some of that.

As a start, we figured we'd better try and define what performance assessment is. It means a lot of things to different people. Most people in the NRC business think in terms of probabilistic risk assessment initially where you're looking at a reactor and electrical and mechanical components. We don't really have those in the waste business. So, when we use the term "performance assessment," what we're looking at is basically a consequence analysis for a low-level waste disposal facility where you're burying waste material that essentially is a source of contaminants that could go off the site in a plume. You really have the same situation in uranium recovery facilities and a high-level waste facility. So, that's what we mean when we talk about performance assessment. For today's discussion, it's essentially the compliance with dose standards set up in the regulations. That's the target that we use in terms of evaluating particular sites. We're looking towards both the technical position and the test case to demonstrate how that is done.

MR. BERNERO: If I could interrupt for a moment, John. It's a very important point. Performance assessment is really the essential licensing evaluation. In low-level waste we speak

directly of compliance with dose standards. In high-level waste there is compliance with dose standards or release limit standards in the high-level waste 40 CFR 191. But the essential character of it is this is the heart of a licensing safety evaluation. How will the waste vary and how will the system perform over time with respect to impact on the biosphere, on the public?

MR. GREEVES: (Slide) Okay. I just put chart 4 in here to give you a perspective of the people involved. As Jim Taylor mentioned, it is a joint effort between NMSS and Research and I want to give a little credit to the people that have worked on this. They've done a lot of hard work. So, I just wanted to show that. We refer to them as the performance assessment working group and they've done a lot over the last two years, as you can see with the documents you received.

All right. Let me recall how all this started. Back in '91 there was a staff requirements memo that the Commission sent down to the staff asking for a program plan in this area, which was needed to describe that. It asked us to show how we were integrating the staff effort in with our technical assistance activities and look towards enhancing the

capabilities of the staff in this process, especially the in-house capabilities, which I'll be describing. How is this going to turn out to be guidance to people out in the agreement states, et cetera, and for us to focus on what are the key issues which you'll see as identified in the charts and question as to how are we coordinating with the DOE, EPA, the states, et cetera? What are the resources that are needed and what's the schedule for this process? So, that's the background.

There has been interactions with ACNW, as you're aware. They sent a letter to Commissioner Rogers back in '91 and so what came out of that was the first program plan in '92. We've updated that. You have a recent update with the paper that you just received. We also had a recent meeting with ACNW about a week ago where we basically spent a day on this topic.

So, with that, the goals of this process are to improve the performance assessment guidance that the staff does provide and there's a couple of different audiences for that. There are developers out there. How can they put together these pieces in terms of performance assessment? Then there's the regulators. How should they review a performance assessment when it comes in the door? So, with that,

we have put together what we think are acceptable approaches in how to do that process and also we've been integrating the research results into this process.

I can give you one example. There was a code that was developed for the high-level waste program back in the early '80s called NEFTRAN. It turns out that that's been the work force of this activity that we used in the test case and I'm quite pleased to see something that the government invested back in those time frames that we've been able to apply it and it's stood the test of time. So, it's a principal work horse and I see Margaret is also using it in the high-level waste program.

COMMISSIONER ROGERS: Excuse me. Before you drop that, I don't want to focus too much on that kind of an issue, but it seems to me that someplace along the way it would be helpful to hear about how it is that that code was developed in the first place and that later on you found a great utility for it, because I think it speaks to the whole issue of how do we prepare for the future in providing the kinds of tools that we'll need in the future through our research programs. You've just cited, it seems to me, an incident in which something was developed a few

years ago. I don't know what the utility of it was particularly at that time or what the motivation for its development, but it would be very interesting to see what the basis was on which that was started that later on we found -- it may have had immediate use right then, but it also seemed to have considerable use now.

So, without elaborating on that point, I personally would like to hear sometime just a little bit of a case study on any of the tools that were developed earlier that you found very useful in this process and what the impetus was for the development of those tools at the time because I think that may give us some guidance in the future with respect to how we view the importance of certain kinds of work.

DOCTOR COSTANZI: Mr. Commissioner, if I might, I think I can give you just a thumbnail sketch of NEFTRAN in particular. That code was developed in the early days of the waste management program in the Agency and it was developed in support of and in assistance to the development of 10 CFR Part 60. It was a high-level waste code. In recognizing what the EPA standard, at least what it was at that time, we thought it was going to look like and that it would require a performance demonstration which would be

essentially a calculation of expected performance of repository.

The code was originally developed to handle saturated media flow and saturated media in basalt, I believe. It was modified to handle low-level waste situations, which of course now is much shallower than the deep geologic repository. But it was originally a high-level waste code and it was developed to support development of 10 CFR Part 60.

MR. BERNERO: But again, the transport of waste as a function of time is the essential similarity in high-level waste or low-level waste.

COMMISSIONER ROGERS: Yes.

MR. GREEVES: What impressed me was it's withstood the test of time. People are using it for a long number of years. I understand there is a NEFTRAN 2 at this point. So, it has been updated. But it was the work force code in the test case which I'll be describing.

The other goal was to enhance the staff capability, and as you'll hear that was enhanced by the doing of the process, basically writing the BTP and running the test case at the same time.

Okay. As far as the phases of the program, remembering that it goes back to really

starting in '92, it was envisioned that there would be two phases. The first phase was to enhance that in-house capability and the strategy was to develop a branch technical position and to develop a test case which basically we describe as a wet test case, a humid environment. It was envisioned that phase 2 would augment that experience gained and we would look at a second test case which would be a dry environment.

It turns out that we feel that we should modify the program in terms of looking at selected SDMP sites. We are confronted with these large SDMP sites, some of which the licensee sees that it could be a cell type environment which in some ways looks like a low-level waste disposal facility and we believe that it would be far more payoff to look at selected SDMP sites instead of looking at the dry site. We'd look at real sites that had real payoff for the staff. So, that's our proposed modification of the phased approach.

As far as --

CHAIRMAN SELIN: I'm sorry, Mr. Greeves. Is that as a demonstration or eventually you just want this to be an operational tool so each time --

MR. GREEVES: It's an operational tool, as

I see it.

MR. BERNERO: Yes. On the larger, more complex decommissioning cases, I see it as a necessary part of the licensing performance appraisal of the site.

MR. GREEVES: I just couldn't see how we could afford to go off and do another mock-up case when we're really confronted with Commission decisions on these cases. So, we recommended that we modify the program and take advantage of it. I'll be describing some of that in the later slides.

Let me comment on the staff capability. There have been significant enhancements since the '91 time frame. It was proposed back in that time frame that we obtain these 486 PCs which were at that point in time an enhanced approach. As we all know, they're the standard within the NRC at the present time. It turns out that these 486 PCs were adequate to conduct the first test case that we did work on. We will be looking towards having the work stations. Margaret already has a number of those. So, I'm quite looking forward to the combination of the two divisions and we will have that enhanced capability. We feel that the mix of the 486s and the work stations would be quite appropriate for our needs.

Now I want to turn to the branch technical position. Let me recognize that this is a work product under development. It's a document. It's about 100 pages long and it is a draft and we have it out to our peer group for comments at the present time, like I'll be describing.

The next chart on 8, it's a little bit busy, but I wanted to put it in here to try and orient where we are in this process. Any of these activities you're talking about some sort of entombed waste. Some of them are quite complex and you've got a number of audiences that you need to speak to. When we met with ACNW, they did point out that we should in the document clarify which audience we're speaking to and various pieces of the document. There's also some things that are generic applications and others that are design specific. So, we would expect to improve upon the document as time passes.

Essentially when you look at this you're going through five different operations. You have to look at the infiltration, the water coming into the site. Then you need to consider do I have engineered barriers, how are they going to perform once the water gets into the disposal unit, how does it interact with source term and then eventually you have pathways

coming off of this disposal unit, either through the groundwater or out into the surface water or even through the air. Ultimately you get a dose demand. I'll be describing a fair amount of that in the test case. So, that's an outline of what you will find described in the branch technical position.

In the position, the staff identified the significant attributes of performance assessment. You first are looking for an iterative process and you need to document that process. We had a discussion with ACNW about site characterization. It's very important to use these tools as a feedback loop to ask yourself, "Do I have enough information? If I need more information, where is the payoff, where can I spend my money in terms of additional site characterization?" We got some comment that it wasn't clear enough in the document that that iteration was taking place and I think that's good constructive comment that we can take advantage of. Obviously the design is part of that also.

The position calls for a formal treatment of uncertainty. When we got into this we recognized that some things were complex enough that to really understand what's going on you really do need to use formal uncertainty techniques like Latin hypercube

sampling.

A point is you need a thorough understanding of the performance of the site. This helps you identify weaknesses where you might need additional information. And then finally the process should help you get in a position of reaching a defensible regulatory decision and ultimately you may find yourself in an adjudicatory hearing.

CHAIRMAN SELIN: I have three questions. I'd put them to you now, but they may be more appropriately answered later. One is what do the site designers use for their models? In other words, is there a model to build on or do we have to develop this from scratch? Or conversely, should they be using what we've developed? The second is a similar question of Department of Energy with their sites, and a third is what does EPA use in doing their standard setting?

MR. GREEVES: I might as well just have a go at it here. There's a whole host of models available out there. In fact, the staff has described those in their performance methodology documents which are in NUREGs. As far as what designers do, we have design staff ourself and they were some of the members of the team that you saw back there. Effectively what

you do is customize the set of models that you want to choose for the design that you have developed for your site. There's a number of them available out there and we selected the ones that were useful for our design and it's my understanding that other designers would select models that were useful for theirs.

I think a point that has to be made is that there are simple models and there are complex models. You can go through this process and if you can bound the conditions with a simple model and you can defend that and you can stay with a simple model. If you can't, you normally go to a more complex model and maybe some of the other people on the group here might want to add to this.

MR. BERNERO: I would just like to add, especially with respect to DOE and EPA, for the last couple of years we have had continuing interaction with DOE and EPA with respect to model selection and application for remedial action cases in particular. This would be the DOE environmental management group and EPA and particularly as it gets over toward Superfund and similar cases.

As John put it, there isn't really a standard model. There are many submodels that may or may not be applicable and there's a great deal of

controversy about how valid are some of the models. You know, many of them are more often used than others. So, there has been an intragovernmental activity to try to develop a better understanding and a better recognition of the better models that can be used.

CHAIRMAN SELIN: Will the position be a basis for this intergovernmental work?

MR. GREEVES: Let me point out that DOE has two groups, the performance assessment task team, which you'll see in the back, and the performance peer group. We have people on those, some of the staff members that are shown in the front participate in that process. They have -- the first group looks at performance assessment technology. They meet periodically, they come together, they talk about issues and they compare notes on what models they're using, what the time frame of interest are. So, that's one effort that we're involved with.

The second one is actually a review group. Apparently all the DOE sites, the waste sites, have to develop a performance assessment for their site, which comes to the second group and then the second group makes those comments on headquarters. Again, we are part of that in terms of we go to those meetings and

we gain access to all those performance assessment techniques. So, it's an iterative process that I think we take advantage of by participating.

MR. BERNERO: But we are not developing the master model for everyone else, nor are we sitting back and waiting for the intragovernmental process to develop a master model that's directly transferrable. This is one of those activities, substantial activity, to apply appropriate models to waste disposal situation. So, it's part of that collective effort. It's not the only part and it's not a passive part.

COMMISSIONER de PLANQUE: Assuming that in some of these cases there's more than one model that presumably can be used for the same thing, has there been any effort to directly compare the results of these models given some standard input?

MR. GREEVES: The staff is involved in an effort with IAEA where a site is described and I believe it's up to 18 nations are looking at this and looking at the site, looking at the source term. There isn't total agreement on what source term each nation is going to use, but they have agreed on the site. So, that's one example. The other is INTRAVAL, which is also in the notes, where I think it's 13 nations are looking at groundwater transport issues.

So, these types of efforts are ongoing where a number of countries are looking at the same site conditions and evaluating it, doing an intercomparison with their procedures.

COMMISSIONER de PLANQUE: Have any gotten to the stage where they actually have results so that you can see the level of agreement between two different models given exactly the same situation?

MR. GREEVES: I'd have to ask the staff that question. I'm not --

COMMISSIONER de PLANQUE: My bottom line question under this is what is the level of agreement given different models and especially when you're looking at the bottom line being dose compliance. What kinds of differences are we talking about and are they anywhere near in the ballpark of the levels that we're talking about for standards?

MR. THOMA: My name is John Thoma.

The international test case is not done. We've done a lot of work on it. When you get the group together, you're not even close on orders of magnitude on agreement as to what the bottom line dose is. But they're each used in their different standard. Now, in our work, we have looked at a bunch of codes and there's a couple of them through the

Office of Research that we've tasked saying, "Would you see how these codes compare?" But we have not done that across the board. But we're not developing brand new codes either. We're using off-the-shelf approved codes. The only code that "developed" is the integrated code that would take the output of one code and put it into another so we could do a systems model. We've only done that once using NEFTRAN as our main driver. We have not tried doing a series of codes.

COMMISSIONER de PLANQUE: Did I hear you say orders of magnitude differences between the --

MR. THOMA: The first time when the international group got together, but each nation is doing it in their own way.

COMMISSIONER de PLANQUE: Each one of whom thinks it's the best, right?

MS. FEDERLINE: Could I just add something about INTRAVAL? I think one of the biggest uses of these international intercomparisons is to point out differences. For instance, INTRAVAL in its second phase ran about 12 test cases where they actually took an experimental situation and everybody ran the same situation and then intercompared the results against the experimental results. Well, the codes were not

identical to the experimental results. Obviously there were difficulties. But I think the real advantages in this is to see where the weaknesses of the codes are, spacial differences, scaling differences. I know concerns that the Commission has brought up before. But it allows the groups who are involved in the test cases to improve their own codes in the particular areas where vulnerabilities are identified.

So, as I see it, it's not so much identifying the best codes, but identifying where weaknesses and vulnerabilities are so that they can go on and improve the codes within their own country systems.

COMMISSIONER de PLANQUE: I understand that. I think what comes to my mind is when we get down to setting levels, dose levels for compliance, how realistic are they in terms of how accurately any of these models would predict the situation.

MS. FEDERLINE: Right.

COMMISSIONER de PLANQUE: You didn't get all yours answered.

CHAIRMAN SELIN: I really didn't get the answer. Is DOE going to use this or are they going to use something else? Is there reason to use something

different? In other words, how robust is this?

MR. BERNERO: DOE is using different codes in different circumstances. EPA is doing the same thing, using different codes. There is some intragovernment coordination.

CHAIRMAN SELIN: That's got to be resolved. We can't have two federal agencies having basically a comparable situation and getting different answers.

MR. BERNERO: Yes. And I don't know what EPA is using in their forthcoming efforts on low-level waste.

MS. FEDERLINE: We shouldn't leave you with the impression that all codes are being used differently. For instance, RESRAD, I think, is used. That's a common code among the agencies. Really, I think where different codes are being used, many of these situations are very site specific. So, slight changes are made to codes to adopt --

CHAIRMAN SELIN: The question is do we, DOE and EPA get different answers for the same problem? That's a question that eventually you have to be able to answer.

MS. FEDERLINE: Well, I can only speak for high-level waste and we've looked at a variety of

performance assessments performed by DOE and contractors and ourselves and we are showing the same vulnerabilities. In other words, we are running slightly different codes, but we are showing sensitivities at the site to similar parameters. So, I think that's the important thing.

MR. BERNERO: Perhaps Fred Ross can give you the answer on the low-level waste.

MR. ROSS: Fred Ross, low-level waste management.

It's important to separate the codes from the models. No two low-level waste sites are going to be exactly alike. So, the models or the assumptions that you use in the modeling are going to be somewhat different for each site, which is going to affect the dose. You can't necessarily compare the doses from one site to another.

Then the codes are brought in as a way of computing or implementing the models. What, for example, DOE is doing and I think what we're trying to do in the guidance is focus on process of modeling so that there's justification for assumptions and consistency in assumptions between sites and then it's up to the developers or the people doing the performance assessments to find appropriate codes that

are relevant to those models. So, it's really -- it should be clear then, I think, that focusing on codes may not be a correct way to look at it. It's the modeling and the modeling assumptions and the processes that are recurring and the need to have some consistency. That's, in fact, what DOE is doing in their performance assessment task team. The task team is looking at all the PAs that are being done for the different sites and they're looking for consistency. They want to make sure that one site is looking at source term and making certain assumptions one way, that that's consistent with what another site is doing and that there's justification -- if there's differences, that there's a justification and a real reason for the differences and the differences aren't just simply the whim and whimsy, if you will.

COMMISSIONER ROGERS: Yes, but the ultimate question is what's the final results look like? I think the thing that we're all somewhat uncomfortable about as we listen to this is that the notion that there are different models that one might construct given a site, there's a site, whatever that site is and whatever it is is there, and one could adopt different models and in exploring those models one could adopt different codes. So, you've got this

hodgepodge of things that could possibly be brought to bear on coming up with a final result. The question that I would be interested in, and I suspect everybody is interested in, is you just turn loose the entitles that would do the whole thing, pick a model, pick a code and get a result, and just let them do it, how different are the final results when all is said and done?

CHAIRMAN SELIN: For one site.

COMMISSIONER ROGERS: For one site.

MR. ROSS: They potentially could be vastly different. There's no question about that. In IAEA, in the models we've used, the results vary all over the board. The reason -- it's not just in the computation, it's in a lot of the assumptions that people use in the models.

COMMISSIONER ROGERS: Yes, but that's the point, that when all is said and done who cares what the details were of how they did it if when all is said and done things integrate out to the same bottom line result? If there are orders of magnitude difference in the final results, that's a very disquieting situation.

MR. ROSS: That potentially could be and is. However, you'd have to look at the assumptions

and see which ones are more justifiable than others given the data that's available for the site.

CHAIRMAN SELIN: I don't want to spend too much on this, but there's a lot of work in here on internal consistency, and when other people are doing comparable things. Now, presumably DOE sites are somewhat different from ours. Their models are appropriate to stressing the characteristics of their sites. But when all is said and done, at some point we have to take a look with a test site, we apply our modeling and codes and they apply theirs and we get different results. What is that? That's part of a plausibility analysis.

MR. BERNERO: We have to root out the reasons for those differences.

CHAIRMAN SELIN: And maybe I'm just smarter than they are. That's always possible.

MR. BERNERO: No, or maybe modeling assumptions are skewed, whatever.

CHAIRMAN SELIN: But it's going to tell us something about the process and we need the external plausibility test as well as the internal consistency test that this paper talks about.

MR. TAYLOR: Yes. We agree.

COMMISSIONER ROGERS: And ultimately it

relates to what the uncertainty band is on what you can make a statement about. The technical experts who want to go in and find out, "Well, just how did you make a particular decision," but from our point of view what's the uncertainty in any of these? We can be perfectly consistent in how we do things, but somebody else can be perfectly consistent and the results are wildly different. How do you deal with that? That's like two people doing an experiment, getting vastly different numbers, each of them with very small error bars that don't overlap on the two numbers. What do you do with that? That's the kind of a situation that sounds to me like we're dealing with here.

COMMISSIONER de PLANQUE: I wouldn't be critical of where we are in studying the models because I realize this is an extremely sophisticated complex problem and we're probably not going to solve it accurately in any of our lifetimes, if ever. I think the bottom line here is make use of that knowledge when we get into the regulatory framework and the standard-setting framework so that the numbers that we use and how we qualify those things is realistic with respect to what we actually know about the validity and the accuracy of these models.

MR. TAYLOR: Of course we're at the draft of the staff or branch technical position and then the validity of that we hope others will test too in all that we do in the process. So, I think there's a lot of work beyond where we are, where we would welcome others internationally or even sister agencies coming in and saying -- critiquing the position that NRC takes.

CHAIRMAN SELIN: You'll see how that comes out when you do the validation. But normally you would expect that if we develop the model for the kind of low-level facilities we deal with and DOE for the kind they deal with, that the differences in the models wouldn't be that they would produce vastly different results, but there's might be very inefficient for our kind of facility or vice versa. In other words, it's where do you approximate and where do you calculate, not so much if the results are far off or the same physical thing like modeling. Then you should have some --

MR. TAYLOR: I think we'll leave here understanding the Commission's concern because you are right. If the results are vastly different, then what is the reason and what are the reasons?

COMMISSIONER ROGERS: Yes. That's

important, but ultimately I think Commissioner de Planque's point is very fundamental. That is what is the state of knowledge here in this whole field of activity? If regulators are saying, "Well, you know, you've got to meet a certain standard within certain limits and an agency can construct a model and use computer codes that show that they, in fact, satisfy that, but somebody else comes in with equally plausible models and equally defensible computer codes and finds a very different result, what do you do with that? It sounds to me like the regulation has to be in tune with the state of knowledge. That's what we have to be concerned about.

CHAIRMAN SELIN: What I hear you saying is we don't know yet the answer to those questions. We have work to do on the internal consistency of our own work before we're ready to do the validation and I think you ought to just --

MR. BERNERO: I would just say that validation and verification is the essential problem with modeling long-term behavior of material in transport. The state-of-the-art is such that when you're talking about a short time horizon, a few years of transport, that's readily validated and verified by experimental programs or just groundwater monitoring.

The state-of-the-art is pretty good there. But where you really get into difficulties is as the time horizon goes out and in high-level waste, of course, it's taken as a matter of course that people go to natural analogues and other techniques to try to get some sort of experimental basis. But in low-level waste, you get into those long time horizons as well and you'll see that shortly, and the question of a very long time horizon where the state of knowledge is just not as good, and this is an essential difficulty of modeling the transport and the impact on human kind of waste transport. That's why it's so important for us to do work ourselves, to have the staff capability to make a regulatory judgment because the state of knowledge is not good for the long horizon.

MR. GREEVES: Okay. I'll look forward to saying more from the IAEA test case and we can narrow these over time. It does take time to do that. Also, I think we'll get a chance to look at these at some of the selected sites that we're going to work on because there will be others looking at them too and obviously we'll be talking to each other about, "Licensee, what were your results? Here are ours. Let's match them up and see where we are." We would also be doing that

for the site characterization process of some of these sites. So, there's much to be done.

COMMISSIONER de PLANQUE: Do you have any idea yet when the IAEA program will yield some results?

MR. GREEVES: I'd have to ask John Thoma.

COMMISSIONER de PLANQUE: Ballpark.

MR. GREEVES: A couple of years.

MR. THOMA: A couple years, ballpark answer on that. There's a lot of discussion going on and when you get the groups together they have to go back and work it out amongst their own internal groups before the next group gets together. In fact, we have another meeting with them at the end of this month to figure out where we are where's the next step.

MR. GREEVES: I guess I'd point out it's typical to find broad variations in results early on in our process. So, I'd look forward to the IAEA study to narrow within a couple of years.

Okay. See if we can move past that chart.

(Slide) The next chart is a busy slide and I really just put it in here to identify the two audiences that the branch technical position is speaking to. Above the dashed line it's addressed to the developer or the applicant. He's the one that's

doing this iterative study here in terms of modeling and site characterization and this portrays the type of work that he would have to be doing.

Below the dashed line is where the regulator in fact now gets that application and on an audit basis does his own independent checks of those activities.

MR. BELL: John, I think this chart is very relevant to the discussion we were just having. Basically the position we're at is we've just made the first pass in all these model comparison efforts through this left-hand side of the chart and we're at this decision box and the answer is is this first pass of all these models that have been done adequate? The answer is no. People are going to have to go back around through this loop, look at the data, how it was interpreted, the assumptions they made and perhaps make several iterations through here before we get to the point where the Chairman was trying to get to when we get down below the dashed line, is there sufficient agreement between all the parties that we can make a confident licensing decision?

MR. GREEVES: Yes. There's a number of passes. The applicant would have to run through that before he would even submit an application.

COMMISSIONER REMICK: Who is the contractor that we're using to do our modeling and integrating the models?

MR. GREEVES: The staff integrated the model in this case. They put together a systems model that included the NEFTRAN code, for example. We do have contractors working with the staff on this, but the staff --

COMMISSIONER REMICK: Who are those contractors?

MR. GREEVES: It's Sandia, PNL, Brookhaven National Lab and Oakridge National Lab. I may have left out one or two, but that's the spectrum of contractors working with us.

Okay. Next I want to describe the test case. The test case was intended to give an example of how to follow the branch technical position. The purpose of running the test case was to develop staff capability. As Bob Bernero mentioned, doing performance assessment is the essential licensing decision, whether you're talking about low-level waste, high-level waste or looking at a specific, for example, SDMP site. You've got entombed waste there. So, in our view, you need to have that capability in-house to a large extent. So, we wanted to test doing

that with this particular case.

The test case, second, also gives you some insight into regulatory issues that face you, for example the time frame question which we're going to get to in a later slide.

The third, it gives you an opportunity to examine the consequences from various different conceptual models that you would need to evaluate.

Fourth, we felt that the test case was an opportunity to test the feasibility of the approach that we put in the branch technical position. It turns out that it was good for us to be developing a BTP and the test case at the same time. They fed each other in the process. So, it was quite good to do them concurrently.

As far as a problem statement of the test case that we developed, as I mentioned we did put together a systems model and the issue was to understand what the peak doses are to the general public and the mechanisms that you could get those doses are through the groundwater, the surface water and the air and all of these pathways were evaluated in the test case.

(Slide) The next chart again is a little busy. I just put it in here to describe that the DTP

was demonstrated with this test case. We wanted to do some trial runs. We chose a combination of a southeast wet site with a hypothetical design that our design group put together, a concrete design, and we selected the source term from the Hanford waste disposal activity. So, we put these together in a combined set to run the test case.

(Slide) The next chart is just in here to give you a little perspective of the design that the staff selected. These are modular concrete vaults. You can see it's about 5,000 feet on one side, 3,000 plus a little bit on another. Typically designers put the higher activity BC waste in the center and the A activity vaults on the outside. What's important in a setup like this is which direction is the groundwater flowing? It's flowing off to the right of the paper. And at this point where do you put a well that somebody may construct and show here? So, just to give you a perspective of what we chose for a realistic test case.

(Slide) The next chart, this is just a piece of the test case and the key in any of these waste disposal sites is to follow the water. Effectively the design that the staff came up with was a series of layers at the top of things like sand and

gravel. They put in a geotechnical membrane that is typical for sites like this that people are incorporating in disposal sites of all kinds. They put in a clay layer to try and shed the water. They put in what's called a capillary barrier to try and -- the point is to divert the water away from the vault. Then you do end up with the concrete vault.

They came up with a case where there was 29 years of data, weather data available for a wet site. What you end up with is about 40 some inches of rain each year. It ends up that you can get about 17 inches of that rain going down through the area of interest.

We looked at the degradation process of these barriers over time. We did not assume that they failed in a particular time. We gave them a degradation process. The staff was confident in this case that the barriers could be relied on for about 500 years. We did look at full uncertainty within these time frames in terms of variation if infiltration, the hydrologic parameters and this was a fairly complex test case. Once you moved out of this arena, would you step into a source term analysis and a pathway analysis. It would involve similar uncertainties.

COMMISSIONER ROGERS: That 500 years, was that just for everything except the concrete vault or did that include the vault?

MR. GREEVES: It included the concrete vault. It really worked as a system. And, you know, there are views as to how long you can rely on these things and in this test case the staff's position was that we can defend it out to 500 years, which becomes important. You can get rid of a lot of the nuclides if you can contain them for 500 years.

COMMISSIONER REMICK: Were the assumptions that the vaults were above ground covered or below ground covered?

MR. GREEVES: This was basically an earth mounded concrete bunker, so it's below ground. These are soil type layers above it.

COMMISSIONER REMICK: Probably one of the worst cases, except for deterioration of the barriers.

MR. GREEVES: It has advantages in terms of, if you're thinking of an above ground vault, you don't have the advantage of these clay layers over top of it.

COMMISSIONER REMICK: No, I'm thinking earth covered above ground. Earth covered above normal ground level is what I'm talking about.

MR. GREEVES: Correct. Each of them have advantages.

COMMISSIONER REMICK: Especially where you have heavy rainfall on saturated earth, I would assume. But, assuming that, below ground would be one of the worst cases.

How about the facilities like Centre de l'aube and el Cabrill, which are vaults above ground but which will be earth covered?

MR. GREEVES: This is essentially -- it looks somewhat like those. These are vaults that, you know, are open during the construction phase. You put the waste in and you build this layer on top of it after you close it up.

Bob?

MR. BERNERO: Yes. If you go back to slide 8, that's a cartoon depiction that is generally like the French sites in that you're above the water table and you have a mound over it with the dual barrier.

COMMISSIONER REMICK: I agree with that, but in those cases at least you're above the normal ground level so the chance of water coming down has a great chance of running off to the side of the storage field, in contrast to the case where you have those

same vaults under the surface and you have rainfall and you have saturated earth conditions, and I'm wondering which you assume. Do you assume they were down in the normal -- below the surface of the normal earth at that point?

MR. BELL: The test case is below grade. It turns out that whatever water does percolate between the vaults ends up helping you, in fact, as you go out, because it's water that's available to mix with the contaminated plumes and that's all taken into account in the uncertainty analysis of the process.

COMMISSIONER REMICK: The point I was trying to make, flux within the vaults themselves in general I would assume would be less when the vaults are above the normal surface of the earth, ground covered barriers and all that, and comparing that with a case where the vaults are below the normal surface of the earth where water there might stay there longer, and so it seems like the flux into the concrete vaults would be greater in one case than the other.

MR. BERNERO: It's a continuum.

MR. GREEVES: I think you're carrying this into another case that we didn't look at at this point.

COMMISSIONER REMICK: Just trying to find out which case you were looking at.

MR. GREEVES: (Slide) I think if you look at the next slide it might be a little bit clearer. I put this slide in to just give the full picture that, you know, you do have to consider that infiltration. Eventually you get through an engineered barrier to a source term and you start the transport process of a plume coming off of the bottom. Actually, it goes down below the vault through the Vados zone and then contacts the water table and these show stream tubes which are plumes coming off and you can envision a well off to the right of this chart where the well is actually mixing the contaminated plumes with the fresh water. And you could also consider somebody out in surface water eating fish out of surface water environments, et cetera. These all were looked at in the test case.

Like I said, we spent a day going through all this with the ACNW and we needed the full day to go through and describe all this.

COMMISSIONER REMICK: We've followed up enough on my hypothesis.

Have you reached a point of knowing whether it might be better to limit the number of

vaults at one immediate location and, as you say, arbitrarily 12 at one location and have another 12 slightly removed from that rather than having 24 all together?

MR. GREEVES: I believe you could find that out using these techniques. You could also find out that you need to limit the inventory that a particular site might take, which I think is a more real question, if you find that some of the long-lived nuclides are causing you trouble out beyond 10,000 years. You may put an inventory limit, which is provided for in Part 61.

COMMISSIONER REMICK: No, I was thinking more of the infiltration into the vaults themselves, if there was an advantage of not having a large group of vaults together and therefore having a much bigger mound.

MR. GREEVES: I would call that "optimization of design," and that is one of the techniques you should be doing in this process which is identified in the technical position.

(Slide) Okay. I just thought it might be useful to give you one example of some of the lessons learned as you go through a process like this. The diagram shows the results of some runs with time going

out in years and then dose consequences on the vertical axis.

One of the things that people are faced with as they go through this process is, what do I take advantage of in terms of my defense of this particular site? Some might say, well, I've got all this concrete sitting there. It's obviously going to do something chemically to the environment. It turns out that it does buffer the environment.

One designer or applicant may say, well, I don't want to take any credit for it, and you end up with the triangles, so that's the run you get without consideration of the chemical buffering of just the chemistry of having all that concrete in the environment.

If you take a look at some of the things you might be able to achieve just by taking into account the chemical aspects of that material, you can see the second run there which is a little bit busy on this chart but it's significantly lower in terms of the dose result. So, this is one of the things that you could glean in going through this process and take advantage of and use as part of a defensible process.

In many cases, people don't take advantage of things. For example, the geotextile that I

mentioned, most people don't take advantage of that in their analysis but they put it in because they know it will help.

COMMISSIONER ROGERS: Well, now, just before you leave this, I'm going to ask the same question. What about the 500 years? If the vault is going to have faults in it or -- I don't know what you assumed, after 500 years or sometime around 500 years, that looks like a very critical time here.

MR. BERNERO: A factor of five or something like that, five or even ten.

MR. GREEVES: The applicant would be there and we do recognize the vault deteriorates. We degrade its properties over time, but the chemical constituents are still there. The calcium is still there that is buffering the environment, and this is essentially what you'd have to come to the hearing and defend. I show this as an example of what you may want to take into account. You would have to defend that that chemical material, that buffering material, either the concrete or something else that you would place there would be in place for a long period of time. If you stick with natural materials, you probably stand a pretty good chance.

COMMISSIONER REMICK: Is there any

explanation for why the curve increases out at 8,000 years or so?

MR. BERNERO: Daughters, in general. In fact, this is a significant question. You get isotopic ingrowth with time and it raises questions about what sort of source term you have for uranium and thorium and the natural isotopes with very long half-lives that may not be an equilibrium.

From a regulatory point of view, if you go back, the environmental impact statement for Part 61 did look at the very long time horizon. But in contrast to high-level waste, there is no explicit time horizon in low-level waste other than intruder dose and relying on societal protection for 100 years and things like that.

But this is what I would view as something of a regulatory uncertainty. Not only what causes this but is it significant. In the regulation of waste disposal, we as a nation have adopted relatively different standards for uranium mill tailings, for low-level waste, for decommissioning residues and for high-level waste now, and all with respect to the time horizon, whether or not humans might intrude and what the criteria area. So --

COMMISSIONER REMICK: The source term

assumption here that would cause the daughters to build in --

MR. BELL: Low-level waste sites typically receive uranium and thorium not in equilibrium with their daughters. So, mainly what you're saying here is radium is starting to --

MR. GREEVES: Okay. As far as some of the results and the issues that presented themselves from the test case observations, the dose is most sensitive to flux through the vault as described earlier and it does turn out that that engineered cover is important. So, it is important to determine how far you could rely on something like that and also the solubility and retardation of critical nuclides is one of the important issues.

Some other observations of importance are that if you could contain those radionuclides for the first 500 years, you have done yourself a lot of good. So, I felt that the test case where the staff felt confident that they could look out to 500 years was a useful piece of work. The question that Commissioner Remick raised, what's important as you go out, iodine-129, technetium-99 pop out and also chlorine-36 depending on an inventory of a particular compact if they had that type of material.

We talked about the ingrowth of daughter products. You've got the uranium situation if you have large inventories which would affect the radon gas situation.

Bob?

MR. BERNERO: I'd just like to interject with a pet subject here. Iodine-129 is conspicuous on this chart as one of the lingering concerns. It's interesting. Recently Margaret Federline and I had a chance to discuss this with the French regulators and the Sulane or Centre de l'aube has some kind of an observation constraint as they go forward, concern about inventory of I-129. This is a chronic problem in everyone's low-level waste disposal because in the first place you don't have a solid inventory measurement and you are adding less than numbers up and getting 2,000 less than X becomes 2,000X, which is a problem.

The other is iodine-129 can be measured, but it has, of course, this enormous half-life. I think there can be serious reconsideration of iodine-129, is it really an appropriate regulatory concern. I just wanted to bring that up.

MR. GREEVES: Let me add that we have a topic report under review that is addressing this

question of are we over estimating the iodine-129 inventory. So, in parallel, we're looking at that and we look forward to the results of that.

MR. BERNERO: And notice that the isotopes of important observation here are all isotopes with very long half-lives.

MR. GREEVES: Okay. Just moving along, just picking a couple of others, let me take the one in the middle, the air dose. This is an example of where you can do a deterministic approach. What the staff did was take the entire inventory of the gases coming off of this particular facility, the carbon-14, the krypton-85, the tritium, et cetera, and they released it all in one year and determined that you wouldn't have a problem. So, this is an example where you could use a simplified approach to come up with a deterministic answer, even at the same site.

I pointed out the chemical buffering question in that earlier example, so I'm not going to spend anymore time on that.

COMMISSIONER REMICK: Why do we assume that buffering is always a good thing that it locks up? Would there be any circumstances under which it would not have an impact?

MR. GREEVES: There are. If you use

chelating agents associated with the waste coming out, they will in fact speed up the process and that's something the developer would have to take into consideration in his analysis and that's something the regulator would have to be asking the appropriate set of questions of the developer, "Did you account for all these chelating agents in your waste inventory?" They will accelerate, in fact, the material getting out.

MR. BERNERO: And recall the chelating agents are used in decontamination procedures.

COMMISSIONER REMICK: Yes. Yes.

MR. BERNERO: You know, cleaning machinery and things like that.

MR. GREEVES: Okay. As far as the technical and policy issues that we came up with, there's these five that you can see on this chart. The one that raises to everybody's top of the list is the question of the time frame. We had a fair amount of discussion with the ACNW on this one and so we'd look forward to fleshing this one out.

COMMISSIONER ROGERS: Could you just say a little bit on what that means? Are you talking about orders of magnitude extension out beyond 10,000 years? What's the time frame for the issues there,

very long-term, very short-term?

MR. GREEVES: Let me frame it this way. Most people think in terms of the 10,000 year number. However, some think that's too long, that there are so many uncertainties associated with 10,000 years we're kidding ourselves if we do calculations out there, and others say, "Oh, no, we've got to go out to a million years." So, there's a fair amount of debate about where this happens. Frankly, I think we need to tell -- provide the guidance to the developers and their regulators as to what we think the right piece is here. Presently in the position it says, "Look out to 10,000 years, run your numbers to 10,000 years and look for peaks beyond that." The document at the present time isn't real clear about what you do beyond 10,000 years and I think that's something that we may very well want to run by you and make sure we get that pinned down as a policy issue.

COMMISSIONER REMICK: How does that conform with what I believe is the EPA approach in the hazardous and toxic waste area with infinite half-lives of 30 years?

MR. GREEVES: I have trouble explaining that one.

MR. BERNERO: I think you have to

recognize that the 30 years comes out in the application. In the hazardous waste regulations and the laws, the statutes, I think EPA is tied much more to 10,000 years than they are to 30 years. It's the application and the choice of maintainable dual liners, leachate collection systems, features that require durability or maintenance to be assured of durability. It's an application.

COMMISSIONER REMICK: But the engineered volt system we're talking about has all those same things and perhaps even more.

MR. BERNERO: Yes.

COMMISSIONER REMICK: I don't understand what you mean by the applications versus --

MR. BERNERO: Well, there is at least a paper trail in hazardous waste regulation by EPA that has no migration for 10,000 years and things like that. But in the application, in an actual Superfund site or something like that, one finds dispositions that are required and approved of, "You've got to have a dual liner and a leachate collection system and monitor it for 30 years and endow a surveillance and corrective action program and these are details of implementation that, quite frankly, are not consistent with that time horizon. But that's the fact of what's

out there.

MR. GREEVES: The second item on this list is treatment of uncertainty. Some people agree with the approach of using formal uncertainty techniques, some don't. We feel comfortable with it where it's warranted.

I talked about the role of engineered barriers and, as I said, we feel comfortable with at least the test case we went through, relying on them for about 500 years.

Another issue is the role of the site and the considerations of these processes out in time. Do you consider global climate changes and one of the things that ACNW pointed out to us was that we said beyond 10,000 years, don't consider that, and they said, "We didn't give an example to defend that." So, we need to punch up the branch technical position and provide a little bit more basis for some of the things that are in it.

The last one is the role of performance assessment during the operation and closure. It seems that most people do agree that this is a technique that should continue to be used beyond the licensing phase. You should use it for the operational and the closure phase to help you in any decisions you might

be making then.

As far as where do we go from here, we've sent the branch technical position out to the various federal agencies, including DOE and EPA. Our sited and host states have copies of it for comments. We have received some early comments from DOE, USGS, EPA and the State of New York. We're also getting comments from some of our contractors. We're still awaiting some comments from the states, although Nebraska's just did come in this week and we expect to begin a formal evaluation of that set of comments in April. We look forward to a workshop over the summer for public comment on the document and resolving any policy issues that come out of this process and ultimately to revise the branch technical position.

As far as interactions with people, we've got a number of mechanisms where we get together with the agreement states. They on occasion do ask for technical assistance in this area and others. We do an annual training session. State programs has run this in the past. It usually occurs in July and we've also had specific sessions with the State of Nebraska, North Carolina and Pennsylvania on this particular topic.

As far as other vehicles, we do

participate in the meetings that I think the Commission is familiar with, the low-level waste forum where the policy makers come to it. We come and give them presentations on technical topics such as this. We also participate in what's called the technical coordinating committee. That's a vehicle where the developers get together and share ideas. We go to those meetings and keep them posted on where we are in developing our guidance process.

(Slide) Next page.

We do end up getting invitations to things like the waste management meeting of the particular year. We were out at the waste management '94 meeting and we did present papers on both the branch technical position and the test case. We also chaired the session on performance assessment.

We have already talked about a number of interactions we have ongoing with the DOE program and the various committees that they have set up. It does give us a real opportunity to get copies of what they're doing and I find it's a valuable tool for us.

Internationally, we've talked earlier about the IAEA test case and I think we all look forward to some results from that within a year or two. I would mention the INTRAVAL project and also

would point out that the staff does, on occasion, get a chance to get over. We visited with the French, the Spanish and the German government over about the past year.

As far as resources, they are laid out in the paper. We've been putting in about four FTE within the program office and Research has been running anywhere from 2 to 2.8 with some associated technical assistance dollars. As I mentioned earlier, we're going to look for splitting the program office effort and we will continue to have application of this with select SDMP sites. So, this subject will move around a little bit, but it's basically about a level of 4 FTE associated with continuing to develop these techniques, hopefully on case work.

COMMISSIONER REMICK: John, you indicated that those contracts are -- I think you mentioned four DOE labs.

MR. GREEVES: Yes.

COMMISSIONER REMICK: What's the probability that DOE is using those same labs for their modeling and so forth, which would not be a problem in this area? But my point is maybe there's a chance for some commonality of approach through using similar contractors since those are DOE labs.

Do we know who DOE is using for their modeling and product development?

MR. GREEVES: Well, each DOE site has its own disposal program and its own performance assessment program for their sites. In some cases, the same groups that are doing the performance assessment of the DOE sites are also the contractors on our work, but not in every case. But they are basically at the same facility. They're aware of what each other are doing and they do communicate. I think one of the things I didn't mention before, I just didn't find a way to put it into the discussions that were going on, is some of the codes, the subsystem codes that we're using in the total systems analysis are, in fact, DOE developed codes or the same codes that they were using at their sites.

COMMISSIONER REMICK: Okay.

COMMISSIONER ROGERS: Before we leave this resources page, just a question about how realistic our '94 budget is. In light of the original budget estimate for '93 for contracts in NMSS was 500K and we spent 678 and now we're talking about going down to 337, what -- was whatever led to the necessity for that additional 178K expenditure for contracts in NMSS, is that all over with? I mean is that apt to

recur in some way?

MR. GREEVES: Yes. Commissioner Rogers, it's somewhat misleading just to look at the budget figures for a particular year because actually what happened is some of the work, some of the money spent with '93 dollars actually forward funded some of the '94 work. So, it's not dropping in half the way it looks like.

COMMISSIONER ROGERS: Okay.

COMMISSIONER de PLANQUE: It depends on which model you use, right?

MR. BERNERO: No year money.

COMMISSIONER ROGERS: Or computer program.

COMMISSIONER de PLANQUE: Yes.

MR. GREEVES: Well, in summary, the staff, I think, has made significant progress with these two principal products being the branch technical position and the test case. There's additional extensive effort in progress. We have been able to identify a number of issues going through this. In fact, a lot of these are contained in the user need letter that we recently sent over to Research in this program area. As we've described, we're making some mid-course corrections. We will be looking at selected SDMP sites and I expect that we'll be back with the program

documents and briefings in the future and tell you about any other mid-course corrections that we think are needed as the program goes along. It's a living program and I wouldn't be surprised with some future corrections.

So that's the end of the presentation.

CHAIRMAN SELIN: Commissioner Rogers?

COMMISSIONER ROGERS: Well, let me say that I really think this is a wonderful piece of work, that everything I've seen and heard about both at presentations at conferences and the summaries that you've given us today I think indicate that this is a very fine professional integration of several of our efforts at NRC. I think that the team that involved both Research and NMSS is, to my knowledge, worked very well together and very effectively. That may serve as a very good model for other things that we may want to do in the future.

I really want to commend everybody associated with the effort because I think it's really been first rate, despite some of the problems that I expressed some concern about because I think they're just there and that's the real world. But with respect to the effort that we are putting in here, I think it's been very, very good. I really want to

commend the staff for all aspects of this. In my opinion it's been a very fine piece of work.

I also think that your moving to start to immediately apply this, the techniques that you've been developing here to the SDMP sites is a very wise move. I think it's very important to start to begin to show results from research efforts. This is not just research, but a lot of it has had its start in research to actual regulatory issues that have to be dealt with in a timely way. I think it's very important that in doing that though that we don't let any of those become little mini-research projects in their own that somehow spin out. I think it's very important to keep that process very much under control so that we can continue to make -- to close out these SDMP sites in as rapid a way as we feel comfortable with from a safety and professional point of view. But I just wanted to say that I thought the work has been very good.

Some questions though. Have you identified any particular areas in which there is additional research that needs to be contemplated beyond what we may have touched on here today with respect to V and V issues, I guess, in models and codes?

MR. BELL: Commissioners Rogers, one of the results of the process that the interoffice group has just gone through in developing these performance assessment models was that we almost simultaneously were preparing the test case and the VTP updated our NMSS office user need letter to the Office of Research. It identifies a number of areas where we, because of things we've learned in doing the test case and developing the BTP, we're asking Research to either help us improve some of the models or some of the source term information or some of the assumptions that we had to make about the performance of engineered barriers in the models. I think the two go very well together and compliment each other. If the Commission is interested, the staff can provide copies of the user need letter.

COMMISSIONER ROGERS: I'd like to see it, yes. I think the other Commissioners might be as well.

I also just didn't touch on it, but I thought that you mentioned early on that in developing the branch technical position together with the model analysis was really very helpful. It seemed to me that's absolutely the right way to go. To do the branch technical position before you had some

assessment of your own capabilities and to be able to put this in a -- put the technical position in a realistic framework is really -- you wouldn't want to get it turned around the other way, in my view. I think that it's probably a lesson for us to learn as to how to proceed when we can. Now, sometimes events don't allow you to do things the right way, but it sounds to me like it was absolutely the right way to go.

But in carrying out your activities, looking at your own capabilities for performance assessment and talking with the states, I wonder what your impressions are of the ability of the states to conduct this kind of performance assessment for their own sites? It looks to me like it's gotten to be a very sophisticated technical and challenging -- very interesting challenging activity. I think we're just breaking into it, it seems to me, from a professional point of view, that we've sort of talked around a lot of these things in bits and pieces and now you're talking about an integrated program here that looks at the whole thing, which is very challenging to carry out and we know that some state agencies have very minimal numbers of staff members that could be turned loose on something like this. Of course, they may

have to do it through contractors and so on.

But I wonder if you have any general comments about the ability of the states to manage performance assessment so that they can, in fact, answer the kinds of questions that we've been raising here?

MR. BERNERO: Do you want to do it? Let me.

This is a very sensitive point because it --

COMMISSIONER ROGERS: Oh, I know it is.

MR. BERNERO: In the development side of the state, you know the state can marshall the resources by calling on contractors and other assets. In the development of a performance assessment capability, in order to develop a site, you recall that one chart with the dotted line that said, "This is what the developer does," and then the regulator comes to audit. As far as the regulatory arm of a state is concerned, it's almost impossible for an average sized agreement state to have at their disposal the regulatory resources to do a truly independent assessment, which is what we're trying to do.

So, I view it as an essential capability

for the NRC and perhaps -- I won't use the word "essential." I'll say an important asset through the workshop process and training process that we can share with agreement state regulators. They have to license. They need a sense of reality to be able to make a regulatory decision. The performance assessment I have before me is a legitimate, valid, robust performance assessment and it's very difficult for them to fund it on their own resources.

So, I think it's very important that the NRC not only have the capability for its own, but be able to share that through the technical assistance process.

COMMISSIONER ROGERS: That's all I have. Thank you very much.

COMMISSIONER REMICK: I'd just say that I thought both the paper and the discussion today was a good one. I'll withhold some of my compliments because I don't know quite what the end result is yet, but I will give you compliments on the process that you obviously have underway. The direction you are heading, and I agree on the SDMP, is a good specific example, and also on your enthusiasm.

When I came in today, one question I had was couldn't this supply the high-level waste, but you

immediately answered that. You are actually using some information from the high-level waste area in the low-level waste and I compliment you on that. I think it's all the more reason why the combination of low-level, high-level makes some good sense.

I'm also very pleased to know that you have 486 PCs, that you're using them, that you're going to be getting work stations and of staff involvement. It's obvious to me, or appears to be anyhow, that you're on top of it. We have to use contractors, but it appears that you're very much involved in it and that's probably because we have some of the tools like your own PCs and things like that that you can become involved.

So, all in all, I'm quite pleased. I wish you the very best, but I'll look forward to the end result being a very -- as I agree with Commissioner de Planque, a very complex and not -- it's a very difficult area and not an exact science in all areas. So, we have to keep that in mind once again on believing bottom line numbers.

COMMISSIONER de PLANQUE: Well, I'm just going to say some of the same things. I think you're doing some excellent work here.

The problems clearly are very complex and

I'm particularly pleased at the extent of interaction that you're having with other groups, not only within the United States, but internationally. I think that's critical, because everybody is facing the same issues, and I would just once more reiterate that you have to provide the reality check for those who are actually setting or proposing dose limits in the sense that they have to match, they have to be realistic knowing the state of the art and what the limitations are, especially with respect to validity, uncertainty and accuracy with which all of these estimates can be derived.

But I would thank you very much. It's been very good.

CHAIRMAN SELIN: I have a question, which is the first question. When do you get to the point where you feel sort of comfortable that we're now into maintenance as opposed to development? How much will we have spent by then? And what happens to the program?

MR. BELL: I'd like to take a shot at answering both the questions or maybe all three of the questions.

You asked what were the objectives, and I think maybe it became clear from the discussion. The

objectives are to develop the capability to independently review an applicant's assessment of compliance with the 10 CFR Part 61 dose objectives, and in fact to independently review applicants' plans with other dose standards as well, since we're now thinking about applying this to the decommissioning program, and also to document it in a way that's going to be useful to the applicants to prepare applications and to the agreement state regulatory agencies who have to review their own applications. So, that was one of the questions you asked.

And the second, how do we know when we're done, well, I don't think the staff of this agency can ever say they are done until they have successfully reviewed a license application and defended it in a hearing. And that's one of the reasons why applying it to the decommissioning program is important.

We do not foresee a license application for a commercial low-level waste site to this agency for maybe four or five years at the earliest. We have decommissioning sites that we can start to apply these things to right now, to model and evaluate real sites. We'll eventually end up having to defend in hearings and when we've successfully done that we'll know at least for that case we're done. It won't mean that if

you go apply it to a different site with very different hydrologic and meteorological conditions that you won't end up having to modify those models and make changes.

I think the same thing has happened over the years in reactor licensing. The staff can evaluate the class of light water reactors that are presently out there in operation and the industry comes in with an advanced class of reactors, and so new methods have to be developed. As I think John said very early in the briefing, it's a living process.

MR. BERNERO: I'd like to add to what Mike just said. I agree wholeheartedly with his responses, but, with respect to the resources, we're just sitting down -- next week, in fact, I'm sitting down to review the '96 budget proposals in this area, among others, and I envision that in the '95, '96 time frame, we shift not from completed development but shift more to an application mode with the possible changes, site-specific alterations which will be a fact of life. But I see this activity then as much more a license application mode, not necessarily licensing low-level waste disposal sites, but in any applicable use. And so, we're right now-- in '95, the effort directed

toward this is tailing off and shifting into that other mode.

CHAIRMAN SELIN: I would just like to point out that when you get there -- see, now every time you learn something you can just put it into the model, but you're going to get to a point where configuration control becomes important, where we document something, where we can't -- we see a way to improve it. You just can't go put that in. You have to wait, you know, once a year do a set of updates so that the people who will be using these models, whether it's the operators or the states, don't have to work with a moving target. You know, they come in and they say "we find these results." "Oh, we fixed that last week. We just didn't get around to telling you."

In effect, the model becomes a rule. I mean, it's a predictable regulatory rule, and therefore it's going to have to be subject to the same kind of configuration management.

I thought this was terrific. I really think it's very interesting, but I am concerned that the resources are tailing off and I am concerned that there be sort of a clear stage to say, okay, now we have something. We're obviously going to have to do

some maintenance, but, until we apply quite differently, development is done. We can start documenting, configuring. You can't do that until you've finished the validation, as we've talked about. If a whole new set of applications come up, of course that's a new mod. That's a new approach.

Thank you very much. Very good.

(Whereupon, at 11:30 a.m., the above-entitled matter was adjourned.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON LOW-LEVEL RADIOACTIVE WASTE PERFORMANCE ASSESSMENT DEVELOPMENT PROGRAM PLAN

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: APRIL 1, 1994

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: PETER LYNCH

STAFF BRIEFING ON THE

LOW-LEVEL RADIOACTIVE WASTE PERFORMANCE ASSESSMENT DEVELOPMENT PROGRAM

April 1, 1994

John T. Greeves, NMSS

OVERVIEW

- Background
- Principal Accomplishments
- Results/Issues
- Additional Guidance Development
- Interactions with Others
- Resources
- Summary/Conclusion

DEFINITION OF PA

- Probabilistic Risk Assessment (PRA) - Performance Assessment (PA)

- Performance Assessment (PA) for today's briefing is defined as the technical analysis used to demonstrate compliance with dose standards.

PAWG MEMBERSHIP

Member	Office/Branch
Ralph Cady	RES/WMB
Andy Campbell	NMSS/LLWB
Bob Hogg	NMSS/LLWB
Joe Kane	NMSS/LLWB
Robert Lewis	NMSS/LLWB
Chris McKenney	NMSS/LLWB
Tim McCartin	RES/WMB
Tom Nicholson	RES/WMB
Ed O'Donnell	RES/WMB
Jake Philip	RES/WMB
Phil Reed	RES/WMB
Fred Ross	NMSS/LLWB
Bob Shewmaker	NMSS/LLWB
Mark Thaggard	NMSS/LLWB

GOALS

- Improve PA Guidance
  - Develop acceptable approaches
  - Integrate research results into PA
- Enhance NRC Staff Capability

PROGRAM PHASES

- Phase I (92-93)

  Enlarge in-house LLWPA capability and develop regulatory guidance.

- Phase II (94 and beyond)

  Augment the core of expertise with a more comprehensive and advanced capability.

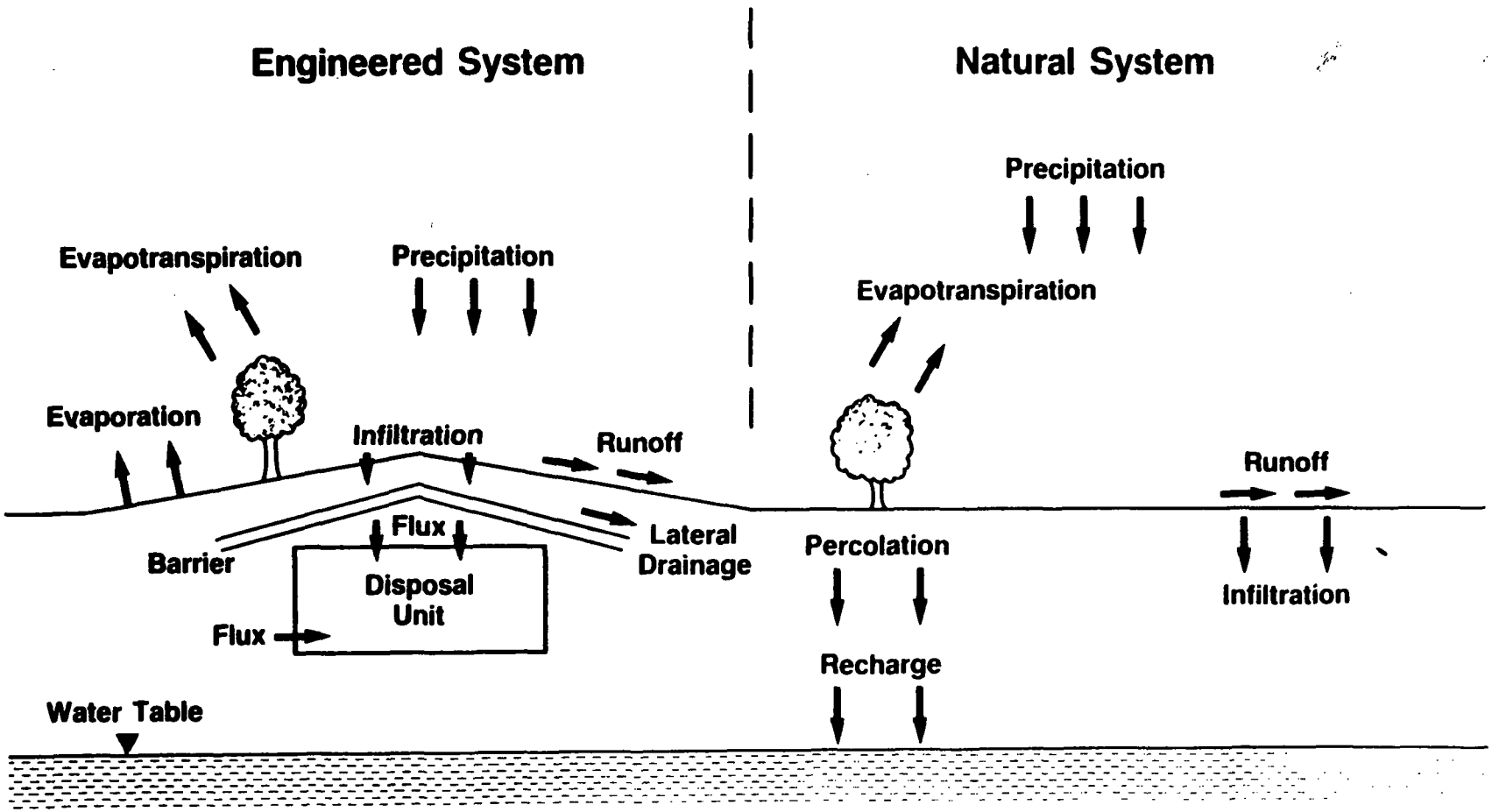
- Program Modifications

  Conduct selected SDMP on-site disposal reviews.

STAFF CAPABILITY/HARDWARE

- Significant enhancement of staff capability.
- In 1992 we obtained "enhanced" 486 PCs for staff use.
  - Adequate for analysis of many individual LLW PA codes and test case development.
- Work stations are now being made available.
- A mix of 486 PCs and work station systems appears appropriate for LLW PA efforts.

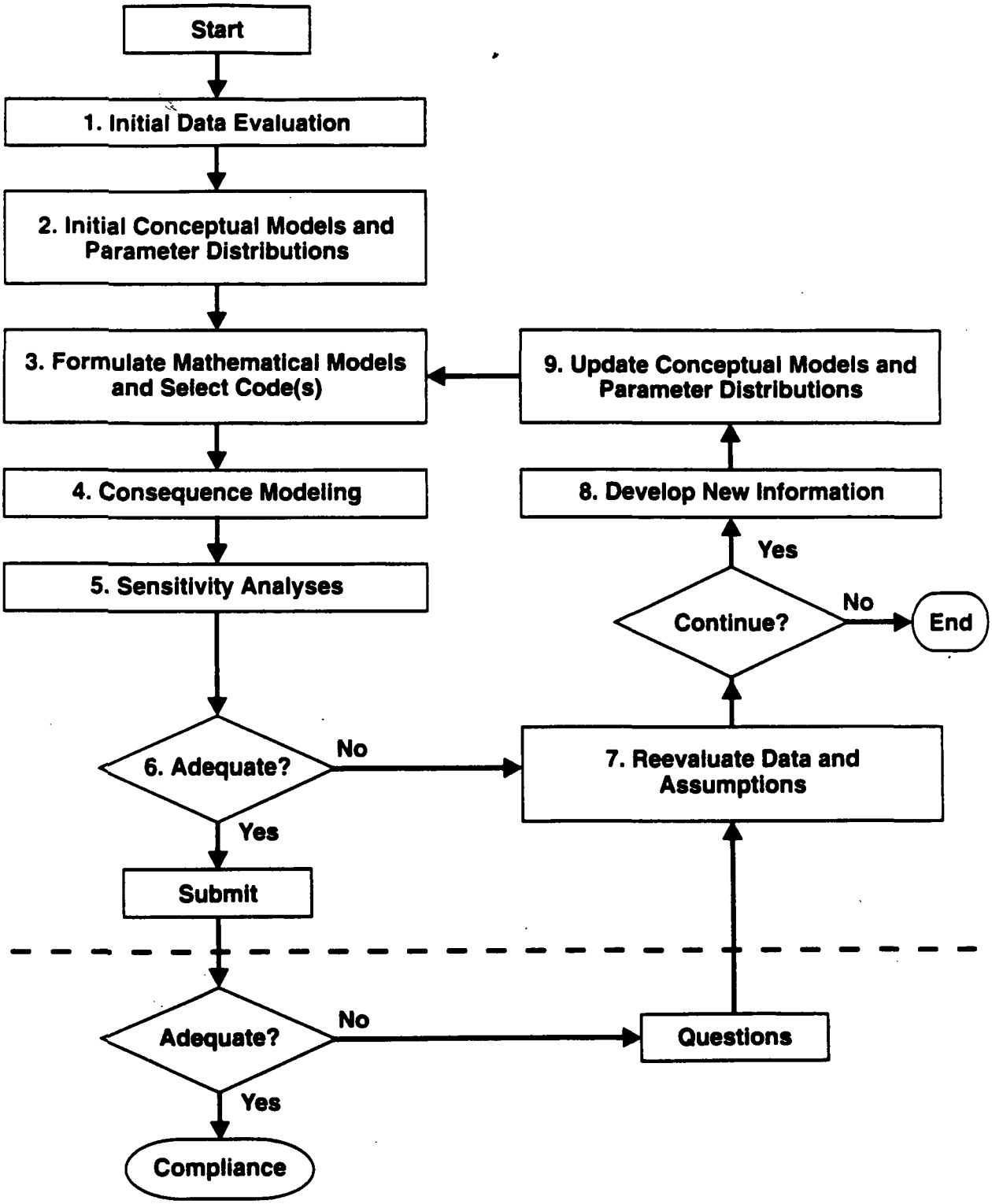
BRANCH TECHNICAL POSITION



Schematic of processes in infiltration analysis.

PA ATTRIBUTES

- Provide an iterative, documented process
- Integrate site characterization and design with PA modeling activities.
- Formally treat uncertainty and sensitivity as an intrinsic part of the process.
- Obtain a thorough understanding of the performance of the site.
- Provide a process for reaching a defensible regulatory decision.



Flowchart of overall performance assessment process.

TEST CASE

PURPOSE AND GOALS OF TEST CASE

- To develop staff capability.
- To provide insight for resolution of regulatory issues.
- To examine consequences of different conceptual models in LLW PA.
- To test feasibility of approaches proposed in BTP.

PROBLEM STATEMENT

- Estimate the peak dose received by the maximally exposed member of the general public. Potential significant off-site transport mechanisms:
  - Groundwater
  - Surface Water
  - Air

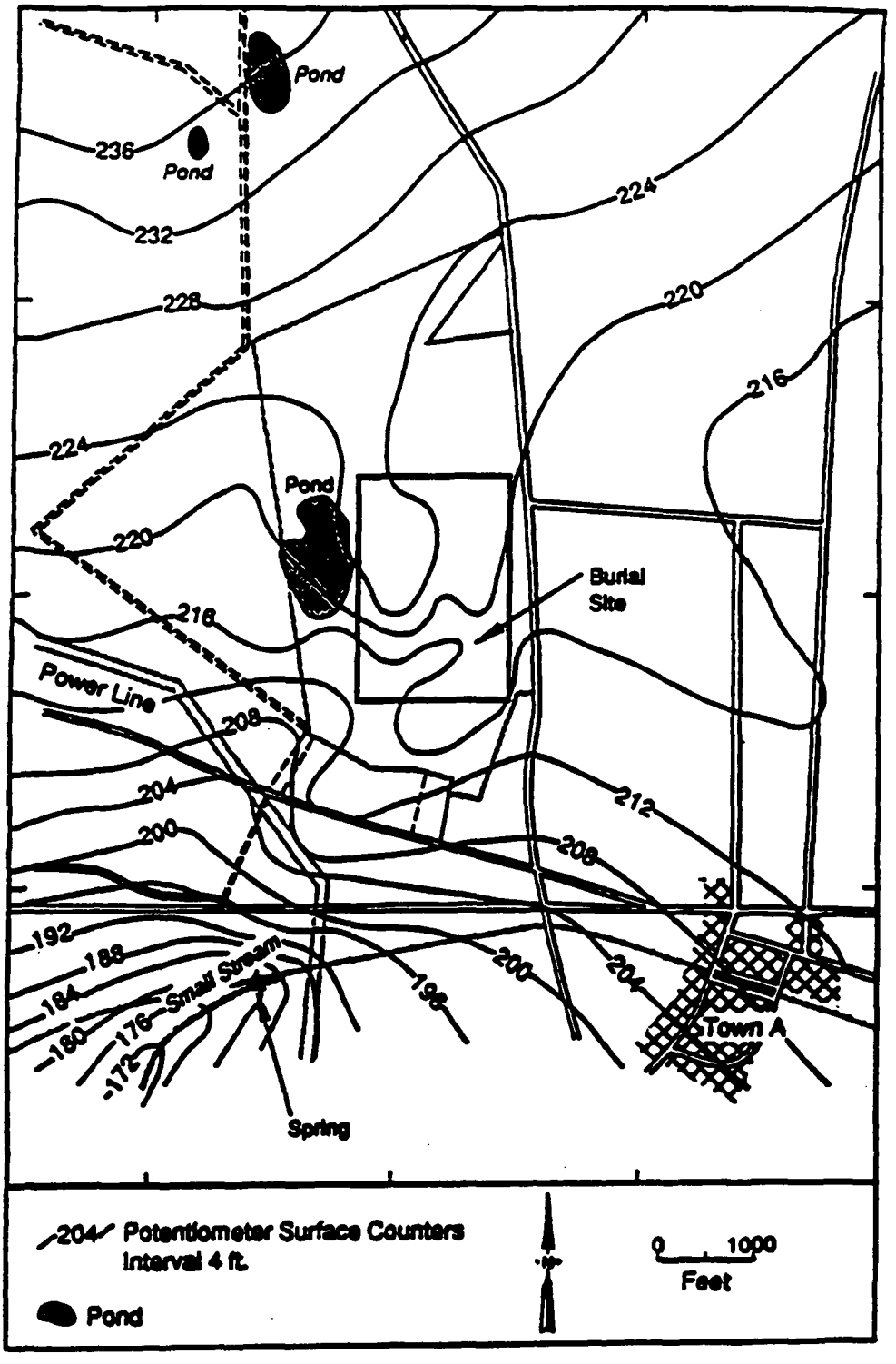
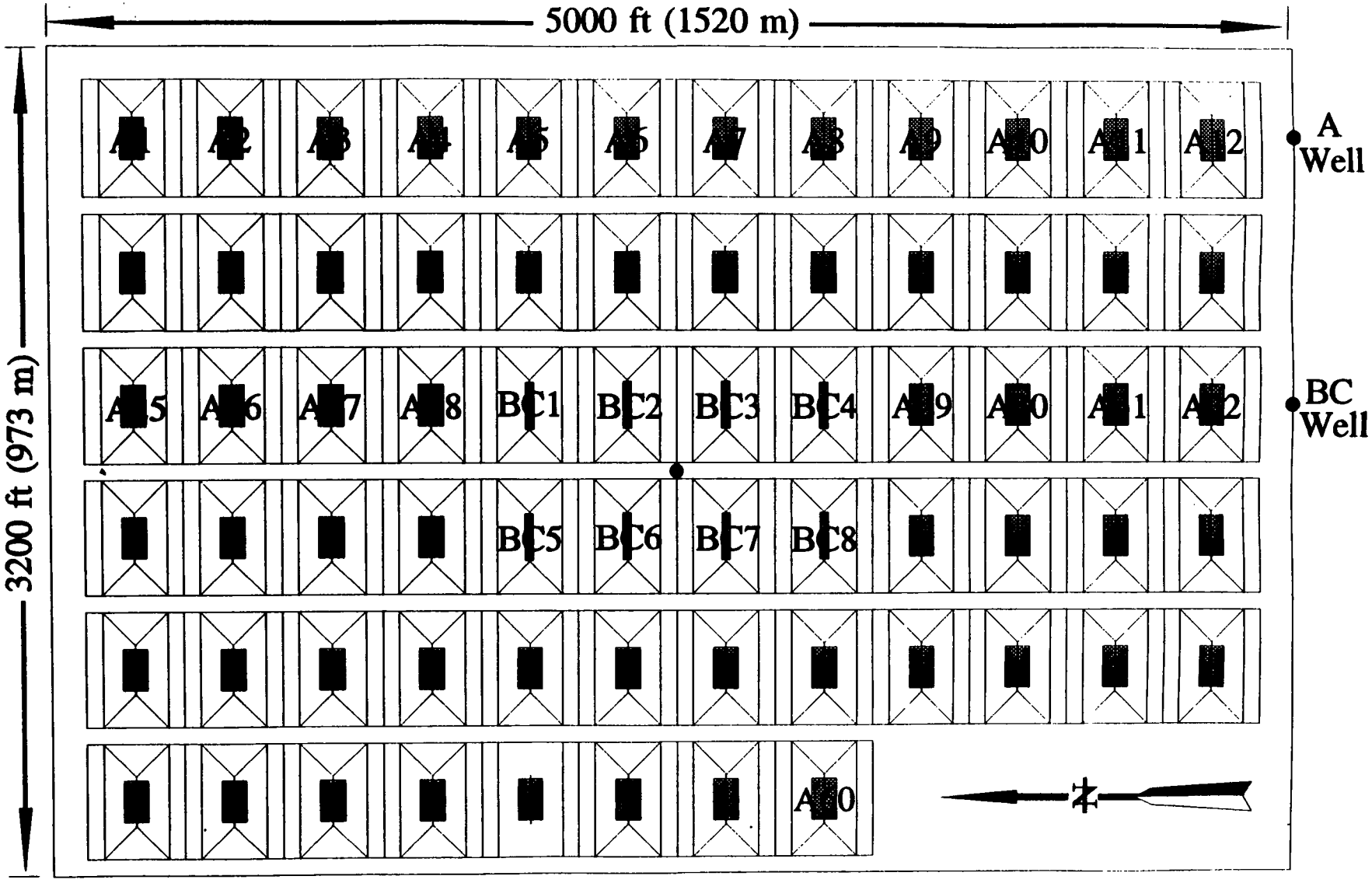


Figure 2.4.8 Potentiometric Surface of Zone 1 at the Disposal Facility



Class A vaults: 94 ft x 142 ft

Class BC vaults: 25 ft x 165 ft

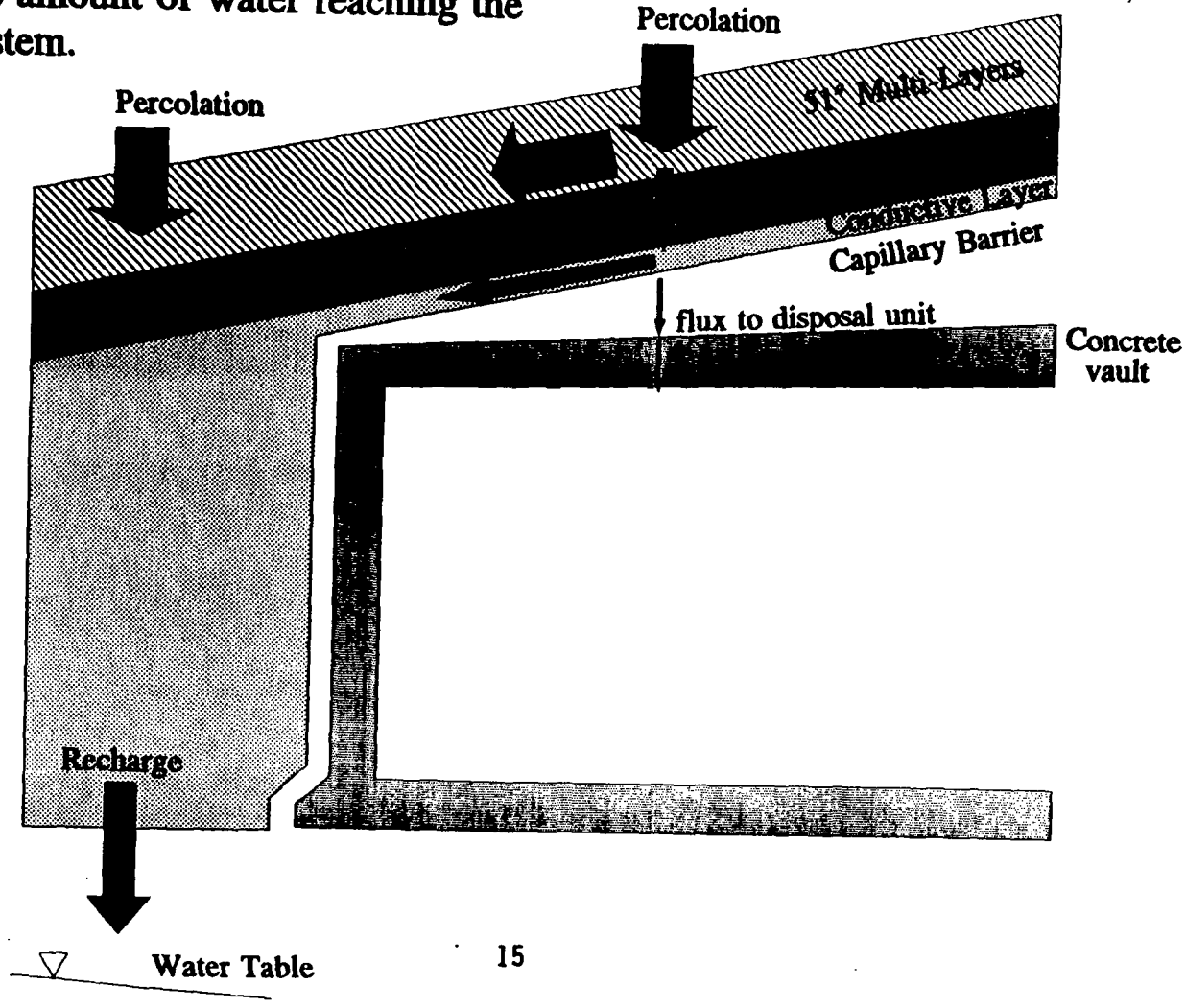
Regional Ground-Water Flow

Infiltration Conceptual Model

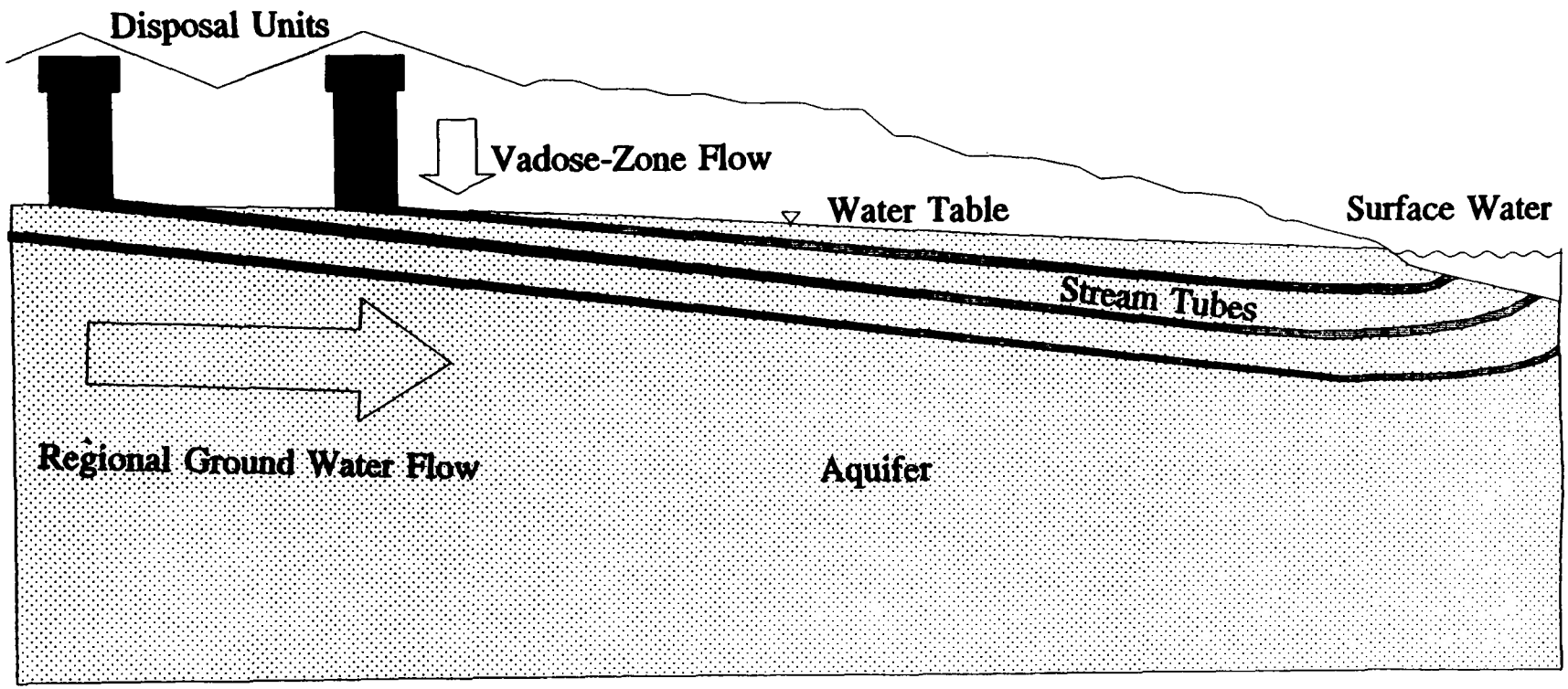
Objectives:

To determine the amount of water reaching a typical disposal unit.

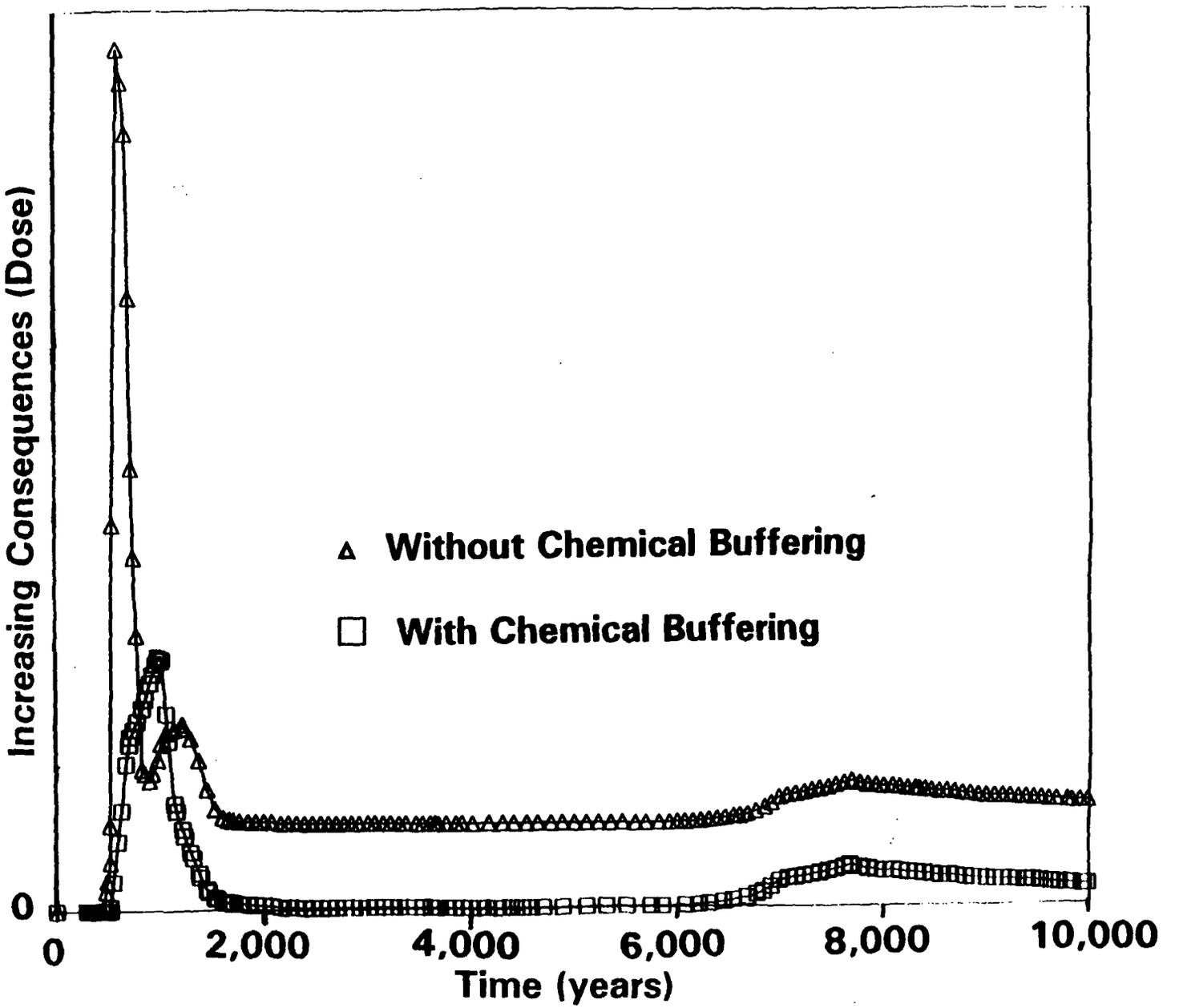
To determine the amount of water reaching the ground-water system.



Conceptualization of Ground-Water Discharge to Surface Water



Relative Significance of Chemical-Buffering due to Concrete



RESULTS/ISSUES

Test Case Observations

- For the conceptual model implemented, dose is most sensitive to :
  - the flux of water into and through the vault,
  - percolation through the engineered cover, and
  - solubility and retardation for critical radionuclides.

Results/Issues (continued)

- Other important observations from the test case:
  - Predicting the long term behavior of engineered structures and environmental conditions is both difficult and important for the analysis.
  - I-129 and Tc-99 inventories are important and Cl-36 may be important.
  - Ingrowth of Ra-226 and other daughters may be important for large U-238 inventories.

Results/Issues (continued)

- Information on radionuclide specific waste streams, forms, and types may allow improvements to release models.

- For the test case, the off-site air dose can be bounded by conservative, deterministic calculations.

- Chemical buffering due to the presence of large volumes of concrete may have significant impact on the release of radionuclides from the disposal units.

TECHNICAL/REGULATORY/POLICY ISSUES

- Time Frame for Performance Assessment Analysis
- Treatment of uncertainty in regulatory decisions
- Role of engineered barriers
- Role of the site and consideration of site conditions, processes, and events (i.e., global climate changes)
- Role of performance assessment during operational and closure periods

FURTHER DEVELOPMENT OF GUIDANCE

- Draft BTP sent to Federal Agencies (DOE, EPA, USGS) and sited and host Agreement States for comment (1/14/94)

  - Comments received to date

    * DOE/Performance Assessment Task Team (PATT)
    * DOE/LLW National Program
    * USGS
    * EPA
    * New York State

Further Development of Guidance (continued)

* NRC Contractors

- Awaiting additional State inputs.

- Will begin formal evaluation in April

- Workshop on BTP after draft published for comment (summer 1994).

- Commission decision on policy issues.

- Revise BTP.

INTERACTIONS

- Agreement States
  - Technical Assistance, as requested
  - NRC training conducted in July of each year.
- Nation wide
  - Attendance at State meetings
    * LLW Forum Meetings
    * Technical Coordination Committee

Interactions (continued)

* Conferences (DOE Annual Conference, Waste Management Annual Conferences).

- Interactions with DOE

* LLW National Program Office

* DOE/PATT (Performance Assessment Task Team)

* DOE/PRP (Peer Review Panel)

Interactions (continued)

- International
  - Leadership in IAEA PA Test Case study
  - INTRAVAL PROJECT
  - Information exchange with specific national programs

RESOURCES

Office	FY 93	FY94
NMSS		
Staff	4.3 FTE	3.7 FTE
Contracts	$678K	$337K
RES		
Staff	2.8 FTE	2.0 FTE
Contracts	$1.025M	$850K

SUMMARY

- Staff has aggressively pursued the Commission's directive in their 1991 SRM.

- An extensive effort is currently in progress.

  - Identified issues to be resolved

- Mid-course corrections

  - Currently to include selected SDMP sites

  - Program evaluated annually when the Commission report is due.

POLICY ISSUE
(Information)

March 28, 1994 SECY-94-083

FOR: The Commissioners

FROM: James M. Taylor
Executive Director for Operations

SUBJECT: ANNUAL STATUS REPORT ON PROGRESS OF LOW-LEVEL RADIOACTIVE WASTE PERFORMANCE ASSESSMENT DEVELOPMENT PROGRAM PLAN

PURPOSE:

To inform the Commission of staff's progress in carrying out the Low-Level Radioactive Waste Performance Assessment (LLWPA) Development Program Plan.

SUMMARY:

The Low-Level Radioactive Waste Performance Assessment Development Program Plan (SECY-92-060) was developed in response to a June 14, 1991, staff requirements memorandum (SRM). U.S. Nuclear Regulatory Commission staff has made significant progress over the past year in meeting the Phase I objectives of the plan. Staff has completed a draft "Branch Technical Position (BTP) on Performance Assessment for Low-Level Waste Disposal Facilities." This document has been distributed to all low-level waste (LLW) sited and host Agreement States, the Advisory Committee on Nuclear Waste (ACNW), the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the United States Geological Survey (USGS) for review and comment. A staff briefing of ACNW is scheduled for March 1994 and there are plans to brief the Commission in April 1994. Staff has also constructed an integrated systems model of a hypothetical LLW disposal facility and has been carrying out an iterative series of analyses to test different modeling approaches,

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504-2500

NOTE: TO BE MADE PUBLICLY AVAILABLE AT COMMISSION MEETING ON APRIL 1, 1994

including uncertainty and sensitivity analyses. In addition, contractors have provided ancillary analyses on different system components to support staff modeling efforts. The staff has also gained PA experience through interactions with State efforts, other Federal agencies (e.g., DOE and the USGS), foreign countries (e.g., France, Spain, and Germany), and international organizations, such as the International Atomic Energy Agency (IAEA).

BACKGROUND:

This paper provides the Commission with an annual status report of progress in implementing SECY-92-060. This is the second annual report; the first was provided in SECY-93-060. The Plan, which was produced in response to a June 14, 1991, SRM, has two primary goals: (1) to enhance staff's capability to review, evaluate, and conduct a LLWPA; and (2) to develop regulatory guidance based, in part, upon staff and contractor LLWPA modeling work and lessons learned from the simulations.

The plan was divided into two phases. Phase I was focused on enhancing in-house capability and developing regulatory guidance for LLWPA based upon existing state-of-the-art technology. Phase II was originally intended to focus on: (1) maintaining and augmenting staff capability; (2) updating regulatory guidance; and (3) incorporating significant technological advances from research efforts into NRC's performance assessment (PA) capabilities. Staff was considering extending the test-case modeling to an arid site (in contrast to the humid site currently being evaluated under Phase I). Phase II, however, is being modified, by applying staff capability developed in Phase I, to conduct PA analyses for certain Site Decommissioning Management Plan (SDMP) sites, where appropriate data are available. Other objectives for Phase II would be maintained; however, implementation of these other activities would be delayed because of limited staff resources.

The LLWPA program plan is being carried out by the Performance Assessment Working Group (PAWG), which is composed of staff from both the Low-Level Waste Management Branch (LLWB), Office of Nuclear Material Safety and Safeguards (NMSS), and the Waste Management Branch (WMB), Office of Nuclear Regulatory Research (RES) (see Enclosure). As described in SECY-92-060 and SECY-93-060, PAWG members are involved in all aspects of LLWPA, including research, methods to enhance staff expertise, development of regulatory guidance, and coordination of PA activities with Federal, State, and international organizations.

DISCUSSION:

1. Implementing the Program Plan

1.1. Enhanced Staff Capability

The first program goal is to enhance staff's capability to review and evaluate a license applicant's LLWPA, including conducting confirmatory PA analyses, if necessary. The primary strategy for achieving this program goal has been to develop and to exercise a test-case PA of a hypothetical disposal system in a

humid environment, using actual site data and a staff-generated facility design and source term inventory. This has allowed staff to test the performance assessment methodology (PAM) and models and has increased staff experience, insight, and understanding in LLWPA. The test-case has also enabled staff to test different approaches to LLWPA developed for the BTP. The modeling effort also has benefited from experience in the high level waste (HLW) PA effort, particularly in the areas of uncertainty and sensitivity analysis.

The staff has completed development of a fully integrated systems code that links sub-models for infiltration, engineered barrier performance, source term, ground-water transport, surface-water transport, and dose. The structure of the integrated systems code allows sensitivity and uncertainty analyses to be conducted for the overall PA analysis. The code has been subjected to an evaluation program within PAWG, to document it, to verify that it is carrying out the intended calculations appropriately, and to identify and resolve bugs and internal inconsistencies. The model incorporates a one-dimensional (1-D) streamtube approach for radionuclide transport, with appropriate geometric considerations to address two- and three-dimensional (2-D, 3-D) features of the site hydrogeologic system. Staff has demonstrated, through analysis of an analytical solution to the problem, that a 1-D streamtube is appropriate for this case. The data input for this integrated model consists of a list of parameters, the expected range of each parameter value, and the expected distribution (e.g., normal or lognormal) of each parameter for the different sub-modeling areas. Several different conceptual models are being evaluated. The staff is currently conducting full sensitivity and uncertainty analyses, using the integrated LLWPA code, for a resident agriculture scenario at the simulated site boundary. The purpose of this work is to determine the sensitivity of the calculated dose to different parameters and also to provide the framework for assessing the appropriateness of potential regulatory positions. The fully integrated code is designed around the specific features of the hypothetical LLW disposal site and, therefore, is not intended to be a generic code to be applied to all LLW sites. Nevertheless, the approaches developed and lessons learned in exercising the test case have been very useful in developing the BTP.

The computer codes incorporated into the model (including newly developed codes) allow modeling of specific physical phenomena of concern (such as waste form leaching and transport of radionuclides) in the PA process. Many of the codes contain complex, iterative numerical procedures that require powerful computers to reach a solution in reasonable time. The ability of staff to use PA codes and to discern both the capabilities and limitations of different codes, is a fundamental part of enhancing staff's proficiency in reviewing and evaluating a license applicant's PA.

The enhanced computer hardware, acquired in fiscal year 1992 (FY92) (i.e., four IBM-compatible 486 machines for NMSS and one IBM compatible-486 machine for RES) along with associated software and support equipment has proved adequate for developing the test-case model. These fast, powerful personal computers (with considerable amounts of expanded/extended memory and large hard disk capacity) allow staff to load and manipulate a large variety of

computer codes. However, since each realization of the data set in the integrated LLWPA model requires 2 to 3 hours of 486 computer time, and staff is running hundreds of realizations to exercise the code, more complex analyses (e.g., 2-D or 3-D models) will require the use of a larger computer system, such as advanced 486 systems with fast processors or workstation systems. The proposed merger of LLW and HLW Divisions will make the HLW workstation system available for LLWPA. Staff will evaluate specific needs for additional units for LLWPA modeling activities. Recently RES has obtained two work station systems, which are dedicated for modeling. It is important to note that, because LLWPA analyses involve both simple and complex models and codes, the hardware requirements include a mix of 486 based computer systems, as well as more powerful systems.

The staff has also worked to achieve the goal of improved capability in LLWPA, through a number of other activities, including research activities described in SECY-92-060. To further enhance staff's capability to conduct and review LLWPAs, several workshops and meetings were conducted, in FY93, to enhance technology transfer to NRC staff from research and technical assistance contractors. In addition, in June 1993 NMSS/RES staff arranged a LLWPA meeting of NRC staff and several contractors to provide a technical review of the test-case modeling, including identifying potential problem areas (e.g., technical problems with data or inconsistencies in the models) and developing approaches for their resolution. This meeting also provided essential insights for developing the draft BTP.

NRC contractors have also been developing and evaluating codes suitable for PA modeling, and to supplement staff efforts, they are modeling specific parts of the test-case problem. These include: independent ancillary analyses of infiltration through a multi-layer cover; concrete degradation studies; source term modeling; geochemical modeling of radionuclide solubilities and sorption parameters; ground-water transport modeling in the saturated zone, and vapor-phase transport modeling in the unsaturated zone; surface water transport; air transport; and dose modeling. In addition, further development and improvement of the PAM and contractor input on LLWPA issues have been a significant help in developing the BTP. These projects are being documented and published as NUREG/CR documents, including: NUREG/CR-5927, Volume 1, which updates the PAM, August 1993; NUREG/CR-6070, which presents approaches on concrete barrier modeling in LLW disposal, November 1993; and the NUREG/CR-6114 series (Volume 1, published December 1993, which deals with applying the infiltration evaluation methodology; Volumes 2 and 3, which are in press, deal with vapor-phase transport analysis and ground-water flow and transport analysis, respectively).

1.2. Developing Regulatory Guidance

The second program goal is to develop regulatory guidance for LLWPA, in particular the BTP on LLWPA, and staff has also made significant progress in this area. Staff effort in developing the BTP on LLWPA is closely related to capability. The staff has completed a draft BTP for review by LLW sited and host Agreement States, ACNW, DOE, EPA, and USGS. The draft BTP has already been reviewed by NRC staff and by NRC contractors involved in LLWPA. The

principal guidance objective of the BTP is to provide license applicants and regulators with an acceptable methodology for performing technical analyses required in 10 CFR 61.13 to demonstrate compliance with the 10 CFR 61.41 performance objectives. This includes giving: (1) general guidance on an acceptable PA process that integrates site characterization and PA modeling; and (2) specific guidance on implementing NRC's PAM. The PAM was developed by NRC as one approach that may be followed in conducting a PA for a LLW disposal facility.

The revised schedule discussed in SECY-93-060 (the first annual status report) called for staff to prepare a draft BTP focusing on PA strategy and resolving policy issues by FY93. Subsequently, staff would incorporate revised sub-modeling area technical positions into the draft BTP in FY94. Staff, however, has completed both tasks, and the draft BTP sent out for review and comment is a complete document that incorporates five main sections. These sections of the BTP focus on the following objectives: (1) defining LLWPA in the context of the 10 CFR Part 61 regulatory requirements for LLW facility performance; (2) providing background information on LLW disposal, the NRC PAM and important issues in LLWPA; (3) describing an overall process for conducting PA modeling activities; (4) addressing important technical policy issues concerning interpretation and implementation of Part 61 technical requirements; and (5) providing guidance on acceptable modeling approaches for addressing technical issues about processes controlling LLW facility performance.

The goal of the review process is to receive comments from the sited and host Agreement States and appropriate Federal agencies, and to address these comments in revising the BTP. Staff will be briefing the ACNW on the BTP and test-case modeling in March 1994. A briefing of the Commission will follow in April. Subsequently staff will produce a revised draft BTP for publication in the Federal Register and public comment by all interested parties. Staff will also hold a public workshop on the BTP.

In addition, staff will continue to conduct the test-case modeling, including sensitivity and uncertainty analyses, using both staff resources and ongoing contractual technical assistance. This schedule will allow staff to address any outstanding technical issues. The staff will develop a NUREG on the test-case simulations to document the technical basis for the overall PA strategy and for specific sub-modeling area technical approaches. In addition contractor analyses of different sub-model areas of the test-case are being, and will continue to be, published as a series of NUREG/CR reports, which will provide further technical support for individual sub-modeling area technical positions. The Phase I test-case documentation is scheduled for completion in FY94. All of this work will be done within existing resource allocations. Because the BTP is an extensive and comprehensive guidance document, the need for developing a Regulatory Guide from the BTP will be reconsidered. Because of resource limitations, completing documentation of the test-case work may be extended into FY96, depending on the level of effort necessary for PA work on SDMP sites.

2. Interactions with Agreement States

During FY93, staff has had several interactions with Agreement States, where knowledge and experience gained from the LLWPA program have been directly applicable. For example, on June 4, 1993, NRC staff met with the State of North Carolina and provided an overview of the BTP development and test-case simulations. Staff also met with an individual from the State of Pennsylvania, to discuss LLWPA issues and approaches for modeling. In addition, on July 28, 1993, in Rockville, Maryland, staff (in conjunction with State Programs) participated in the LLW and Uranium Recovery Regulatory Workshop for Agreement States, which included a half-day session devoted to PA, including information on the PAM and strategies for modeling, the test-case simulations, and the development of the BTP. Staff also gave a presentation of this information at the LLW Host State Technical Coordinating Committee Meeting in Rockville, on August 24, 1993. The experience and knowledge gained from these LLWPA program activities permit direct feedback and input to staff's development of PA guidance. Staff has also worked to provide technology transfer to the Agreement States through various activities such as organizing workshops (discussed below) and distributing publications. Staff will continue these efforts in the future, as well as providing specific technical assistance when requested.

3. Interaction with National PA Activities

NRC staff has been active in national LLWPA activities, particularly in association with DOE. NRC staff is participating in the DOE PA Task Team (PATT) meetings, held approximately every four months. The purpose of PATT is to discuss and coordinate the LLW PA activities at DOE sites, identify and resolve technical issues, alert DOE headquarters to policy issues, and develop revised guidance for the disposal of DOE LLW. NRC staff also participates, as a non-voting member, in the DOE Peer Review Panel (PRP), which evaluates and determines the technical acceptability of LLWPAs for DOE sites and provides input to DOE HQ. Participation in both the PATT and PRP is beneficial to the NRC staff in developing regulatory guidance for commercial disposal facilities. Moreover, these activities provide an important means of coordinating NRC and DOE LLWPA endeavors.

Staff presented a day-long workshop on the LLWPA test-case modeling to the DOE/PATT in Gaithersburg, Maryland, on November 17, 1993. Because PATT members are practitioners of LLWPA and are directly involved in doing LLWPAs for DOE facilities, the workshop provided an excellent opportunity for technical discussion of issues in LLWPA and staff's test-case modeling efforts.

The staff has also continued interactions with the National LLW Management Program Office (NLLWMP), operated by EG&G at the Idaho National Engineering Laboratory (INEL) for DOE. This office provides technical assistance to the States under the 1985 Low-Level Radioactive Waste Policy Amendments Act. During FY93, the NRC staff had numerous technical interactions with the NLLWMP, involving activities such as joint planning of the annual DOE LLW Management Conference, to develop a comprehensive technical program on LLW PA;

and attendance by DOE LLW Program Office staff at selected NRC technical meetings. Staff is also discussing holding additional workshops on LLWPA through the NLLWMP.

Staff participated in a number of professional meetings, where topics pertaining to LLWPA were presented. Staff presented a number of papers on the development of LLWPA guidance and resolution of technical issues, and also participated in panel discussions on LLWPA at the DOE/LLW Management Conference in Phoenix, December 1 through 3, 1993, and the Waste Management '94 conference in Tucson, February 28 through March 3, 1994.

Staff helped organize and participate in a "Joint USGS-NRC Technical Workshop on Research Related to LLW Disposal," held at USGS headquarters in Reston, Virginia, from May 4 through 6, 1993. This workshop was the initial effort by NRC and USGS staffs conducted under the Memorandum of Understanding (MOU) between the two agencies. Over 60 participants from Agreement States, Federal agencies, DOE national laboratories, and private contractors meet to listen to ongoing USGS and NRC-funded research, and to discuss the technical issues involved. A USGS Water-Resources Investigations Report documenting the workshop proceedings is scheduled for publication in May 1994. Staffs from both the NRC and USGS are organizing the second joint project under the MOU, which is a special session on "Research Related to LLW Disposal," to be held at the American Geophysical Union (AGU) Meeting in Baltimore, May 23 through May 27, 1994.

Staff also organized a "Workshop on Performance and Modeling of Concrete as Engineered Barriers for LLW Disposal," in conjunction with staff at the National Institute of Standards and Technology, which was held in Gaithersburg, Maryland, from January 31 through February 2, 1994. There were more than 80 participants representing States, national laboratories, universities, consulting organizations, and representatives of five foreign countries (France, Spain, Switzerland, Great Britain, and Canada).

4. Interaction with International PA Efforts

As described in SECY-92-060, staff has continued cooperation in international efforts concerning LLW disposal. The staff has participated, as a consultant to the IAEA, in the Coordinated Research Program (CRP) on the Safety Assessment of Near-Surface Radioactive Waste Disposal Facilities. The CRP is conducting test-case programs similar to NRC's. The staff and a contractor, Sandia National Laboratory, are participating in these PA modeling exercises. A consultant meeting was held from May 9 through 14, 1993, in Vienna, Austria. The meeting focused on finalizing the first test-case problem write-up and further development of the second test-case problem on LLW safety assessment for the CRP. In addition, plans were developed for a three week course for international participants in LLW PA modeling that was held at Argonne National Laboratory, February 14 through March 4, 1994. Two staff members gave one-day lectures at this training course. Several Agreement State representatives also attended this course under NRC's Agreement State training program.

As part of NRC's research information exchange activities with the French Commission de le Energie Atomique (CEA) and the Swiss National Cooperative for the Disposal of Radioactive Waste (NAGRA), staff gave overviews of the PA program in Paris, France and Wettingen, Switzerland on October 14 and 15, 1993, respectively. At that time invitations were extended to CEA and NAGRA representatives to attend the concrete workshop discussed above.

In addition, staff members were able to visit disposal sites in Spain, France, and Germany, in FY93. Staff also provided a half-day briefing on LLWPA in a meeting with representatives from France on LLW disposal, held in Rockville, on March 31, 1993. February 14 through 18, 1994, staff discussed LLW disposal issues with representatives from the Czech and Slovak Republics and the Ukraine. The interaction during these visits, and the information on different approaches to LLW disposal and LLWPA in other countries, have proven to be very useful in evaluating domestic issues and approaches.

5. Resource Impacts

In SECY-93-060, staff provided a revised budget estimate of direct resources necessary to support Performance Assessment activities in FY93. The following data compare the budget estimate with actual staff time expended and contractor support obligations.

	FY93 Budget Estimate	FY93 Actual
NMSS/LLWB		
FTE	4	4.3
Contractors	$500K	$678K
RES/WMB		
FTE	2.8	2.8
Contractors	$1.025M	$1.025M

Additional resources of 0.3 FTE and $178K were obtained from staff overtime expended and the reprogramming of FY93 funds.

In FY94, staff has budgeted resources of 3.7 FTE and $337K for NMSS and 2.0 FTE and $850K for RES to: (1) publish the BTP for public comment and hold a public meeting; (2) publish documentation of the test-case and ancillary analyses; (3) provide technical assistance on LLWPA to host Agreement States as requested. In addition, staff will commence some work on specific SDMP sites, to determine the applicability of the LLWPA methodology to site remediation efforts.

COORDINATION: The Office of the General Counsel (OGC) has reviewed this paper and has no legal objection.

James M. Taylor
Executive Director
for Operations

Enclosure: PAWG member list

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PERFORMANCE ASSESSMENT WORKING GROUP

PERSON	SUB-MODELING GROUP	OFFC/DIV/BRANCH
Ralph Cady	Hydrology	RES/DRA/WMB
Andy Campbell	Proj. Manager, Source Term/Hydrology	NMSS/LLWM/LLWB
Chris Daily	Dose	RES/DRA/WMB
Bob Hogg	Dose	NMSS/LLWM/LLWB
Joe Kane	Engineering	NMSS/LLWM/LLWB
Jack Lentz	Hydrology	NMSS/LLWM/LLWB
Robert Lewis	Source Term	NMSS/LLWM/LLWB
Tim McCartin	Source Term	RES/DRA/WMB
Chris McKenney	Dose/Air	NMSS/LLWM/LLWB
Tom Nicholson	Hydrology	RES/DRA/WMB
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Bob Shewmaker	Engineering	NMSS/LLWM/LLWB
Mark Thaggard	Hydrology	NMSS/LLWM/LLWB

NOTE: Hydrology includes: Infiltration, Ground Water, Surface Water Sub-Modeling Groups

Enclosure