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SPRING FULL BOARD MEETING

OCRWM Program Planning and Integration

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Dr. Jared L. Cohon
Dr. Edward J. Cording, Session Chair
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I N D E X

P R O C E E D I N G S

DR. CORDING: We going to start the session now. Will you please be seated? Thank you very much.

My name is Edward Cording. I'm a member of the Board, and will be chairing the session this morning. We welcome you back to the second day of our session of the Nuclear Waste Technical Review Board, and today we're going to be seeing updates on the ESF, the exploratory studies facility, the science program at Yucca Mountain Project. Then we'll continue with discussions on the overall program and program integration.

I know that the time is very short for several presentations. We're going to do the best we can to try to be able to glean from those presentations the things that are important, and keep as close to schedule as we can.

We're going to conclude with a roundtable discussion this afternoon, which will involve all of the speakers from the two days, the Board members, consultants, and staff, so that will be this afternoon.

We've also provided time for comments from the public at the end of the day, so those who wish to make comments are urged to sign the public comment register. It's in the back of the room here, with our staff, Helen Einersen and Linda Hiatt.

So, I'd like to proceed right now, then, with the

first presentation. Rick Craun of DOE made presentations yesterday. He's going to continue to update us today, then, on the progress principally in the construction at the site, exploratory studies facility.

MR. CRAUN: I'll go ahead and get started. I've got quite a bit of information here this morning, so I'll try to go quickly. I'll skim through it. If I'm going too quick, send me a signal and I'll slow down.

I'll skip the outline and go right to the ESF operations status. Yesterday, we were at Station, approximately, 50. We're about a thousand meters away from the south turn. I'll give you some more information later on in the presentation on when we expect to "hole out" the machine or complete the five-mile loop.

Last night, the thermal test alcove was at about Station 69, and on April 10th, we passed the three-mile mark on the ESF.

I believe it was last week, we were down for a week. During that period of time, we did our 1500-hour inspection on the TBM. We did everything but the bull gear inspection. As we got in front of the machine, we noticed that the wear was a little higher than expected. That's the bottom bullet here. All the other indications on the 1500-hour inspection were within spec, were normal.

The wear plate inspection indicated a high wear,

primarily due to the blocky ground. We're looking, also, at ways in which we can--some lessons learned.

The bucket pickup on the TBM is such that it has a tendency to bring and pull around the material, and that has a tendency to rough up the edges, has a tendency to have us do a little bit of over-excavation, et cetera. That extra rubble at the front of the machine is wearing the front of the machine, so in a emplacement drift design, we will take these lessons and pull them into the machine design that would be used on the emplacement drifts. So, we are starting to pick up, as we expected to, in the ESF information that'll help us in the emplacement drift or the repository design.

We have some operational issues that I thought you would be interested in. We have high silica dust and Cristobalite levels in the tunnel at this point in time. I'll jump to the last bullet. We have donned respirators. It looks like a little filter mask, but it is classified as a respirator.

We've done quite a bit of ventilation repair, and also, some modifications. I've got some photographs of a wet scrubber that we've installed. We've changed the duct work as to how we ventilate the alcoves, trying to, we feel, diminish the recirculation of the air in the tunnel.

Part of our contributing problem is that as it picks up the air from the TBM and from the alcove, depending

upon the pressures in the duct work itself, it has a tendency to recirculate it back into the tunnel itself, so we've gone through quite an extensive sealing program to seal the leaks on the ventilation fan line itself.

During that process, on one morning when we went to start it up on a Monday morning, we sealed it well enough that our ventilation start-up sequence had to be changed because we collapsed the vent line. We went ahead, and it was sucked in, is the right way to say it. We did repair that. We were down for two days on that issue, and we have recovered from that situation.

We have a series. We've assembled three teams, different teams of consultants to try to look at the IH issues, to look at the ventilation issues, and to look at the overall how are we performing the ventilation of the tunnel. We should start getting some reports from these teams around the April 29th and May. Depending on which team it is, we should be getting reports in that area.

I believe last week, Thursday or Friday, we got the state permits to allow us to do a gas injection test on the ventilation system, which will allow us to measure more quantitatively the recirculation and the ventilation system, so those tests should be underway now.

I wanted to share with you what we're trying to do this year. We've processed a couple of changes. Originally,

at the beginning of FY 96, we were to proceed to Station 39 + 40, and then terminate operations of the machine.

We were able to, without increasing our budget, based on efficiencies and looking carefully at the scopes of the tasks of funding for '96, we were approval a CR, the top CR there. It was the first one--it's got a formal number, but I didn't know what it was--to extend the operation for two shifts all year.

Right now, we're in the process, and have been working on this for the last three weeks, of trying to complete the second CR, which will allow us to continue three shift operations. That's nearing completion. I would imagine that that should be out this week or next.

Later on in the presentation, I'll get into some of the accelerations that we're trying to, with this CR, we're also trying to incorporate some extra funding or shift some funding into the excavation of the alcoves on the Ghost Dance 1, Ghost Dance 2, and the thermal test alcove.

We have been able to pull back those schedules. I think when I briefed you last, we were able to improve those schedules from the original baseline. We've also pulled another four months out of those schedules, so we are continuing to improve those to allow access for the scientists into those areas sooner than expected.

The difficulty, obviously, is trying to balance

having three headings going at the same time, locations of construction, with a ventilation system and a Cristobalite or silica issue, to also balance FY 96 funding. We're trying to shift to three shift operations without asking for more money from the project, from elsewhere in the project. We feel very strongly that the science and the engineering activities that are taking place need to go forward, and we're trying to do the TBM operations based on what we were originally funded at the beginning of the year.

I'll do this very quickly. This is one of the two standard slides that I always put up. We're right about Station 50 right now. We've been in Category I for the last three days, and the ground, based on a discussion with a CMO last night, the ground looks pretty good. Hopefully, that'll continue. We've had some people indicate that between Station 50 and Station 60, it may be fairly good ground, so we're hoping that's the case. Our production rates will go up appreciably. I'll come back to that point in just a minute, the point relative to how our production rates vary with the ground control that we're installing.

This may be a little hard to read. I wanted to share with you--and I've simplified it a little bit, just so that the chart wouldn't be too busy. We are forecasting a hole out in the upper right-hand corner of October to January, '96-'97.

What you see is, on the left side, the outside of the loop is really what we have been--that's kind of our working, planning numbers. On the inside of that is what we've been able to actually accomplish.

We were able to actually get ahead of schedule, one, by both production rate, but, secondly, by the fact that we were able to shift from series activities to parallel activities. We feel that a reasonable forecast is 17 to 24 meters a day. Twenty-four would be more indicative of more of a Category I ground control that we'd be installing. Seventeen would be more of a Category IV ground control that we have been installing.

Let me take these out of sequence. I'm going to jump to the next one, and then I'll come back to that. This is a very busy chart, so I'm not going to explain it all to you, but it's useful in getting the point across, and that is, this dark line at the top and down below is the ground control that we've installed in the tunnel.

As you can see, in the beginning, we were installing predominantly ground classification, Ground Class 4. We have been installing some now. This stops at Station 44. If you were to go on out, there'd be quite a bit of Category IV ground control that we're installing.

The upper section, the center section is Category I. What we're doing is tying this chart together with the Q

value of the rock mass to find out how well we're doing relative to our ground control that we're installing as compared to the rock itself.

We're also tying it to production rates. What we're starting to work on now is trying to look at ways in which we can design our ground control system so that when I go from a Category I to a Category IV, I don't cut my production rates in half. Right now, I'll go from 30-ish meters a day to 15-ish meters a day, so what I need to do-- and the purpose of the ESF, in my mind, one of the purposes-- is to go ahead and allow us to obtain some of the construction information we need so that when we design, or when we procure a machine for the repository, if we have multiple ground control systems, we need to have it such that if I go to a Category IV, I don't cut my production rate in half. So, we're really looking now at ways in which we can alter the Category IV ground control so that I can maintain production rates.

If we can accomplish that, then the TSLC, or Total System Life Cycle Cost of the repository would be greatly affected. We would be able to shift from a 20 to 30 meter a day, up to a 30 to 40 meter a day, and that would significantly affect the repository cost estimates.

Some of the lessons learned, and I think there were some points yesterday about how the design might evolve over

time, and this is maybe an example here, where we've found that we really only, of the five ground controls, we really only do use two, so I think as that would evolve into, then, the repository design, we may have only one or two ground control systems that we would incorporate into the design there.

As we were to start in to, say, procure waste packages, then that design would probably mature, also, throughout the life cycle of the repository, so I would imagine, with a feedback system, and a lessons learned system, we would be able to do that not only from lessons learned in the ESF, but also in the repository itself.

We've found that in switching from Category I to Category IV, we lose a lot of down time on the machine, just trying to empty the machine out of steel sets, and then reload it with rock bolts and wire mesh, et cetera. It takes a fair amount of time to do that. It's a lot of physical labor to do that.

So, in some ways, if we can design a Category IV ground control, maybe a liner system that could be installed very quickly, and without impeding the operations of the machine, then we can sustain actually higher production rates, lower our costs in the actual construction of the repository, et cetera, so we're looking at those lessons learned there from the ESF, and I'm trying to stay on

schedule, so I'll hurry.

As I indicated a few minute ago, we are continuing to try to improve the access time for the scientists, when the scientists can gain access. Through a thermal test in the Ghost Dance, it looks like I've got the thermal test data up here. I haven't got the information on the Ghost Dance. We've been able to pool the schedule from December to August, '96. We've also been able to improve the schedule on the north and south Ghost Dance Fault. That schedule is still not solidified.

In order to accomplish that, we were looking at potentially procuring a second Alpine Miner. We may not be able to accomplish that due to financial constraints, so we may have to do some drill and blast. Drill and blast has more of an impact on the TBM operation. It's harder to get the muck out. There's a lot of interface there that we're having to work our way through.

The intent is to provide as early as possible access to those major fault structures, and that's what we're working on, and working very closely with Susan and Dennis to balance the construction schedule with the test equipment availability and the test plans.

The next chart is just a repeat, so I'll just show it to you, and then keep going. It's got the same data. I think the only maybe new data is the test start date, the

TSD, which is August of '97.

We also have a Board of Consultants for the tunnel. It's got a much longer title than that, but we had our third visit with them, and we have a draft report which should be final in another week or two, and I just selected a few issues--not all positive issues, but a few issues that they mentioned in their draft report.

They continue to see--and, actually, our safety record from a personnel perspective is good--they continue to see a clear focus in the field on safety, so they speak very highly of that.

Cost effectiveness. I put together three issues there. They're just related to cost effectiveness. There was a report to--and also in this report--discussion on staffing levels, whether or not we had more than would be expected in a commercial operation, et cetera, so there's more discussion in this report on the need to continue to work that issue. The M&O and the DOE are working together on that issue.

They've noticed an improvement in communications between the field and the downtown office area, design. One of the things that we pointed out to them was our ability to shift a design or change a design fairly quickly in the field, with some very quick interface with the downtown designers. So, we've improved that process. That's the

improved communication, et cetera. So they were thinking we were heading in the right direction. We weren't yet at the goal line, though.

We had quite a few discussions on ground control, NQA-1. Is it Q? Is it non-Q? Are the ribs Q? Are the rock bolts Q, et cetera. We had a lot of discussion on that. It was a good, healthy discussion, as discussions go. They wanted us to continue working that issue, and we are also very motivated to work that issue. It has a tremendous effect on the, again, the TSLC for the repository, or the total cost estimates for the repository.

The Board has indicated in their report that from an ESF, it's nearing completion, and so their ability to provide input that we could implement between now and bringing the machine out is becoming very limited, so they put a section in there that basically indicates that their ability to add more constructive data to the ESF may be limited.

They also indicated that they thought they would be able to participate effectively in some underground issues for the repository design.

With that, I like to bring photographs. A lot of people don't get to see the tunnel very often, so I do have just a couple of photographs if you want to adjust the lighting and see how these show up.

This is the thermal test alcove. I think I have another one that shows, actually, the Alpine Miner in operation, and, basically, the nice thing about a mechanical excavation is we can put a conveyor system which will actually bring the muck and put it up on the main conveyor, and that way you can go ahead and bring it out of the tunnel.

If you do a drill and blast evolution, you either have to crush the rubble and then put it on a conveyor, and with our silica issue, that'll make it more difficult for us, or you then have to use locomotive and trains to get it out of the tunnel itself, and then we have a lot of logistics issues, because we have to pull in a lot of materials to keep the TBM running, so those are the types of impacts we're trying to balance.

This is one of the modifications, or one of the things we did to try to work on the ventilation system. We separated up to the thermal test alcove. We've separated all of those alcoves, since there is no construction in those alcoves, we've separated them from the main fan line, so instead of having the main fan line remove or pull air out of those alcoves, basically, what we're doing now is, with a little fan, we're blowing the alcove air into the main tunnel itself, and then having the main ventilation system pull it all the way down to the TBM and exhaust it. If it's clean air, it's not a problem. That will allow us to put more air

ventilation on the TBM to try to get a better air flow down there.

We also are trying to improve the air flow at the thermal test alcove, so we've installed a fan for that alcove, and then we've got some dampers that we've installed recently to help balance that flow, and to try to diminish the positive pressure that we've got in the fan line in that area, also.

I'll go this one very quickly. It's just part of the scrubber unit that we installed on the thermal test alcove, and if these are in the right sequence--and they're not--this is a photograph of the north first Ghost Dance Fault access. This is where we brought the machine down. We brought the Alpine Miner out of the thermal test area, brought it down to here.

We wanted to check to make sure that the machine would function properly in this ground, in case we were able to procure a second Alpine Miner. We brought it down here and did a little over two meters, about two and a half meters on a Saturday--last Saturday, I believe it was.

It also help us because, as you're turning under the conveyor system here and the utilities, if you're drill and blasting, all of that has to be removed and has to be lifted aside and protected, so, mechanical excavation, it's easier for us to get in there, turn under, and then get back

out, and then turn the TBM back on on Monday, the following Monday.

Just another ventilation system. This is the scrubber here, and the center, the white portion, hooked up to the rest of it down there.

This is the one I wanted to show you. We've been adding a lot of dust control systems at the Alpine Miner to try to improve it, and that's actually what you would see. That's the fog system that we've got going down there, and you can see that here's the operator of the Alpine Miner. He's fairly much in a clear area. He is in a respirator, because there are still high silica level and Cristobalite issues, but, as you can see by this photograph, it shows quite clearly that we're trying to manage our dust issue very effectively, so we're keeping it in that area. We have some carry over into the main tunnel, but it's not nearly as bad as it has been in the past, or previous times.

With that, I'll end the presentation.

DR. CORDING: Thank you very much, Rick. We're close to being on schedule because of the early start. I know you had too tight a time frame here.

One point I thought was that, in looking at the ground, at least one visit I had, and talking with some of the people that are working there, I got the impression that we're not running through a lot of faults in the last several

thousand feet. We're principally hitting some cooling fractures, something like columnar joints that are kind of continuous vertically, locally, but not very laterally continuous, and causing kind of a very local effect around the TBM, but the fact that the steel legging goes in means that it takes more time to get the support up in some of those areas.

MR. CRAUN: And even though I didn't show it in the photographs, you can see that quite clearly, because, as they're excavating, you can see as you're facing the end of the tunnel, in the upper right-hand crown area and the lower left-hand floor area, you can see a lot of overbreak, overmining, et cetera.

DR. CORDING: Some of the other techniques you are using with the mesh, seeing that those might be feasible to be used throughout the section, maybe that would be one of the things that might help in production. Those sorts of things, I know, you're addressing.

Just one question, one more. Jared?

DR. COHON: Jared Cohon, Board.

Rich, you're forecasting these heater tests will start early. Is the intention to end them early as well, or to extend their duration?

MR. CRAUN: I'll leave part of that to Dennis. Some schedules, the start date and the end date are tied as

tightly, so I'll let Dennis--do you know the answer to that, Dennis? You'll talk about it in your presentation? Okay.

DR. CORDING: There's one other question. I'm violating my own statement.

Just one other question, though, is that if we had --the use of the road header in this rock is, you know, it's hard rock for road headers, even high capacity ones, or the boom-mounted cutters for the site alcoves, and that is taking a very long time to make that advance around and come around the corner, and if that type of equipment is used to go to the Ghost Dance, that also would be a very slow process, so I was just wondering how you were thinking of that.

MR. CRAUN: Well, right now, we're doing, typically, about 1.8 to 2.4-2.5 meters a day on the Alpine. One of the problems we had in the beginning on the Alpine Miner, if you look at from when we started the thermal test, it was an old machine, so we had a lot of down time, a lot of repair work that we had to put into it.

Of late, though, the production rate has been fairly consistent. We broke down again Monday, I believe. We broke the conveyor system on it. Again, I think that's more age. The machine itself is, I think, capable of doing the job. It's really the age of the machine that we've got that's causing the problems.

DR. CORDING: But that sort of rate over a drift to the Ghost Dance will take quite a bit of time. It is a slow rate.

MR. CRAUN: The impact of drill and blast, though, is quite significant. We're looking at, until you get far enough down in the Ghost Dance areas, we're looking at a two-hour evacuation period of time where we'll have to evacuate the tunnel. Those two hours, as you're aware of, there are TBM availability numbers and TBM utilization numbers. Right now, our machine is available approximately 20-some hours a day. Our utilization numbers are running around nine hours a day.

The concern is, is does that two hours--it obviously will erode both of those, but what percentage will go into the nine hours? And that's what our concern. That'll have a tremendous impact on the hole out date projections.

DR. CORDING: Did you have a quick question?

DR. LANGMUIR: Langmuir, Board.

I could probably do this with a slide rule if they existed anymore, but, at the end of one of your illustrations, it says, "Hole out, October, '96 - January, '97." Do those dates apply to the slow rates you're experiencing now with the TBM?

MR. CRAUN: Yes. The 17 to 24 bounds where we are.

DR. LANGMUIR: That does bound all the progress rates you've experienced?

MR. CRAUN: Yes. The only thing it doesn't consider would be the effect of a drill and blast operation, which will affect both the utilization and availability numbers. We have not completed the logistics analysis of the trains in the tunnel to find out whether or not we're going to have more than just the drill--if we have to go with the drill and blast, more than just the evacuation period. We may have a haulage issue that we have to work, so, right now, those numbers do not include that issue, those two issues, which would have a tendency to lower those numbers and extend the hole out date.

DR. CORDING: Okay, thanks very much, Rick.

Now, we're going to go to Dennis Williams, who will be making the presentation on the science program, the current results, and Dennis has been managing the science program for DOE.

MR. DENNIS WILLIAMS: Lynn Hoffman's going to flip the charts for me. Hopefully, we can go a little bit faster that way.

Dennis Williams. Update on the site investigations program. Basically, what we're going to run through is some of the things that have been happening with us. This is a little bit of an outline; ESF testing, thermal testing alcove

construction, a little bit on the thermal testing with some predictive calculations for the heater tests, moisture monitoring. We still have a surface-based program. I'll talk a little about G-2 aquifer test, the ongoing tracer testing in the C-Hole complex, pneumatic monitoring, and we recently put SD-7 into that instrumentation program of the pneumatic monitoring.

The geology part of the program, we're getting back some real good information; the detailed geologic mapping of the repository area on the surface. We went forward with some south ramp geologic predictions because the TBM did not stop at 39 + 40. They're rolling on, thankfully; a couple of comments on the probabilistic volcanic hazard assessment and how we're presenting that data to hand off to PA; a little bit on Min/Pet, some geochemistry.

In the hydrology, some of the stuff that's coming in on the apparent ages of fracture minerals, there's the Chlorine 36. We'll talk about that briefly, and an update on conceptual models.

It's a big package. It's kind of a Buscheck package, and it's kind of a Wendy Dixon or rapid fire presentation, so maybe we'll get through it.

On the alcove, you saw this from Rick. Basically, he began the excavation January 19th. We're up in the 16 meter area, thermomechanical alcove completed April 12th.

We've got the thermomechanical alcove extension. This was built so we could put instrumentation drillholes to go into the heater, which sets in this vicinity right here. We should turn that test on about August of '96, the observation drift going out to Station 130 meters--I won't do 1+30--make the turn for the connecting, and then back into the heated drift area; again, a start date on the testing there of August, '97.

One of the things that we were able to do at construction, while they were building the extension, we were actually drilling instrumentation holes coming in from this side from the observation drift, so those things are starting to click on the program out there.

Some temperature profiles, we'll real quick go to the colored versions of that, the simulations from Nick Francis. Temperature distributions at one year for 1 Darcy and 10 Darcy bulk permeability case, heater setting in here. The point of this diagram is perpendicular to the heater that sets at zero, one meter here on your vertical access, a meter on your horizontal access, the thermal contours of 200, 150, and 100° Celcius coming out from the heater right here, so 200, 150, 100 out here, and this is a temperature distribution prediction for one year on this particular test. That's that single element or thermomechanical heater.

Liquid saturation distributions. The chart here

from zero saturation to 100 per cent saturation; again, your vertical access, horizontal access based on one meter increments, the heater setting right here, the dry-out zone in blue, or the red as we're approaching saturation here, and the ambient setting out here at 70 per cent saturation.

Going on with more predictions from Tom Buscheck on the drift scale, I think the Board does have colored diagrams in there to help understand this a little bit better. These are basically time-phased, a half a year, one year, two years, and four years. The red is the dry-out. The blue is where we're condensing, with the heated drift setting here in the center, and we do run the timing out.

Basically, a conductive system here. We're showing more of a convective system, with the benefit of some of the geology going in here from a predictive standpoint. These are all based on a two-year prediction. We have high bulk permeability zones here, a single fracture zone that'll be intersecting the heated drift. Here we have multiple zones. Again, red is the dry-out. Blue is picking up the wetter than ambient condensation.

I'll tell you a couple interesting aspects here. You do see the condensation, even at the two year, possibly coming back into the drift, and if you look down here on the thermal contours, you'll see this 100° dropping back into the drift for both a single fracture zone and multiple fracture

zones.

ESF moisture study, something that we implemented this year: Objective to determine the amount of moisture removed by ventilation and muck as the TBM advances; basically, moisture removal from the rock. This will provide data for our thermohydrologic coupled processes model, and we'll have a report due in September of '96.

A little bit of the preliminary results from that, a scoping study in '95 showed that the ventilation air relative humidity increases from the portal to the TBM. We are removing quite a bit of water out of that tunnel. We've got LBL in there doing humidity measurements and infrared images, again, indicating the relative humidity increase on the weekends and towards the TBM.

We do have Alcove 3, which was bulkheaded off. We knew we had high humidity in there, and Alan Flint's been in there doing some flux measurements, and he has about one millimeter per day coming out of the columnar unit. That's basically the bottom of the Tiva, and about .25 millimeters per day from the vitric unit, which is the top of that PTn unit, the thermomechanical unit that we talk about a lot.

G-2 aquifer test, pumping up on the north end of the block to characterize large hydraulic gradient. We anticipated a ten-day test. We ran it to a 16-day test. We actually ended it on 4-27. We'll probably have about two

months recovery of the water-bearing zone there. Hopefully, it can tell us something about the perched water.

Under the old program, we did have two boreholes that were going in to evaluate the perched water. We're trying to get by with this.

C-Hole complex, we're conducting hydraulic and conservative tracers in that. We've completed two hydraulic tests and conservative tracer tests this past year, and we're getting set to start the reactive tracer tests probably-- well, either today, or at least sometime this week.

Just a little bit on what we see from that on the breakthrough curve, pumped almost eight million gallons of water, basically, 28 per cent of the total tracer recovered. Again, this was sodium iodide, a conservative tracer, you know, basically, just goes through there, does not sorb, so you have the most conservative indication of what's going on in the aquifer. Probably a little bit more than that tracer was recovered because there was probably a component that we didn't see just because of detection limits.

Pneumatic testing and monitoring, you've seen this diagram quite a bit before. We currently have eight boreholes that we're monitoring. We've got the two Nye County boreholes that are being monitored. They're still working for us under a grant configuration. We did get SD-7 put into the system. News from last time, SD-12, with the

permanent installation, did see the TBM 500 feet upstream from SD-12. It may have seen it out at 1100 feet.

SD-7, we did put a temporary instrumentation in it. It's called the SeaMist system. It's basically a borehole liner. You can put it in and pull it out. It has monitoring ports on it. We did the typical installation, where we basically tried to have the top monitor in the columnar unit, which basically monitors atmospheric, then you get the barrier of the PTn, which sets in this vicinity right in here, and then down in the middle nonlithophysal, which is the proposed repository horizon.

A little diagram of the SeaMist. Basically, that membrane that goes in the hole. You have ports for extraction and pressure monitoring. The results look quite similar to what we get with the permanent installation, so we were able to realize some cost savings by putting this one in the ground.

Geologic mapping. Central block geologic field mapping, this is something that the USGS are doing for us. We do have a pretty good map coming in on that, more precise locations of geologic structures on the surface. This will probably help us out on resolving the Chlorine 36 issue. This good surface map, compared to the good underground maps, gives us a good three-dimensional picture of what we're dealing with.

On the south ramp, the predictive geology, do have some very rough information that's gone in to the designers. Again, they're kind of pushing us to the limit because of the rate of advance of the TBM and changing the program on us, but we're feeling the ground will probably be difficult and several faults and breccia zones down on the south end, but no major structures at the south portal. So, if you can get to the south portal, you'll get it out okay, Rick.

Probabilistic volcanic hazard assessment, the final report delivered to the M&O, being reviewed; a mean aggregate probability of 1.5×10^{-8}, value very similar to that made by project scientists.

This is an example of some of the data that, or the style of data that will be handed off to PA. These kinds of things tend to leave the dirt geologists a little bit cold, but that's okay. If that's what we need, we'll get it.

Min/Pet, Min/Pet contributions to the near-field environment, that report came in and we'll be able to use this in discussing our alteration history and past mass transport. One of the things I wanted to say real quickly about things like this, the question was asked of Russ Dyer yesterday, "How do we keep the PIs on the program, the critical people on the program?"

Well, these programs last for a long time, and you're going to have people come in and out of them. I mean,

they're going to go on to bigger and better things. They're going to retire. You know, they might even die off, but one of the ways that we keep the continuity is to keep reports coming into this organization. We have to rely on the reports and the data. That's one of the reasons why Susan has put so much emphasis on synthesis reports, why we've put emphasis on getting information into the technical database. We had 350 deliverables in the scientific program in FY 95. This is how we maintain that continuity, and assure that government investment in this project.

Geochemistry. A lot of it revolves around the UZ flow and transport codes, so does the FEHM code. This past year, we added thermal effects to the model, the first simulations of the effect of heat on neptunium transport, and we did send that FEHM code up to the Canadians at AECL and had them do a review of it. They thought it was a good code for the intended purposes down here.

On the saturated zone side of that, we've completed the grid construction for GEOMESH, so we can get the geology into that, so consider the progress, Mike, that's been made in the modeling arena.

Hydrology, apparent ages of fracture minerals, the Chlorine 36, and maybe some update on some conceptual models quickly. Again, I think we all know the purpose, to further constrain the timing of percolation into the repository

horizon, and, of course, get this data out of the ESF. We had a report in from Paces of USGS, and one of the updates on that was a U-series apparent age of fracture fillings running from about 60 out to 400,000 years.

Isotope tracers, Chlorine 36, the purpose, to constrain the residence time of UZ water as a function of depth and structural features, continuing to collect data from the ESF. I won't go into too much on bomb pulse, Chlorine 36. It is derived from the atmospheric testing of nuclear weapons. We know if it's there, it had to get there within the last 40 or 50 years. All this is under our study plan, 8.3.1.2.2.2, which is water movement tracer tests. That's what we have in place. That's what we deal with.

Some of the first results coming out of this from the underground, we have the ESF stationary here on the lower axis, and the concentrations of the Chlorine 36 here on the vertical axis. You see some of the hits in the higher numbers, down here around 200 meters. We have some here in the 1200 meter range, 2,000 meters, 2600 meters, and 3500 meters.

If you go back and look at the details of the report on that, you'll see that this corresponds pretty well with the Bow Ridge Fault. This is in the imbricate fault zone. This is around the Drillhole Wash area. This is near the curve, and this is over close to the Sundance Fault.

As we looked at this information that was coming in, we kind of revisited the conceptual models, and I'll move on to the three model descriptions here in a minute, but three possible conceptual models for how the Chlorine 36 may get to repository horizon rocks, and this gives you a little bit of an idea of why some people were surprised, other people weren't surprised, you know, what was the organization's response to this, so I'll move to that real quick.

The top diagram up here is basically from Montazer and Wilson, and you see a major fault structure that may break the PTn, the infiltration comes through, it moves down the fault, and then goes out either as the fault plane, or is distributed in the vicinity of the fault plane as it moves down through the rock mass to the potential repository horizon. That's probably a pretty good picture for something like the Ghost Dance Fault.

Of course, that's one of the reasons why we're going to the Ghost Dance Fault, because many of us felt that we would see this kind of a situation, so when we move into the Ghost Dance Fault, we've got two alcoves planned. We'll do testing. We'll see whether or not it fits that particular model.

This particular model probably fits quite well at the Bow Ridge Fault. We don't have the PTn there, but we

have bomb pulse going down the fault plane, no big deal, so no surprise there.

Model B indicates some smaller fractures potentially running through the PTn. We have the infiltration. It has the lateral flow along the PTn, hits some of these potentially smaller fractures that may be throughgoing, moves on down those fracture systems lower in the section. This model was developed, in part, because of the bomb pulse hits that we got upstream of the Sundance Fault.

At the Sundance Fault, you don't have Chlorine 36 on the fault plane, but you have it on fractures upstream of that for something like 130 meters, so maybe it is more indicative of this type of a conceptual model.

We also considered the fact that we might have some irregularities on the PTn, some potential perching in some small areas. That increases your matrix saturation. Maybe you get a depth so high that it actually weeps through and then goes through down some fractures, so these are some of the concepts that we tossed out as we discussed the data results coming out of the Chlorine 36 report, and the next three pages are basically what I've told you in words.

To go to that Chlorine 36 strategy, basically, what are we doing? Basically, continuing our systematic and feature-based sampling in the ESF to test these conceptual

models. What are the biggies? The biggies are getting to the Ghost Dance Fault as fast as we possibly can. That's where we wanted to go a long time ago. We still want to get there.

We don't have our samples right now. We did have tests collected, but we don't have samples, analyses back from the PTn area of the tunnel. The PTn will help us determine which of these conceptual models is possibly the best, and understand some of the processes for how this stuff gets through the PTn and lower down into the repository.

Other isotopes to corroborate observations from Chlorine 36. As we saw once before, with regard to tritium, we didn't have any Chlorine 36 hits down there. You would really have a pretty good feel about this if you were getting, say, both Chlorine 36 and tritium at the same spot at the same time, so corroborating data helps us out a lot.

We need to do some work on constraining the amount of bomb pulse required to produce the observed ratios. This is a relatively new technique. It seems like it evolves a little every year, so we're continuing with that evolution, and, of course, testing these possible conceptual models with our UZ flow models.

There was one run in the report that Jim put out that had a model run on it. That was basically a three-day run at that particular model. There has to be a lot more

work done on that.

Conclusions. Obviously, a thermal testing alcove construction continues to progress. Our constructors are trying to do it faster and better, and make that thing work for us so we can get the testing started. Because they get done early and we start testing early doesn't mean we shut things off early. We have certain durations that we want to run these things. There's a lot of discussion about whether or not those durations are long enough.

One of the things that we've tried to do is make our predictions, and then periodically evaluate what we've done, and determine whether or not we shut the test off, or continue the test to run, and DOE is taking a very strong role in making sure that we don't shut tests off early.

G-2 and the C-Hole testing continues, geologic mapping being finalized. Again, I can't overemphasize the value of this type of mapping, the tunnel mapping for understanding things like Chlorine 36.

I was able to go into the tunnel with the geologists and go to the exact place where a sample was taken for Chlorine 36, and they had the fractures on the map that shows where it was located.

One of the things that was in that report, for the people who have read it, is the cooling joints, the syngenetic features, those things that you commonly think are

strata bound. Well, how did that Chlorine 36 get to that point? This has got to be a tortuous path to get there, but if you've got that information, if you know where the surface break is, if you know where it's at exactly in the tunnel, in what fractures, that's the three-dimensional geologic framework that you can figure out what's going on. You can understand the processes. It's not only the data hit, but it's the processes on how it got there.

Of course, the South Ramp geologic predictions, something you have to have. The probabilistic volcanic hazard assessment, and, again, getting that data in the form that can be used by PA. We've had a lot of discussions, as Abe has pointed out in the past. "Well, you guys don't exactly know what we need." Well, we have an idea of what we need from a field standpoint, but putting it in that form that those guys can use readily is a very important--that's where a lot of progress has been made on this program.

Fracture minerals, continuing to work on that; again, the people that are working on that, getting it down to picking off that very last surface, that youngest surface off of these fracture minerals, making a lot of progress in that, and the Chlorine 36 studies continue.

That's it.

DR. CORDING: Thank you very much, Dennis. I recognize that you had a lot to cover in a very short time. We really

appreciate your efforts on that, and the information presented.

Your approach in looking at the geologic mapping, correlating that with the Chlorine 36, finding the fractures, finding the faults, and then essentially fixing them by locating them underground and then seeing what happens across those features is such a key thing that I think that, to me, that is the reason we're down there, and that is why we're doing this work, to get across these major features, and I think that's so important, and what you're doing there, it seems that you're taking advantage of that facility to do what is just essential for this program.

We have time for several questions. I'll start with Don Langmuir.

DR. LANGMUIR: I probably shouldn't say this, but I'm very disappointed, not in you, Dennis, but in the fact that you didn't get twice as much time. We're down there to do the things you're talking about getting down, and, to me, this is a critical--I'm biased, obviously, but this is the purpose for the ESF, and the material was so abundant, and so quickly presented, that it was very tough, I think even for those of us who understood most of it, to think about it enough to have useful, constructive comments or questions.

One thing I would like to ask is, have you considered CFCs as an additional tracer when you look at your

Chlorine 36, chloroflourocarbon data? You're going to have it in stuff that's that young. It provides another insight into, perhaps, the quantities of water, as well as the times. These are new tracer ideas that have come out in the last decade or so, actually, or less than that; very constructive.

MR. DENNIS WILLIAMS: I personally haven't. Those types of questions, I think, are better directed to some of our PIs who work on this, who have the in-depth knowledge of the chemical tracers that could be used. I think if we want to follow up on this, we may have a little bit of a technical session, perhaps, where June Fabryka-Martin could come in and address some questions like that.

DR. LANGMUIR: One last thing. You had simulations of thermal tests. I noticed the title of the simulation was thermomechanical simulation, which tells me what I was arguing yesterday, that that's all you're going to learn.

MR. DENNIS WILLIAMS: I think the thermomechanical was the first one, the one that was for the single element heater, which was the thermomechanical, but the other one is the drift scale, which is more of a coupled test. It's got the hydrology component, and then, I think, a minor chemical component on it, so we may have--but let me look at the particular overhead to--we may have mis-called the drift scale.

DR. LANGMUIR: Well, maybe you went by it so fast, I

assumed it applied to the next two or three.

MR. DENNIS WILLIAMS: Okay.

DR. LANGMUIR: Actually, I'm looking at Buscheck's simulations here, and he's showing us what we're calling the born loser problem, where you've got the heater on a fracture, and he's got four fractures, or five fractures with water flowing back down in the fractures.

MR. DENNIS WILLIAMS: Yes.

DR. LANGMUIR: Maybe we can talk about this later, but I would assume that the intent would be not to put a waste package in a place such as you've modeled, with these reflection effects.

MR. DENNIS WILLIAMS: Well, this is a prediction for a specific geologic condition. We will, hopefully, understand the geologic condition that we're dealing with as we get into that thermal alcove, because we will be mapping along the observation drift as we get there, and then we will map in detail the test bed as well.

I would hope, at that time--and what I would be driving for is to take that actual geology, and then have Tom run through a simulation based on that actual geology, which will be, you know, a more pertinent prediction, and possibly give us a better result, but I agree that this is probably one of the worst case situations that he has modeled here, but I think we have to consider a worst case situation.

That's in the spectrum of possibilities.

DR. CORDING: John Cantlon.

DR. CANTLON: Dennis, John Cantlon, Board.

A couple of questions. One, yesterday, I asked some of the earlier speakers the extent to which some of the investigators were actually involved in the details of the synthesis, and so on. We picked up signals that some of the investigators were really not very aware of the attempt at synthesis, and so on.

Could you give us some kind of a feeling of your own perception of how far down in the investigator mix this move towards synthesis and coordination, integration, how widely it's perceived, how well they're on board, that sort of thing?

MR. DENNIS WILLIAMS: Well, I don't know for sure whether you ever know absolutely whether someone is philosophically on board with you or not, but I know that both DOE and the M&O, under Tom Statton, for scientific programs, has made a concerted effort to have a lot of discussions with these folks.

I know that we've been with the lab leads on several occasions, talking about our desire to synthesize this program, to put it into these reports, to put it into the database, to put it into the information that will last forever, regardless of whether or not we have PIs, or other

people, you know, the long-term people on the program.

I know that there was some concern in the 250 declining case because it looked like the program was going to be shut down before we got to license application. Probably some of that boiled over into this.

We've made a lot of efforts to get information out to these people that our desire is to synthesize this information, to come to closure on it, to collect up the data, to do something with it, but, again, you never know for sure how effective all those efforts are until you starting getting an actual report in hand. Those reports will be coming in this year. Maybe it'll give us a first indication of whether or not we're successful.

DR. CANTLON: Now, a related question; that is, that you have groups of people who object to using the waste isolation strategy as the primary synthesis. Could you illuminate a little bit what the alternative would be as a means of synthesis or involvement of the data sets?

MR. DENNIS WILLIAMS: My feel is that there's not really an objection to the waste isolation strategy as being a driving force for synthesis, or for how you drive the program. I think most of the objections come in some of the details of some of the emphasis.

A lot of people have a problem with relying on an engineered barrier. I worked in the dam business for many,

many years. I realize the interrelationship between the natural system and the engineered system. You have to have both to make it work. That's a little bit of my perspective.

I'm not from that strong regulatory environment of years ago where it had to be, basically, the rock mass. You couldn't use the engineered barrier to accommodate a poor mountain. I don't think it's a matter of accommodating a poor mountain. I think it's a matter of multiple defenses, multiple barriers doing the best economically to take advantage of both your natural system and your engineered system.

DR. CANTLON: Thank you.

DR. CORDING: Pat Domenico.

DR. DOMENICO: I'm looking at the tracer information on the conservative tracer. Is that test still going? It started February 13th. Are they still pumping, or did they terminate that test?

MR. DENNIS WILLIAMS: No, we terminated the one on the conservative test.

DR. DOMENICO: Did anybody say anything about the very low rate of mass recovery, 28 per cent? Did that bother anybody? Where did the other 72 per cent go?

MR. DENNIS WILLIAMS: Maybe that's dispersion.

DR. DOMENICO: No, dispersion doesn't destroy mass, no.

MR. DENNIS WILLIAMS: It went somewhere. We don't know

for sure where it went.

DR. DOMENICO: Well, see, if you try to use this to prove a dilution case, which I presume that's why we'd use a conservative tracer, it'd be pretty difficult to try to prove dilution with a 28 per cent recovery of the total mass.

MR. DENNIS WILLIAMS: Let me put it a little differently. I, personally, don't know where it went, but the people that are working on this are trying to determine, you know, what we've got down there, the results of this test. We basically shut the test down here a couple weeks ago. They're analyzing the data.

DR. DOMENICO: Oh, okay. Thank you, then.

DR. CORDING: Jared Cohon.

DR. COHON: Cohon, Board.

I'd like to follow up on John Cantlon's first question about synthesis, and the role of science. It was I who, in a burst of enthusiasm at the end of yesterday's session, said how impressed I was at how DOE was getting its act together, and it was very promising, I think. We saw signs of pieces being pulled together, a clear strategy starting to evolve.

One thing that's clear, however, is that the success of this strategy will rest, to a very great extent, on the extent to which it can be based on good science, and the continuing role of scientists in the implementation of

the strategy.

I was a little bit worried by your response to Don Langmuir's question about his suggestion about CFCs, and I think your response was, "Well, that's better taken up with the PIs," and that seems to me to be exactly counter to the kind of pull together strategy that we were talking about yesterday; that is, if a good idea emerges, or maybe a bad idea, but a new creative idea about how to get at what is viewed as a key issue--we know it to be a key issue from TSPA--then, it would seem to me that the program ought to be sending that down to the PIs, and there ought to be some mechanism to make sure that idea is either dismissed or taken up. But the days of, "Well, let's see if the PIs want to do it," I think, are behind us.

MR. DENNIS WILLIAMS: Well, a little bit of my reluctance to discuss it is basically because I'm not a geochemist, and when you start talking about the details of something like this, you're going to leave me in the dark real, real fast, and when we get into those kind of discussions, I would like to have the PI, or the investigator, whoever is the knowledgeable person, possibly a geochemist from my staff to discuss the details of whether or not that's a valid approach.

But, if we determine that it's a valid approach, then it's not up to the PI to say, "Hey, we're going to

pursue this." It's DOE that's going to give the direction to pursue this, so does that explanation give you a little more comfort on how we work?

DR. COHON: Yes.

MR. DENNIS WILLIAMS: Okay. Thank you.

DR. CORDING: Dennis, Ed Cording, Board.

I'm pleased to see that the humidity tests controlled humidity so you can look at the flux. Do you feel that you're able to get a feel for the flux in those areas where you're controlling the humidity in the ESF?

MR. DENNIS WILLIAMS: Well, again, I go by the confidence that was expressed by the work that's coming out of Alan in Alcove No. 3. I mean, we knew that that alcove had high humidity in it practically two days after we excavated it, and that was one of the reasons for bulkheading that thing off, is to preserve that moisture, and his tests are being run in the actually bulkheaded-off alcove, so, you know, basically, that's how the program's set up. That's what we're trying to do.

We've also got Berkeley in there doing thermal scans, I believe it is, from the portal up to the TBM to see, you know, what are we doing to the humidity in that mountain, or in the mountain, due to the excavation.

DR. CORDING: Some thermal sensing?

MR. DENNIS WILLIAMS: Yes.

DR. CORDING: For temperature differences?

MR. DENNIS WILLIAMS: Right.

DR. CORDING: It seems to me that's an area that should be part of--it's really an important area, in addition to the isotope studies, of trying to identify what's happening where you can control humidity or can pick up what's happening in the flow system there, and I was just interested, and maybe we can talk in the future here about your other plans on the rest of the drifts.

And, of course, humidity control and moisture measurement in the thermal facilities is going to be very important, and I think that's another topic we'd like to hear more about your progress there at some point.

MR. DENNIS WILLIAMS: Right, and the original package on the presentation had a half a dozen slides on that moisture monitoring, but, again, we were trying to cover a multitude of things in, originally, a 15-minute time frame. It just wouldn't work, and it doesn't work well.

DR. CORDING: And you got five more minutes, and I gave you some minute at the expense of the rest of the day, but I think it's very important, and I thank you very much.

Are there any other Board comments?

DR. LANGMUIR: Dennis, I appreciate that it's all very fast, the Chlorine 36 insights that you gained in the tunnel recently. You proposed three possible models to explain what

was being observed with Chlorine 36, and my question is:

How could you resolve which of those three models was the correct one, and if you were to, what does this do to performance assessment? To what extent will this impact the, perhaps the suitability of the mountain for understanding of the distribution of infiltration in the mountain, if you did learn which of these models was the correct one, and how are you going to try to do that?

MR. DENNIS WILLIAMS: Okay. I'd like to bail into a little bit how we're going to try to deal with that. I feel that probably a critical part of that is the PTn, looking at the contact of the PTn. Again, we have samples from that, but we don't have those analyses back yet.

Furthermore, when we go into the tunnel and look right below the PTn, we see some rather large structures in the welded tuffs below the PTn going up, and apparently going into the PTn. I think we need to look at that very closely to see whether or not we've got bomb pulse coming down those types of throughgoing fractures.

But, the basic objective is to understand the processes for how this is taking place. I mean, do you have --we probably have Chlorine 36 bomb pulse at the top of the PTn. What's it coming through on? Is it coming through on big fractures? Is it coming through on small fractures?

If it's coming through on large fractures, like

faults, what happens after it gets through the PTn? I mean, is it staying on the fault plane? Well, this isn't the setting that we have at the Sundance. Apparently, it didn't stay on the fault plane if it came through on that particular feature. We have it upstation for 130 meters.

If we look at the Bow Ridge Fault, and if we had, say, Chlorine 36 on smaller fractures upstream of the Bow Ridge Fault plane, maybe that's telling us that the Chlorine 36 is actually coming through the fault plane, and then going down a lot of other fractures, basically, upstream in the hanger wall block.

So, if we can get an understanding of why this happens the way it does, then we can give that picture to PA, and then Abe, who is standing up, appropriately, can take it from there.

DR. LANGMUIR: Basically, rephrasing my question, how are you going to find it out?

MR. DENNIS WILLIAMS: How are we going to find it out?

DR. LANGMUIR: How are you going to find out what's going on? You've elaborated on my question, really, with more detail.

MR. DENNIS WILLIAMS: Well, the way we find out most things in geology. We do the mapping, we collect the samples, we analyze them, we put the picture together, and then we come up with an interpretation of what's going on.

DR. LANGMUIR: Is this planned?

MR. DENNIS WILLIAMS: Yes, it is. As I pointed out, I mean, this was originally planned in the water tracer test study plan, 8.3.1.2.2.2, and that was planned. We're elaborating on it now because of what we've seen with Chlorine 36.

Abe?

DR. VAN LUIK: This is Abe Van Luik, DOE.

I think it would be appropriate to say--and I tried to say this yesterday--that we're going to do an honest evaluation of this mountain, and the Chlorine 36 issue, at this point, is unsettled. There are multiple conceptual models being considered. We trust that the site program will come up with a correct interpretation, or interpretations. It may be that at different locations, different conceptual models need to be invoked.

It complicates our lives considerably in performance assessment, because we will have to do a more detailed modeling of transport in the unsaturated zone than perhaps we would have done had the equivalent continuum model been sufficient.

Whether or not this is a pervasive problem, or a localized problem, I think, is still to be decided, and whether or not it will have performance impacts that are serious is still to be decided. Performance assessment

can't, a priori, say this is a non-problem; however, we are optimistic that what we are seeing is, one, localized, and, two, represents a very small volume fraction of the total water in the unsaturated zone, and if that remains the case, I think it becomes a very minor problem. It just complicates our modeling.

DR. CORDING: Okay, thank you very much.

Vic Palciauskas, staff.

DR. PALCIAUSKAS: Vic Palciauskas.

Most of the measurements, of course, in the ESF are running parallel to the Ghost Dance Fault, and that means, basically, it's very difficult to tell which of the models, A, B, or C, is really operative.

Now, the two alcoves into the Ghost Dance Fault will basically say something about whether Model A is operative or not. It would seem to me that the logical thing to do is go perpendicular to the ESF, perhaps westward, and see whether you do find bomb pulse Chlorine 36 going away from the Ghost Dance Fault. This would give you some information on whether Models B or C are operative.

Do you agree with that?

MR. DENNIS WILLIAMS: I don't necessarily agree with that, because as we go back to the east, where we are finding bomb pulse on smaller fractures, not associated with larger faults, I mean, it's there. We have the data hits right now,

so I'm more inclined to look towards what is above us, to look towards the PTn to try to understand what's going on.

DR. PALCIAUSKAS: How will you get a distribution or the density of locations of the bomb pulse Chlorine 36, whether it's coming down in a--I guess my question, or my statement is the following:

The model that was conceptually used was basically Model A over the last year.

MR. DENNIS WILLIAMS: That's correct.

DR. PALCIAUSKAS: And now you see that it's more pervasive. You have to sort of set a limit to how perverse the Chlorine 36 distribution is, and the only way, it seems to me, would be to go and see how it is perpendicular to the Ghost Dance Fault across the block.

MR. DENNIS WILLIAMS: Okay. Well, as we go into--as we build the alcoves into the Ghost Dance Fault, we will be going perpendicular to the Ghost Dance Fault for those particular intervals, so we will be looking at the rock perpendicular to the Ghost Dance Fault.

DR. PALCIAUSKAS: Over a very short interval, though.

MR. DENNIS WILLIAMS: You know, a matter of a couple hundred meters.

DR. CORDING: Thank you. We're going to need to go on. Thank you very much, Dennis; appreciate it.

MR. DENNIS WILLIAMS: You're welcome.

DR. CORDING: We're going on now with James Carlson, and he's the Director of the Systems Engineering Division of OCRWM, and will be making his presentation on program integration.

MR. CARLSON: I'm going to switch gears considerably from the previous presentations. Mine's a very general process presentation, talking about integration at the program level.

When I started into this, I think you've heard a lot of the material I'm going to cover, and I'm going to try to pick up some schedule by running through fairly fast.

There are several points I want to start out with, is when I started into this, Woody contacted me in November about this presentation. I was a little bit at a loss as to how to present program integration to this group, who focuses primarily on the technical aspects of the program, and I think Bill Barnard gave me a suggestion. He said, "Focus in on the communication between the program, between the projects, and how that's achieved within the bureaucracy that we work in in Washington."

I'll also try to talk a little bit about how moving into the electronic age, or the electronic communications age has helped us in program integration, some of the specific formal integration mechanisms, and some of the informal communications that go on, and, finally, I'm going to sort of

repeat a little bit, or generalize on what Russ Dyer and Lake Barrett said about the program's gone through a lot of change over the years. Right now, I think I'm the longest employee in Washington with regard to the program. I've watched the policy changes. I've watched the funding changes. We've moved through a lot of management, a lot of organizations.

Lake and Russ tapped on this, but it also has forced us to try to integrate more fully to keep the projects moving forward, in spite and consistent with these changes.

I borrowed this slide from Russ Dyer yesterday, just to focus in on where we sit, and we're up at that program box up at the top corner, where the interfaces come in, where we interface with the projects with regard to ensuring consistent policy across the program.

We also would have a similar box, a little different content inside, for the organization that Dwight Shelor represents, where he talks about the waste acceptance transportation and storage.

The program organization, which I'll get to in the next slide, does a lot of interaction with the external parties. The organization I'm with is in the upper left-hand corner, the Office of Program Management and Integration. We have four divisions. The two organizations at the bottom are the business centers for the program. They're actually responsible for implementing the work and implementing the

program.

One of the key activities or key things going on within our office and within the entire management organization up at the top is where this Congress and this administration is streamlining government and trying to work to reduce the overhead, so we can get more resources out to folks like Dennis and the people you heard from yesterday to actually implement the project, so we're doing a lot of work to try to cut back the overhead of the program.

I'm going to walk through the integration activities, primarily by discussing what each division does. Before I get into that, the one that I don't have a slide on is the regulatory integration group, which is a rather small group that works on developing the consistent policies for the program with regard to dealing with the Nuclear Regulatory Commission, the EPA standard. There's a lot of coordinators, a lot of senior policy involvement in those areas.

Also, Alan Brownstein, who works with that group, did participate in the broad integrative planning effort that you heard about yesterday for the Yucca Mountain Project, so there is integration between the headquarters organization, particularly in the heavy policy areas. There is extensive integration.

The planning division has several key functions;

the strategic planning, which serves to integrate the program, sort of develops our overall goals. This was, I think, new to the--I don't know if it was new to the program, but it became much more important with this last administration.

Hazel O'Leary is very key on strategic planning, mission definition. Dr. Dreyfus, I believe, had five separate strategic planning sessions where he brought his senior managers in shortly after he came on board to make sure everybody was, to use one of Lake's terms, singing from the same song sheet; that there was program-wide agreement on our missions, our goals, and I think he presented it to the Board shortly after it was closed on. He presented it in Congressional testimony and budget formulation.

The next level down is the program plan, and this was, I think, the initial one was either late '94 or early '95. The Board certainly had a number of briefings on the program plan. This program plan, for me, was sort of a major step forward in the program, because it was a long time since I'd seen the cost profile and the anticipated funding brought in sync with what the program can expect to accomplish, and this sort of served as a multi-year guide for the program to lay out what the activities were.

We recently have gone through the revision of this, as Lake indicated. It should be out next week, and the

revised program plan, I think, recognizes how the environment has changed from a public policy viewpoint in the expectations and funding, as well as looking at it--and Dwight will talk about some of the new initiatives in waste acceptance and storage and transportation area, to try to bring the program, again, within the expectations of the external constituencies, and the anticipated funding that we might see coming from the Congress, trying to keep it to meet those competing needs.

The third plan is one that's sort of key to all the managers on this program. It's the annual work plan, which is developed each year, and, basically, it's the agreement between the program director and the project managers on what work scope will be accomplished during that year.

The annual work is a controlled document. I'll use a lot of terms that you've heard over the last two days, so I'll try to move quickly through this.

Another key integrating activity are the scheduled meetings, planning and performance reviews. One very key integrating activity is one that you folks can be very proud of. Preparing for TRB meetings is a very integrating experience. We put in a lot of time to make sure that things fit together. We learn a lot during that process.

There are also staff meetings. The Director has a weekly staff meeting that has, certainly, all the

headquarters division directors, and officer managers participate, where he and the Yucca Mountain folks are tied in through a speaker phone. He reports on what's going on at the top levels of the agency to the staff. The division directors or office directors report on issues and current status of activities.

The annual plan review, as I mentioned earlier, the annual plan is the contact between the Director's office, Lake and Dan, and the individual projects, and the office directors in headquarters on what they're planning to accomplish during that year, the work scope. This is baseline and control documents, where changes that exceed certain thresholds are reviewed at the Director's level, and approved. Changes at the lower levels are reviewed with the project managers. Impacts are considered, and decisions made on proceeding.

Also, we have a mid-year review, where the Director again reviews how we're doing against the annual work plan, particularly in the resource area, to ensure that, you know, if something's come up, whether we have resources available to reapply. I think Rick Craun's discussion of the TBM operation is a good example of the kind of issues that do come up, where there is considerable discussion of what our funds profile looks like, and whether we can afford to proceed with those changes, and, as he said, they're trying

to work it at the project level at the moment.

Finally, every two months, we have a Director's program review, where the individual project managers, and, often, the assistant managers report in their particular areas to the Director as to their progress against the work plan, identify the issues that have come up, discuss status of changes that have been made, and pending changes.

We also find that document review serves to integrate the program; also, document preparation. The term integrated product teams came up in a number of presentations yesterday. This is the way that we've tried to approach most of these activities.

The development of the three plans that I mentioned earlier, these were developed with integrated teams. Often, an initial cut will be made by the headquarters staff or the headquarters support contractor. Then they go out to the projects for input and discussion, and, at other times, the input is developed at the project and sent back and integrated within the headquarters organization to ensure consistency.

The annual budget preparation is accomplished in the same manner. It involves an integrated activity across the program.

The speeches, a lot of the policy is articulated through the speeches that Dr. Dreyfus or Lake will make to

various organizations, including the Board, the NRC testimony, the hearings on the hill. These are all, again, integrated throughout the program for review, and in the preparation to ensure that we do have a consistent approach to these activities.

Finally, as I mentioned, the testimony. One of the areas where we're getting a lot more utilization of the electronic media is we now have a, I'll almost call it a policy baseline available on our machines that includes the latest speeches, the latest response to Congressional questions and answers, that will give the members, or the program participants a instant view of where the policy stands, to ensure we're working in a consistent manner.

I'm going to focus a little more on the technical integration now. We have a number of what I've called integrating technical, or descriptive documents. I think synthesis documents is probably a better word that I heard used just a minute or two ago.

At the program level, we have a total program description, and a concept of operations, where we articulate how the system will work from receipt at the reactors, to the ultimate disposal. The sections of this report that involve the repository are prepared through these integrated project teams with repository people, and the sections that involve the waste acceptance and transport are worked through the

Office of Waste Acceptance, Storage, and Transportation.

The same sort of descripter, I think, can apply to the waste isolation strategy, where these are somewhat umbrella documents that characterize the entire system, or how it works, and allows the actual participants and the folks doing the work to see how it fits together.

There are other areas where similar activities are going on, and one is the criticality area, where the M&O has a working group that is looking at the issue of criticality and developing a strategy and approach for dealing with that.

I think you've heard, in the last two days, a lot about controlled baselines, and I think Rick referred to CRs, which are change requests. I like to group them into two sets of controlled baselines. One is the technical requirements baseline, which is a compilation of the appropriate regulations and the technical or the policy decisions that have gone into defining the overall program in the Civilian Radioactive Waste Management system.

This is subject to change control at the various Board levels. At this particular point, this is a very detailed and, in my view, a very cumbersome set of requirements documents, or a suite of documents, and we're now working to try to better streamline the way we manage this so that the projects are able--or so we can address change, as it comes, more effectively, and the business

centers have more control and more direct involvement in how they manage their requirements they need to meet.

The other controlled baseline is the annual work plan, which incorporates the work scope, the technical activities that will be performed, and the cost and schedule. This is the baseline that we tend to manage against, and the change process deals with when we need to move funds, or we change the scope of the activities.

I think, yesterday, several people talked about change management. The change management process basically deals with changes in the approved baseline. Level 1 baseline changes are approved by the Director or the Deputy Director. The Board at the Level 1, or the program level, consists of the office directors and the business center managers.

We also have a provision for other impacted parties to participate in Board meetings on these issues. One of the ones that I'll mention in a few minutes, we are going to have--EMs been involved in review of the decisions, since it involves the disposition of DOE-owned spent fuel, for which they are the custodian.

The actual Board-proposed changes are evaluated by all elements of the program, and such issues as technical, quality assurance, health and safety, design interface, regulatory, environmental impacts, construction, waste

isolation, scientific investigations, especially engineering, cost, total estimated cost, total project cost, total system life cycle cost are all analyzed and fed into the change requests so that the Board can look at the impacts of the proposed change.

The other thing that I should mention, and I think Dennis Royer talked about it yesterday, are the systems studies are performed to develop some of the information for these changes as they come forward.

Some of the more recent program level board changes that have been processed in this fiscal year, there are two changes associated with the MPC and, basically, the impacts of the appropriation on our work in that area. We are also, right now, processing one on incorporating the DOE spent fuel into our technical baseline. This is one where the Office of Environmental Management within the Department do participate with us. We've worked very closely with them on this change, and they actually comment on the proposed changed, and will, if we have a Board meeting and discussions, they will sit in and participate.

The final one that's coming up is baselining the annual work plan so we have that under formal change control process.

This is just a dated slide that talks about, to give you a feel for how these particular changes are

implemented, this is a directive of actions that came out of a MPC policy change, and this is looking at moving us away from a federally-developed multi-purpose canister system. I won't go through it. It is somewhat similar to some of the things you saw yesterday, where the forecast date, and the date assigned, and the responsible party are all identified with a specific action that comes out of the change.

The last area of technical integration we've talked about is the interface management activities, and this, we had two activities that are ongoing. We have an interface control working group, which is--I think I'm the designated chair, but involves representatives from all the engineering design organizations within the program, and we basically look to ensure that the interfaces, the physical interfaces between the various parts of the system do interface correctly; that what we ultimately end up with will fit and operate efficiently.

We had been meeting regularly. We haven't met since the last round of budgets, while we're re-looking at the role and the level of activity. Basically, the responsibility for the interfaces in ensuring that they fit does rest with the implementing organizations. This group mainly serves as a facilitator, sort of an oversight function, and what we want to encourage and push for is that the design teams, when they are working in areas where they

have a common interface, do coordinate.

There's been a lot of that going on with the MPC. I think the waste package people who work for Rick Craun have worked very closely with the design people, who were supporting to Jeff Williams, or doing the effort for Jeff Williams on the multi-purpose canister.

There are other areas where there's ongoing interface between the projects. The actual design activities for the handling facilities, I believe the design team that had worked on some of the interim storage designs, conceptual designs, worked with the designers on the waste facility, and now, as they're going into this TSAR effort that Lake mentioned, there's interface back where the design work that had been done for the advanced conceptual design is being fed back to the design organizations who are supporting the interim storage facility work.

The last area that I'll mention will be the external integration, and I mentioned earlier, there's a lot that has to do with NRC, EPA. Certainly, there's a great deal of external integration with the Congress and the different staffs of the committees that is handled out of the Director's office.

We do a lot of external integration with the other elements of the Department of Energy with regard to the disposition of their waste. In the high-level waste areas,

we've had a standing group that meets periodically with the producers to ensure that the waste products are consistent with our requirements. I believe Steve and others have briefed you on this in the past.

We also have a DOE spent nuclear fuel working group, which has, again, been approached through a product team approach, or an integrated product team, I guess we'll call it, where we've had myself and Steve, and representatives from the waste acceptance side and the repository side working with the individuals who are the custodians of this material to identify the near-term issues, and to propose a path forward to integrate this into our program. This baseline change proposal, I think, is the next step in that process.

And, finally, there are other materials, and, with that, I'll sort of close, since Steve will cover that in his presentation. I'm sorry that was so fast, but I, hopefully, got us a little bit back on schedule.

DR. CORDING: Thank you.

We have time for just, perhaps, one or two questions. Yes; John Cantlon.

DR. CANTLON: In your Overhead No. 7, where you address technical integration, could you illustrate for us the way those four bullets might accommodate a waste isolation strategy integrating principle? In other words, here you've

got a theme, a way in which you're trying to make a coherent system that actually works to do the job you're assigned to do. How does your bureaucracy, which is what you're looking at, how does the bureaucracy now accommodate that challenge?

MR. CARLSON: For the waste isolation strategy, I'd almost prefer to turn a response over to someone like Dr. Dyer, but I will talk from my perspective--

DR. CANTLON: We heard his yesterday. We want to hear how the bureaucracy responds to that challenge.

MR. CARLSON: Now, within the--are you ready to jump in, or are you going to let me take a shot at it?

(Laughter.)

MR. CARLSON: The waste isolation strategy itself has, the earlier drafts have been circulated back within the program. Certainly, the regulatory integration group is taking a hard look at it to make sure that we're consistent in our regulatory approach, and the approach reflected in that policy.

My staff, who has experience in those areas, has looked at it, some of the contractors who support me, to make sure there's nothing in there that's inconsistent with our view on the policy. Now, when we get into the technical details, we don't have the, call it the horsepower to get into that.

The document is--and this, I don't believe it is

baselined, but it does become controlled. It's the--such as this concept of operations in this total system description, it's not something that's submitted through formal control, but it's approved by the Director, and you don't change it without it going through an extensive review. It's not something that I could go and change, and say, "Well, this week, I don't think this is the appropriate way to go."

I believe the waste isolation strategy, when the--I can't be sure I characterize them right, but when the negotiations are finished and we have a good consensus on it, will fit into that mold. It's not something, given the work that's gone into getting the agreement, that can be changed simply, so it does serve somewhat of a function of a controlled baseline for the program, and it certainly does serve to define the interfaces, and try to tie them together within the structure of the scientific programs, the PA, as Abe described it, and the work that Rick Craun's trying to do on these horrendous schedules that he's facing.

Does that help at all, or am I--

DR. CANTLON: Well, having spent 25 years as part of a bureaucracy, I know that bureaucracies can be facilitators, or they can impede synthesis of this type, and I guess what I was trying to find from you is, is there a real commitment on the part of the bureaucracy to facilitate this synthesis, which has been one of the weak points of the program almost

from the beginning, the lack of synthesis and coherence around the real final objectives.

Early on, you heard the Board criticize the program a being regulatory oriented rather than a gestalt, looking at the gestalt of the challenge, because it's a prototype problem, and if you're just simply addressing the way the regs are put together, and the question is, can a bureaucracy as old and as entrenched as DOE accommodate this kind of a challenge to come at it, and I was trying to find from the core, the heart of the bureaucracy, whether that's taken to heart now.

MR. CARLSON: Yes, it's taken to heart, and, as I've said, I have the fortune or misfortune of being the longest surviving federal employee at headquarters on this program, and there has been sharp change, and there has been a lot of refocusing and re-looking, as you say, at the overall picture, and rather than a very strict focus on regulatory interpretation, but more of a look at how this system is going to behave and perform, and does that provide us adequate safety, which is, I think, the question that you were driving at, yes.

DR. CANTLON: Thank you.

DR. CORDING: Dennis Price, Board consultant.

DR. PRICE: This may be the chance to ask something that I've really been curious about. Bless Bess, where is TESS?

TRW, I haven't heard the words yesterday or today, and I would think, in program integration and talking about communication, and so forth, that--this is one question. I've got another question later--that, certainly, TRW is supposed to be integrating the program, program integrator, and what's going on there?

MR. CARLSON: Okay. If I didn't call them out specifically, most of these integrated product teams that were talked about are composed almost entirely of contractor individuals. Now, the DOE spent fuel working group or product team are feds, but the systems study that Rick Memory mentioned yesterday, which did include program systems engineering people, people from the waste acceptance group, those folks are all the M&O contractors.

The integrated criticality planning team--and that was an offshoot of one of the more, I thought, very good activities that came out of the early MPC work, where they formed program integrating groups within the M&O to address common issues. Now, these became known, affectionately, as PIGs, but they've continued to stay on and function within the areas of criticality.

I think, as I said, the thermal loading study, the M&O is in the middle of all of these things that I've described. They are very involved, certainly, in the requirements documents, the documents maintenance, the

baseline change. The Level 3 Board is the contractor board at the--within the M&O.

I believe the interface management within the project at this point has entirely been assigned to the M&O, so they are in there in a very active, integrating role.

DR. PRICE: Well, just as someone who was actively involved in the program and then stepped out for a little while and then came back, it really struck me that there's a difference in visibility of the M&O, and we're on program integration, and so I would have expected more visibility.

MR. CARLSON: Yeah. I think one of the differences has been that I think this briefing for the Board or this session was very much set up for the federal staff and the managers to get up and talk about their integrated planning, their integrated activities, so this one--and you are correct, there has been much more of a focus on the federal involvement.

DR. PRICE: And the second question I've got, speaking of program integration, and talking about the program moving into the production mode, didn't notice anything in the presentation about the integration of the design disciplines, and so forth, the human factors, system safety, reliability, maintainability, systems engineering kinds of things, and how they're integrated into what is really going on in the program.

MR. CARLSON: Rick, would you like to address that one?]

MR. CRAUN: This is Richard Craun, DOE.

I think at the level that we've presented, you're right, we did not really address the internal engineering integration, starting from the systems, the layout of the structures, and those issues, the integration between one organizational element and another.

Those activities are there. You know, we can more than easily bring forward discussion in those areas. A lot of activity is taking place. Again, a lot of that is being tied together with the schedule that we're trying to drive down into those levels so that we can identify at what point do we need the system descriptions defined, and then how do those drive the general specifications for those systems, so a lot of that activity Paul Harrington, yesterday, touched on briefly, but there's a lot more of that taking place, especially as we're shifting into more of, as I tried to explain yesterday, a production mode, to actually start producing the design itself, and producing all of the information necessary to go into either a license application or construction.

So, that does exist. It is available, and we'd be more than willing to talk about it.

DR. CORDING: Thank you very much; appreciate it.

We're going to have our break now. We'll take a

break for about 14 minutes. We're going to pick up a minute on the break. If you would, be back promptly, and then we are going to continue with the rest of these presentations.

We'll probably be going to lunch a few minutes late if we can't completely catch up. We'll reconvene at 10:25.

(Whereupon, a brief recess was taken.)

DR. CORDING: We have three more presentations before the lunch break, and the next one is Steven Gomberg's on other material that may be destined for geologic disposal. Dwight Shelor will also be talking, and then Lake Barrett will be giving us a wrapup before lunch, so we look forward to all that, and, please, Mr. Gomberg.

MR. GOMBERG: Okay, thank you.

I wanted to thank the Board for the opportunity to present this update on work in progress. It's a very top-level integration activity that we have been doing to work with the other materials that may require geologic disposal.

As Dr. Dyer pointed out yesterday, something, I think, that I've always tried to take to heart, that is that integration is everyone's job, and, certainly, that's true, and we've had a lot of good integration and work from the DOE and the M&O people.

I wanted to point out some special integrators who have really facilitated the progress that we've made. Diane Harrison, from Yucca Mountain Project, I told her I would

embarrass her somehow today, and Christine Sfinike from the Office of Waste Acceptance, Storage and Transportation.

I've tried to put this in a format. The first part of the presentation will be general, generic information or process for being able to evaluate any waste form for ultimate incorporation into the program, and then I'll talk specifically about four of the potential nuclear materials that are being evaluated to some degree within the program for possible inclusion.

Why are we doing this? Certainly, the OCRWM Strategic Plan identifies two key goals. Our primary goal, of course, is to lead the effort for disposing of high-level waste and spent nuclear fuel, but our second strategic goal is to participate actively with key deliberations that affect the Department's decisions on disposing of nuclear materials.

Now, currently, the program is baselined, and the planning basis and the technical requirements basis basically, limit receipt of spent nuclear fuel and high-level radioactive waste in the primary emplacement area, the first repository, to no more than 70,000 metric tons, and this is basically allocated 63,000 metric tons to civilian spent nuclear fuel, and 7,000 metric tons equivalent of vitrified high-level waste. What I'll be talking about in this presentation will primarily involve reallocating the defense allocation of 7,000 metric tons.

Our current planning is to accept spent fuel and high-level waste that is not also regulated under the Resource Conservation Recovery Act. We are a Part 60 facility, not a treatment, storage, and disposal facility, under RCRA. Obviously, there is more capacity that needs disposal than the 70,000 metric tons, and for various reasons, in addition to that capacity, there are some thoughts about future growth option, if that's available, and if the safety and performance of the repository will allow that to potentially put more in there.

Now, throughout the Department, there is a recognition of the nation's responsibility to address the remnants of the Cold War. Most, if not all of the wastes that I will be talking about or the materials today fit within that general category. Certainly, the Department's Defense Nuclear Facility Safety Board, the National Academy of Sciences have all recognized the vulnerabilities and the issues associated with cleaning up the remnants of the Cold War, and, in addition, within the Department, there have been a lot of activities that have formulated decisions, strategies, and policies that, of course, the Civilian Radioactive Waste Management program is very integrated and involved with.

Now, from a management and disposal perspective, there are certain key considerations that a material or waste

form is looked at. Certainly, the inventory and the characterization data is the key that we need to be able to assess and understand the characteristics of the waste form, as they are important for disposal.

There are regulatory and statutory considerations. Is it spent fuel or high-level waste, defined under the Nuclear Waste Policy Act? Certainly, the criteria for a waste package and its components, which is the title of 10 CFR 60.135 is a key consideration, and that's also one of the drivers that identifies those aspects of a new material that might be important, that might have certain characteristics that we really need to focus on, and I'll refer you to Part 60 for some of those considerations.

Next, the design and operational considerations, primarily the waste package design must be considered, and conceptual designs are fostered and developed to help us through the process of analyzing how we would go about actually disposing of some of these materials, if that's the case.

Also, long-term performance, both of the engineered barrier system, and the total system performance are very critical. Certainly, those aspects of the waste isolation strategy which relate to the waste form, primarily, that's the source term, are looked to to be consistent with. Some of the key drivers from the performance area are total system

performance and the criticality, long-term criticality analyses. And, thirdly, we need to understand the cost and schedule implications as part of incorporating these waste forms.

I wanted to talk next about a very general process or the steps that would be done, ultimately, to incorporate new materials into the program planning and execution. Certainly, right now, for most of these waste forms, we are in the first step, which is conducting the preliminary analyses. Basically, we compare the waste forms, very simply, to the commercial spent fuel, and the vitrified borosilicate high-level waste standards that are currently the program planning basis, and use that as a basis to assess areas of importance for new waste forms.

Ultimately, we will get to a point where we feel comfortable in modifying the programming planning and design bases, and begin the process of starting to look at putting these into our designs and our licensing strategies. The first step, and the one that Jim alluded to and I'll talk about a little bit is the baseline change proposal process.

We have submitted an initial baseline change proposal to incorporate DOE spent fuel, and to make it part of the program and project planning basis. That's a first step in ultimately getting these things incorporated into the lowest level design specifications and other details that

would really facilitate the implementation of these new materials into the program.

Jim talked about the impact evaluations that go on, and those are all the things that we need to do. That's one area where the M&O has been very aggressive in integrating and developing all the appropriate analyses to support the impact analysis.

And, at that point, we would then revise the documentation in the program to allow the bases to be in place for work to proceed, and identify changes to plans and work scope in order to make sure that these activities can be implemented.

Then, obviously, we would incorporate these into the program development activities. It becomes a very iterative process. As more information is developed, we submit more and more low-level baseline change proposals, and, ultimately, get to the point where we have detailed design and licensing strategies. We have the information we need to do NEPA and environmental evaluations, and, also, to get in the process of developing detailed waste acceptance criteria.

Now, what materials am I talking about? I wanted to talk about five materials that we are currently spending a relatively low level of effort within the overall program on trying to integrate; Department-owned spent nuclear fuel,

surplus weapons fissile material--primarily, we're interested in the plutonium part of that, as opposed to the high-enriched uranium part of that--alternative immobilized high-level waste forms, cesium and strontium capsules which were removed from the tanks at Hanford and are currently in the form of cesium and strontium salts, and greater-than-Class C low-level wastes.

I wanted to point out that from the program perspective, where we do our integration, primarily, is with the project offices, and, also, with the people that are responsible for managing these materials currently within the Department, the Office of Environmental Management, and the Office of Fissile Materials Disposition.

The first waste form now, in the specific part of the presentation, there is a diverse inventory of spent fuel owned by the U.S. government, and this is generally going to be referred to as DOE spent nuclear fuel.

The way I've structured this last presentation was to try to lay out for you the decision making process, either completed or ongoing, within the Department, and so that's the first set of slides. The decision process is backed up by environmental impact statements, programmatic environmental impact statements, records of decisions, and other things along that line.

Certainly, for the Department-owned spent nuclear

fuel, the most important, in my opinion, a record of decision; whereas, from the programmatic environmental impact statement for the DOE-owned spent nuclear fuel and the Idaho National Engineering Laboratory environmental impact statement, the primary plan there was to use as a Department planning basis that some or all of the DOE-owned spent nuclear fuel would be disposed of in a first geologic repository.

Certainly, there have been other environmental impact statements--I've listed them here--which have also been integrated and consistent with that overall programmatic EIS, and have also helped to lead us to a set of decisions.

The next part of this for these new forms would then be to talk about the inventory, what waste forms are we talking about? I said the DOE spent fuel was rather diverse. I think, at some count, there's over 150 different types of spent fuel that are out there. I tend to categorize them into some simple categories. N-reactor production fuel is certainly the majority of it. There is roughly 70 to 80 per cent of the overall material is the Hanford production fuel that is right now residing in K-Basins out at Hanford.

Naval propulsion reactor spent fuel, we've talked a lot about that. There's a small percentage of that inventory for the Naval fuel.

Research reactor spent fuel, special case

commercial spent fuel, which includes things like the Fort St. Vrain spent fuel, the TMI fuel, West Valley Demonstration Project fuel that came out through the reprocessing. I'll let you read through. The total inventory is about 2741 metric tons projected through the year 2035, compared at to about 84,000 metric tons of commercial spent fuel, also projected out to about that time frame.

Okay, then the next part of the aspect for each of these materials was to talk about the activities or the progress we have done. Certainly, RWDM has made some progress to assist with the Department's evaluations and decisions, especially as it would relate to disposal. We've identified preliminary requirements for the disposition of DOE spent fuel. This is a top-level set of requirements. It certainly needs to be developed in more detail as we progress through time.

We are working on identifying key data needs that will be needed for DOE-owned spent nuclear fuel. We're using existing activity, the Unified Database working group, to try to get the expertise we need through an integrated product team to identify those data needs.

We've also participated with environmental management in going out to the sites and looking at the quantity and quality of the data that exists right now on the DOE-owned spent nuclear fuel, and, obviously, we try to

compare that, as best we can, to the records and administrative controls that the utilities use.

Through the DOE spent nuclear fuel steering group that Jim to earlier, are some lower level integrated product teams, and one of the things they've been doing that's very useful is trying to develop an integrated set of characterization test plans that could be used to get some of the information we need on the performance-based characteristics of these new materials.

And then, as I said, we've submitted an initial baseline change proposal. This first step was to change the planning basis and the top level requirements. Generally, what it would do is allow for the initial 7,000 metric tons of high-level waste to be displaced, some of that to be displaced by up to 2,300 metric tons of DOE-owned spent nuclear fuel.

And then other important activities to help us assess the impacts on DOE spent fuel being incorporated into the civilian radioactive waste management system, we've established the DOE spent fuel steering group. It's a very important integrating body. We are currently evaluating our work scope and our schedule-based impacts for incorporating the spent fuel into the program. We want to do this in a way such that we would minimize impacts to the overall project schedule to submit a license application in 2002.

We have done some preliminary performance assessment sensitivity studies and criticality calculations for DOE-owned spent nuclear fuel, especially focusing on some of those higher initial enrichment fuels.

We have done a bit of work focusing on research reactor spent nuclear fuel, both foreign and domestic research reactor fuel, and are right now completing up an assessment of aluminum-clad fuels and looking, from our part, from the disposal considerations that are important to a series of about eight or ten different options for dealing with some of these research fuels.

And, in addition, we have been working in the near term to ensure that the canistering concepts for N-reactor fuel are consistent with the RW canistering needs, and, also, trying to look at the impacts of pyrophoricity as might be related to the N-reactor fuel due to its special nature, and ensure that those are not considerations for repository concern, but ensuring that the right data is collected on the pyrophoric characteristics of that fuel.

Okay, the next form is surplus weapons, usable fissile material. As you're aware, the administration is trying to reduce the stockpile of fissile materials that are potentially out there that need to be managed, maintained for safety, and controlled from a nonproliferation standpoint. There's currently a draft, a programmatic environmental

impact statement on storage and disposition of weapons-usable fissile materials, and RW provided a lot of support on evaluating the disposal considerations of some of the various options that were under consideration.

Record of decision is planned, I think, for later this fiscal year, I think in the August-September time frame, and that will narrow down to a smaller set the number of options that are being considered. These decisions have not been made yet, so this is more a inventory of the potential waste forms that have been analyzed. We don't know yet which one will actually be the preferred, as far as the record of decision goes.

There are also more reactor disposition forms, and that is basically looking at BWR or PWR, mixed oxide spent fuel. That would basically be provided and burnt in commercial reactors. That may actually become part of the 63,000, or the civilian allocation, because that would basically be given to the reactors, and then they would burn that as part of the power generation, as part of the concept of removing this fissile material from the environment.

In addition, there are immobilized forms, primarily involving different concepts with borosilicate glass and plutonium. There's also some crystalline ceramic forms, and some glass-related bonded zeolite forms.

Some of the activities that we have done in support

of the EIS and future activities that we plan to do, we've done a lot of long-term criticality evaluations, but we still need to do more work on some of the degraded mode. We've looked primarily at the intact mode of criticality. We've conducted some total system performance assessments and, given the relative level of the inventory of radionuclides, it's been shown that there's not a significant TSPA contribution compared to commercial spent fuel and high-level waste.

We've looked very carefully at some of the operational and handling considerations. We want to minimize handling. We want to have a way that we can ensure that material control and safeguards can be effected, and ensure that it would be integrated as part of the overall repository operations, with a nonproliferation focus.

We've also evaluated some of the regulatory and statutory implications that question is it spent fuel and high-level waste. Certainly, there is some thought that for the high-level waste, the immobilized forms, there may need to be some rule making or determination as to whether those waste forms fit into the general category of high-level waste.

The Board has been to Hanford before as one of your trips, and I'm sure you've been out to Area 200 and got to see, I think there's around 177 tanks out on the tank farms,

and on which decisions are being made on how to best clean up the tank waste in accordance with a tri-party agreement that was established some years ago with the Department.

The draft tank waste remediation system environmental impact statement was issued in March. The preferred alternative was basically to vitrify or immobilize the high-level waste in the tanks into some form, and transport it for disposal to a repository.

In addition, and in parallel to this, there's been a request for a proposal submitted back in February, requesting proposals for privatizing the cleanup operations. Basically, a private vendor would come in, treat the waste in the tanks into some immobilized form. The Department would accept it and, ultimately dispose of it.

One of the things I wanted to point out on this slide, by the way, and why I'm talking about this is some of the alternatives looked at non-borosilicate immobilized high-level waste forms, or what I'll call here alternative immobilized high-level waste forms.

One of the reasons they've been looking at these alternatives, of course, is because the costs and the number of canisters under some of the options are just prohibitive. The TWRS EIS looked at about seven or eight different options, four of which were called ex situ. Those would be required to be taken off site for disposal off site, and

they've identified canister counts, and these are the DWPF-size canisters in the range of anywhere from 1,500 to over a half a million canisters of high-level waste.

I don't know about anyone else, but I can't imagine being in a position of working a half a million canisters into the operation of this program, and, obviously, we're looking for cost efficiencies, and there are other alternatives that are being evaluated, and we expect that as part of the RP process, vendors will come in with their own proposals for alternatives, and we are working with EM to be in a position to help evaluate those proposals.

RW has been involved in numerous interactions regarding the Hanford tank waste issues. We've provided Hanford a set of preliminary requirements to use in evaluating different vitrified high-level waste forms.

We've done a total system performance sensitivity study. I think, Abe, you did it yourself, from what I read, and we found, with very conservative assumptions, that it's not very sensitive to total system performance, what the different types of immobilized forms are, within some level, certainly, of sensitivity, but it did identify that there is a need for certain information that we need to try to focus on and make sure is available as we evaluate these forms, primarily dissolution and chemical-related information that we're going to need to tie it into the waste isolation

strategy, and ensure that they don't contribute overwhelmingly to total system performance.

We've also done an analysis looking at a four and a half meter, 15-foot canister, if you will; also helped them put more glass into packages, reduce the canisters, reduce the cost, but also be consistent within the operational strategies of the program, and, ultimately, get those underground.

Cesium and strontium capsules, I talked about a little earlier. One of the things that Hanford did to manage the heat was to remove cesium and strontium from the tanks. They put them in the forms of cesium chloride and strontium fluoride salts. Some of those have since been taken out and used for commercial uses for controlled radiation sources. Those are all being brought back and disposition is being looked at for those. We've recently identified some areas of concern regarding the direct disposal of the capsules.

We're also planning on working with Hanford over the course of the finalization of the environmental impact statement to better refine and develop the cost estimates to really help in the decision. Costs are not necessarily traditionally part of the EIS process, but some of these costs are of such magnitude that they really do need to be considered as part of the overall equation.

Finally, something that is not really high-level

waste or spent nuclear fuel. It's very consistent with the hardware, the non-fuel bearing components. That's greater-than-Class C low-level waste. It's low-level waste that exceeds the Class C definition of low-level waste that the NRC uses in Part 61, and the Department has a statutory obligation to dispose of these materials.

As part of the revisions to 10 CFR 61, the NRC noted that unless the Department proposes an intermediate storage facility; i.e., not a near surface, not a deep geologic, but an intermediate suitable for disposing of greater-than-Class C low-level waste, it was only authorized or suitable for disposal in a Part 60 facility.

The Department is still developing strategy recommendations. I'm not aware of any environmental impact statement or programmatic-related decisions. The Department has decided that it's not cost-effective to dispose of the relatively small amount of greater-than-Class C low-level waste in an independent facility, and they had proposed looking at co-disposal, A, in a geologic repository with spent nuclear fuel; B, with other low-level wastes the Department owns, called DOE-held or special case waste, and so they're looking at all those options.

The inventory is roughly 3,000 cubic meters, 2,000 of which is basically non-fuel bearing hardware, as part of the decommissioning or disassembly of commercial spent fuel

assemblies. In addition, there are some sealed radiation sources and some other commercial-generated waste, which is filter resins, filters, other contaminants, things along that line.

Okay. With that--and I've included some backups to, hopefully, give you a chance to read some more information on that. With that, I hope I've kept within my time frame, and I'll open it up to any questions.

DR. CORDING: Questions from the Board? Don Langmuir.

DR. LANGMUIR: A very technical point of curiosity. We got to look at and learn about the cesium/strontium chloride salts on a trip to Hanford a year or so ago, and that the Department had tried to do some very useful, constructive things with them, and then got sued for it, at great expense.

But, the point of the question is, as a geochemist, I'm aware of some very insoluble minerals, called pollucites, minerals of cesium and strontium-like silica and alumina, and my bet is if you emplace--I'm sure this has been discussed--in some of these mineral phases, they'd be much less soluble than they are in the glasses that are the other option, and I'm wondering where you've--I'm presuming this is part of the analysis that's been going on as an option.

Can you address that?

MR. GOMBERG: Yeah. We haven't looked, to my knowledge, at specific options along the level that you're talking

about, and one of the reasons has been because of funding limitations. We have really identified our desire to continue looking at further work, and, certainly, as you said, putting it into the glass is one of the options.

Certainly, we would want to consider those ideas as we, hopefully, next year begin some more detailed evaluations for cesium and strontium, and, certainly, anything to reduce the solubility, which was certainly one of the key drivers as to why we felt we needed some further analysis, is definitely a very positive thing that we would want to look for.

DR. LANGMUIR: It'd be a very cheap and quick and dirty evaluation. It shouldn't cost much at all to determine whether that's an appropriate disposal criteria.

MR. GOMBERG: Okay, and, certainly, cost is definitely one of the key drivers.

DR. CORDING: John Cantlon, Board.

DR. CANTLON: Yes. The defense side of DOE, as I noted from Lake Barrett's presentation, is scheduled, essentially, to equally co-fund OCRWM's budget now from '87 on, and looking at your Overheads 11, 12, and 13, you lay out a fairly substantial set of data needs, research needs to address problems relevant to disposal.

Some of those research needs, for instance, the whole business of confirming the zirconium cladding in Naval fuels and its corrosion status, and so on, the criticality

question, the diversion security issue related to Naval fuel, all are so specific to the defense waste, I guess the question I'm raising is the fact that they're co-funding a very limited budget, which really is sort of storage and repository development questions.

I'm wondering whether or not the defense budget itself has got a major research program to address these explicit issues that are more centrally related to their particular challenge they're placing on the disposal.

MR. GOMBERG: Certainly, the environmental management, which is the subject of these slides on DOE-owned spent nuclear fuel, 11 and 12, at least, do have a budget that has been identified to support the disposal-related activities under their primary function of preparing the waste for disposal.

One of the reasons we have tried to work together is because we realize we cannot be in the position, or necessarily need to characterize 150 different waste types. We do know that characterization is potentially costly, and each waste form, each spent fuel type has its own set of characteristics compared to spent fuel that we want to focus on, so we've tried to minimize the number of forms that we would characterize, do it in a controlled fashion, and also focus on those aspects that made it different from our uranium oxide, zirc, stainless steel clad spent fuel.

DR. CANTLON: The next question, then is: Are you set up so that you can carry their data sets into a QA-based business so that you could use them in the licensing of the repository?

MR. GOMBERG: EM has basically sent direction to all their field offices that any data they collect would be collected in accordance with our quality assurance requirements and description document. They have put together QA procedures and guidance on collection of data which would, hopefully, get us set up to that point, and that's especially important because, I think, the way it's envisioned now--and, certainly, there are a lot of decisions that need to be made--we would expect EM, as the custodians of the fuel, and having it available at their facilities, to primarily do the testing that would generate the data that we would use in our models.

DR. CANTLON: Okay, and the last question here, since Hanford alone has possibly as many as over a half a million canisters to put in the repository, then you have Savannah River, INEL, and other places generating high-level waste. It's reasonably clear there's going to have to be a second repository, or we're going to have to have a very much larger content in Yucca Mountain.

MR. GOMBERG: Certainly, one of the things that's been driving the space of the repository--and if I say something

wrong, I hope Rick or Dennis will correct me, or Abe--is the heat from the commercial spent fuel.

Some of the advanced conceptual design work that's gone on now has shown that you can place some of the cooler materials within the existing spaces within the spent fuel packages, and so, from that standpoint, I guess the way I look at it, very simply, is either--certainly, there's more than 70,000 metric tons that will need to be disposed of. Either the first repository limitation of 70,000 metric tons need to be evaluated, or we would have to look seriously at the need for a second repository.

As you know, one of the bullets I put in the background is we're not required to do that until around 2007.

DR. CANTLON: Right. Thank you.

DR. CORDING: John Arendt, Board.

MR. ARENDT: I don't know whether you're aware or not, but there's some recent discussions, probably informal discussions on the use of the depleted uranium hexafluoride stockpile by converting the UF_6 to U_3O_8 or UO_2, and then making--well, as a uranium silicate, and making glass beads, and the possibility of using that material for fillers in the waste package.

I don't know whether you're aware of that or not, and I was wondering whether you have interacted with, or are

interacting with EM or ME on the disposal of the UF_6 inventory.

MR. GOMBERG: I'm aware of it. I don't know all the details of what they're doing. We routinely work with them, and one of the concepts, as part of the UF_6, the depleted uranium inventories that we have is looking at ways of blending the high-enriched uranium with the DEU or LEU to make the criticality control case much more doable, much more supportable, and so, a lot of those discussions are going on, and we have people who are involved or are aware of those activities as part of our overall integration.

MR. ARENDT: In fact, I think there is probably some informal talks that are being carried out at the high-level waste meeting in Las Vegas this week, so there may be more information available from the OCRWM side as to the use of this material.

MR. GOMBERG: Yes.

DR. CORDING: One more question from Carl Di Bella.

DR. DI BELLA: Actually, I have a comment and a question.

The comment is if you're studying a repository with, or you're studying the possibility of having a repository with greater capacity than 70,000 metric tons, and you're also looking at the possibility of a greater-than-Class C going to the repository, it seems to me that,

perhaps, the EIS should also consider these alternatives. That's my comment.

The question is: How do these materials that you've been talking about play in the 1998 viability assessment? Specifically, will any of them be included in the TSPA that is done for that?

MR. GOMBERG: Abe, you're here, and, certainly, you would be one of the best people to touch on what will go in the TSPA VA.

DR. VAN LUIK: At the risk of being reminded to wake up again, I was whispering to my neighbor while you were asking the question.

Could you repeat the question?

DR. DI BELLA: Yes. I was asking how these materials that Steve's been talking about would figure into the viability assessment, and, specifically, which might be included in the total systems performance assessment that will be done to support the viability assessment.

DR. VAN LUIK: And I have to answer truthfully, that, at this point, we're looking at spent fuel and high-level waste for the viability assessment, because the other waste forms that we are considering, although we are actively doing performance assessments on them, the statutory system does not yet include them because the decisions haven't been made to include them, and this may change over the next year, I

think, if we are redirected.

But, you bring up a good point, that what we do for the viability assessment may not address the exact inventory that decision making will direct to go to the repository twenty years from now.

MR. BARRETT: Let me comment a little bit about that.

DR. CORDING: Yes, Lake Barrett.

MR. BARRETT: Given the limited resources we have available to do the viability assessment, the viability assessment is basically geared, as Abe said, on commercial, you know, reactor fuel, and the defense high-level glass, the traditional waste forms that we've been evaluating.

All these oddball cats and dogs materials are likely to go to the repository, okay, and they most likely will. We've looked at those to the degree that we know that there's some unique aspects, like, say, the high-enriched and criticality we're going to need to deal with, but there would be engineering solutions that we could apply and revise, you know, at the appropriate time to do that.

So, we know of no show-stoppers regarding these other materials that we could not eventually be able to address, but we don't want to try to bring everything in at this point and evaluate all 150 types and have all the data done at this time, but we know the EM and the Navy, you know, are doing that, and we believe we'll able to do it. At the

time between now and '98, we will not focus on it.

DR. DI BELLA: So Naval fuel won't be part of the viability assessment?

MR. BARRETT: We are in discussions with the Navy, and what the Navy is doing with their engineers is saying that they have--they can make their fuel as good as or better than the commercial fuel, and it's a very different fuel. So, if they have that material, we can include that material in the viability assessment, but we in RW are not spending our limited resources to do analyses of the Navy fuel. We're working with them and sharing information back and forth on the canisters and, as we've discussed about the zirconium cladding as a barrier, and those kinds of things, we are working with them, and we will learn from them, and they learn from us, and we work together.

DR. CORDING: Okay. Thank you very much.

Our next presentation is Dwight Shelor's on new directions in waste acceptance, storage, and transportation. He is Deputy Director, Office of Waste Acceptance, Storage, and Transportation in OCRWM.

MR. SHELOR: I guess it's a pleasure to be here. It's also, probably, a pleasure for you that I'm the last one that's going to spend a lot of time with you. However, this reminds me of one of our colleagues the other day indicated that he was once asked to leave the State of New York because

he spoke too slowly, and after these presentations this morning, this is going to be real slow for you, so we'll get onto it.

I'm going to talk about new directions in waste acceptance, transportation, and storage this morning. In the presentation, I will discuss the current situation with regard to new directions in waste acceptance, transportation, and interim storage planning.

I'll talk a little bit about our strategic objectives, and I plan to focus on the transportation planning in terms of the near-term waste acceptance and transportation activities, and our proposed approach.

Interim storage planning, I'll discuss a conceptual facility to the point that one can see how our near-term activities support our longer-range contingency planning activities, and non-site specific activities, this is basically the development of a non-site specific topical safety analysis report for the first phase of a two-phase interim storage conceptual facility, and, obviously, that effort will support our long-term contingency planning.

Back to the current situation, in a recent statement of administration policy, it says, in part, that the administration is committed to resolving the complex and important issue of nuclear waste storage in a timely and sensible manner.

With respect to the site of an interim storage nuclear waste facility, it says, "Any potential siting decision concerning such a facility ultimately should be based on objective criteria and informed by the likelihood of success of the Yucca Mountain repository site."

Pending legislation in both the House and the Senate address the issue of interim nuclear waste storage, and, as you know, the fiscal year of 1996 Appropriations Act sequestered $85 million for interim storage until legislation authorizing interim storage is enacted.

In our revised program plan, we use a two-stage strategy. This strategy assumes that the Yucca Mountain viability assessment will be made in 1998, and that a known storage site will be designated in 1999.

The first stage of this strategy includes those activities that do not require a specific delivery point, or a specific site. In this phase or stage, we are achieving two near-term objectives; one, to develop a market-driven approach that relies on the private sector for waste acceptance, storage, and transportation services; and, two, conduct non-site specific safety and environmental analysis for an interim storage facility that could facilitate the licensing.

The second stage of the strategy involves work to be accomplished after a site is designated. It includes

requirements for development of an interim storage facility at a specific site, and acquisition of waste acceptance, storage, and transportation equipment and services from the private sector.

The Office of Civilian Radioactive Waste Management is planning to carry out its waste acceptance, storage, and transportation functions using a market-driven strategy that relies on competitive contracts with the private sector for implementation.

In this privatization initiative, contractors will perform Office of Civilian Radioactive Waste Management's functions under the standard contract with the owners and generators of spent fuel. They will then accept spent fuel at storage sites as agents of the Office of Civilian Radioactive Waste Management, and deliver it to a federal facility.

Contractors would be compensated based on performance of these services, and would accept financial risk. Contractors would be encouraged to use innovative approaches to improve efficiency, to solve problems, to overcome obstacles to performance, and to lower costs.

We set out to meet these objectives in developing the strategy and the plan: A practical and implementable framework for success, maximum use of private industry capabilities, expertise, and experience, to provide

incentives for innovative and cost effective solutions, minimize DOE involvement in operational activities, encourage utility cooperation and participation, and to use performance based contracts. In other words, the contractors will be paid based on delivery of services.

Contractors will be responsible for provision of waste acceptance and transportation service to all purchasers within a region, according to annual allocations in the annual capacity report. However, contractors may, with purchaser agreement and DOE concurrence, alter the order of acceptance to achieve efficiency of operation or a lower cost.

For example, contractors may work with purchasers--and that's a technical name that really means the nuclear utility that have standard contracts with them--anyway, work with the purchasers to more efficiently move spent fuel through the use of shipping campaigns. While annual allocations may not be met, the contractors to meet all spent fuel pickup requirements over a period of a few years.

The contractors would provide all necessary casks, canisters, and similar equipment required for transporting spent fuel from the purchaser's site, and they would also conduct the actual transportation of spent fuel from the purchaser's site to the federal storage facility or repository, whatever it was. This includes provisions of

transportation carrier services, escort services, and responsibility for communications and in transit monitoring and reporting.

In addition, the contractors will be responsible for the following: Acceptance of spent fuel as an agent of the DOE at the purchaser's site prior to transportation; provision of compatible storage overpacks and lifting hardware for all canisters of spent fuel shipped to an interim storage facility; determination of transportation routes and for interaction with state, Indian tribes and local governments to ensure acceptable routing; provision of heavy haul transport from the purchaser's site, if required, and for any heavy haul that might be required to go from the rail head to an interim storage or repository facility.

Multiple awards are required. This will be the first of several similar procurements covering waste acceptance and transportation services to be provided over several decades. To establish and sustain viable competition for these procurements, multiple awards of contracts to competing contractors are contemplated.

For these multiple awards, the country could be divided into regions; for example, the four NRC regions that exist today, with one contractor providing waste acceptance and transportation services to all purchasers in that region, with allocations in the DOE's annual capacity report.

Contractors may propose to service any number of regions on a regional basis; however, to preserve competition, and to ensure favorable pricing to DOE in the future, no single contractor would be awarded more than a fixed, maximum number of contracts. For example, in a four-region setup, no contractor would be awarded more than two regional servicing contracts.

Fixed-price type, performance-based service contracts are anticipated. Incentives and flexibility will be provided for contractors to improve efficiency, solve problems, overcome obstacles to performance, and to provide low cost services to the Department. Innovative arrangements which result in reducing DOE risk or lowering costs will be encouraged.

It is anticipated that contracts will be broken into phases, with an initial phase for procurement of long lead items, and for transportation planning activities, and, also, to achieve operational readiness.

The second phase will be for the actual movement of spent fuel from the purchasers' sites. The initial phase, again, would be for a few years, at least three for procurement of transportation and storage equipment, and achieving operational readiness. The second phase would be a multi-year service period; for example, five years for completing waste acceptance and transportation services. A

multi-year service period allows the contractors the flexibility to improve the efficiency of operations, and reduce costs through campaigning of fuel pickups at the purchasers' sites.

Expression of interest. We're planning a public solicitation of expressions of interest and comments from potential offerors and from purchasers to obtain comments on the acquisition of waste acceptance, storage, and transportation services. This notice will be published in the Commerce Business Daily and the Federal Register, and is planned for issuance in the very near future. I'll go ahead and say probably during the week of May 13th, which is week after next.

A pre-solicitation conference is planned for later this summer so that we can discuss the approach further, and receive input on our proposed procurement approach.

I'm going to shift gears a little bit and turn to interim storage. It's a repeat statement, but I want to emphasize that the Secretary has stated that the selection of the candidate site for an interim storage facility should await the results of the 1998 viability assessment of the repository.

Work planned in the near-term, our first stage of our overall strategy, is strictly non-site specific work related to enhancing a NRC licensing interactions, and I'll

say a little more about those near-term activities later on.

We would only embark on the second stage of our long-range contingency planning activities if legislation is enacted that designates an interim storage site. The near-term activities in the stage one certainly compliments our long-term contingency plans.

Our contingency plans include a phased approach to design, licensing, and construction of an interim storage facility. This phased approach allows spent fuel waste acceptance services to commence sooner through the deployment of a simple facility, with minimum delays. For example, the first phase of this contingency plan facility would accept only canistered spent fuel.

In this conceptual development, we will build on the existing facility designs that had been developed some time ago for the MRS.

The interim storage contingency planning, obviously, at this time, is fairly consistent with the pending legislation, and is compatible with our transportation planning work.

The second phase of an interim storage facility would provide the capability, then, to handle uncanistered spent fuel. The uncanistered handling facilities associated or developed in the phase two would be constructed using a modular approach; in other words, the modulars will be time-

phased to coincide with anticipated demand for uncanistered spent fuel unloading. Again, we will use existing designs to a large degree, previously developed for the MRS.

Going back now to the near-term activities, our near-term activities would include development of a topical safety analysis report to support resolution of generic non-site specific licensing issues for an interim storage facility.

The TSAR will be developed in phases to match the phased approach for possible deployment of an interim storage facility; that is, an initial phase then describes a simplified facility that only receives and stores canistered spent fuel, and then a second phase that describes the full service capability of receiving both canistered and uncanistered spent fuel.

Obviously, the potential benefits include the early issue identification and resolution with the regulator, increased confidence in the licensing schedule, and reduce, hopefully, the NRC license review duration, and shorten the duration of environmental data gathering if and when the site is designated.

Issues that we plan to address in the TSAR include long-term dry storage. Dry storage of spent fuel for time frames longer than the 20-year license currently issued by the NRC needs to be addressed, Seismic requirements, 10 CFR

72.102 identifies two seismic requirements for interim storage facilities; for example, one for sites east of the Rocky Mountains, and one for sites west of the Rocky Mountains.

At the present time, the NRC is considering use of a probabilistic approach for seismic site evaluation, and the TSAR could address seismic concerns using this new approach.

Another area is off-normal recovery. The phase one concept will not have recovery facilities, as only canistered spent fuel would be received. The TSAR will address how off-normal canisters will be handled. For example, we may just be able to place them in a transport cask and satisfy the requirement.

And then design basis accidents. The effect of a canister drop at an interim storage facility needs to be reviewed under a Part 72 license. This has not been addressed independent of a Part 50 license at this time.

And then, in the phase two of this TSAR and possibly a facility development, the dry, uncanistered fuel assembly handling will have to be addressed.

Further, the Department will follow Reg. Guide 3.48 for development of the TSAR. Site environmental criteria will be developed to envelope most areas of the continental United States. The criteria will be developed using subpart (e) of 10 CFR 72, along with other applicable guidance

documents; for example, previous design studies, existing transportation cask and storage system certificates, and so forth.

It is anticipated that the phase one TSAR will be submitted to the NRC in 1997. After the TSAR is submitted, normally, the NRC would issue a safety evaluation report upon satisfactory completion of the TSAR review, and then the safety evaluation report could be or can be referenced in a subsequent licensing proceeding.

Since I have talked real slow, I'll summarize very quickly. The waste acceptance and transportation activities are fully integrated with interim storage contingency planning and consistent with the Administration's position.

Near-term TSAR activities will position DOE to respond rapidly, if necessary, and, obviously, at this time, the funding allocations remain--keep the emphasis on the repository site characterization.

Thank you very much.

DR. CORDING: Thank you.

We have a question from John Cantlon, Board.

DR. CANTLON: Dwight, you indicate that you contemplate the private haulers being able to optimize their pickups, and so on, taking some liberties with the Q, and, you know, the flip side of that is the question of whether or not you contemplate a similar flexibility among the utilities where

there might be a market in selling pickup rights so that one utility could, in a sense, get out of the storage business in order to close up.

Is that contemplated in your scheme?

MR. SHELOR: Well, actually, the utilities or the standard contract holders have always had the ability to trade these acceptance rights, and I would expect that they would give that serious consideration when we get to the point of starting to pick spent fuel up.

I don't want to be misleading relative to the service contractors. I think one of the really important aspects of this approach is that these regional contractors have got a real job in logistics, planning, and management, because they have to interface with the utilities. The utilities normally are not going to want you on their site before or during or immediately after a fueling outage, and they have other requirements that they need to meet as to when they could actually load spent fuel out, and there may be a lot--well, the logistics and the scheduling are tough.

What we're going to tell, I believe we should tell the regional servicing contractors is that that's the Q, and you have to run the Q unless the utility agrees to change it in that time frame. We can't leave it open-ended on both sides.

MR. ARENDT: What responsibility does OCRWM have in this

proposed operation? And you might maybe put that chart back up there, and I'd like to know where OCRWM's responsibility starts and ends. Is it just at the repository, or is there any dual responsibility?

MR. SHELOR: No. Obviously, we want to keep the dual responsibility down. I think what really happens is we're going to have the responsibility. We can share some of the authority, but we're going to retain responsibility. Nobody's going to let us off the hook that easy.

And, basically, if OCRWM is up here, and we have these standard contracts, there are 72 of them with different utilities and storage sites right now today, so we're kind of the focal point. We have contracts with the utilities. We plan to have contracts with these private sector regional servicing agents so that they, then, would carry out our responsibilities or functions under the standard contract to move spent fuel from the storage sites to a federal facility.

MR. ARENDT: So the contract is with OCRWM?

MR. SHELOR: We have not made a decision yet. It has to be, ultimately. We have not addressed whether or not we will empower our management and operating contractor to let the contracts, or whether it'll be directly with the Department.

DR. CORDING: Okay, Jared Cohon.

DR. COHON: Following up on John Cantlon's question and your response with regard to the role of these regional

servicing companies, you didn't mention the public, and the role that they'll play in the operations of these companies, especially with regard to route selection.

MR. SHELOR: Well, right now, today, the routing guidance of the Department of Transportation has HM-164, which essentially designates the interstate highway system as the acceptable routes for truck shipments. It also allows the states to designate alternate routes in terms of route selection.

I would expect that most of the shipments, the vast majority of the shipments that would be involved in this activity would be by rail. There are currently no comparable DOT regulations for rail shipment, but it's not uncommon. There are requirements for hazardous shipments.

The fact these regulations do exist, the NRC has basically been designated by the Department of Transportation to issue standards for radioactive waste shipments, and they have, and that's under 10 CFR Part 71. Shipments have been made for the last several decades. The safety record is outstanding. There have been no significant incidents of any kind, and I expect, on a relative scale, that the addition of these shipments on an annual basis will not hardly be noticed in terms of the overall hazardous waste capacity.

MR. COHON: Well, I'm not as sanguine. I think you're going to have quite an interesting public relations problem

to deal with.

MR. SHELOR: Oh, that's absolutely true. I think another key aspect here, as I mentioned earlier in our objectives, is we need the cooperation and the assistance of the utilities themselves in these regions. They have established relationships with the local communities and the states and the regions.

In addition, I didn't mention, but we have plans, or are essentially trying to finalize plans for our implementation of Section 180(c), which basically directs us to provide funding to the states, Indian tribes for training at the local level for emergency response, normal shipment and emergency response. All of these things have to work together to make this work.

DR. COHON: Just one last comment on that, and then another brief question.

The public that these shipping companies will have to deal with are public that largely is not benefited from the powerplants from which the waste will be coming; that is, if you look at a map, that large expanse from the Mississippi River to Nevada, assuming that that's where it's headed, there ain't no nuclear powerplants in that area, and these are the people that will be having the shipments going by them.

In any event, the question: One of your overheads

referred to the reduction of DOE risk through this private sector arrangement. What's DOE's risk, and how does this reduce it?

MR. SHELOR: Well, okay, they are basically--and we haven't gone through this. We're in the process of development Statement of Work and formulating a request for a proposal, but there's two ways that one could finance this.

One way is for the Department to make progress payments to a contractor to fabricate equipment that he will need to transport this material. If that were done, and once that equipment were fabricated, then, essentially, DOE would own that transport cask, for example, and that's done in many cases, but it requires a commitment of resources up front.

The other way to do this, and a very attractive way, is to structure the procurement such that the contractor can go to the financial market and basically borrow or obtain financing to order the equipment, and particularly, the reusable equipment, so that he would own it when he's done, and then, basically, recover his costs through a lease arrangement and providing services. That's the kind of risks that we're referring to.

DR. COHON: Thank you.

DR. CORDING: Bob Williams, consultant.

DR. ROBERT WILLIAMS: Thank you.

I don't know whether this is a real or hypothetical

question, but is there a possibility of either a utility or some organization such as the Mescolaro Indians having a storage facility as part of this construct? Have you taken into account something other than a federal storage facility?

MR. SHELOR: I haven't really addressed that, Bob. Right now, anything is possible. The recent developments with the Mescolaros have not been too promising.

MR. BARRETT: Let me comment on that, just so there's no misunderstanding.

If there were to be a private storage facility, we, OCRWM, would not be moving the material from reactor sites to the private storage facility. We would move material from facilities, be they react ors, be they private storage, into the federal system.

Now, going with the market-driven might be more compatible with national needs if we went this way, for other people to use transportation, say, intrareactor, or something like that, as opposed to the old paradigm, which was a classical DOE contract, DOE-owned, contractor operated, so we would be more flexible and more useful to the nation under various other scenarios, but there is no intention on our part that we would ever enter into, through this--that we would enter into moving of spent fuels between reactors and any private storage facility if there ever should be one.

DR. CORDING: Yes. John Cantlon, Board.

DR. CANTLON: Yes, let me follow up on that, Lake.

Does that mean that the private haulers, essentially, would be free to contract for any other nuclear hauling, in addition to the contract? So, they're free, essentially, to do any other nuclear hauling they can get?

MR. SHELOR: They'd have to, you know, they would contract to perform services that--on a schedule that we had agreed to, but that would not prohibit them from hauling for anybody else.

DR. CANTLON: Additional, right.

MR. SHELOR: That's correct.

MR. BARRETT: The answer's yes, they could.

DR. CORDING: All right. Well, thank you very much.

We have now time for Lake Barrett comments. You're on for fifteen minutes on the schedule, and whatever time you wish to have--

MR. BARRETT: Less than fifteen minutes, certainly.

Let me just make three minutes' worth here of sort of my assessment of what we've done over the last couple of days with you.

The focus of the meeting was planning and integration on the program. That is a tremendous challenge, even under normal conditions, for a program of this magnitude and complexity. The environment that we are in is anything but normal, I think, as we will all understand. I believe

the organization has responded very well under the circumstances we've been in, especially considering where this program has been over many years.

In the last three years since Dreyfus has been in, and I was sent back to the program, you know, we've worked hard to try and do that. I'm very proud of how the organization has responded. It's sort of like steel being forged to become tough. It's by fire and big hammers that beat the steel into the toughness, and I think the program has done very, very well.

I think sort of the key that we've tried to do is to have a common vision from the very top--that's Dreyfus--to the very lowest levels of a clerk somewhere in the program, and if the directors will direct, you know, the managers will manage, the engineers will engineer, the scientists will go gather the data, interpret the data, and generate the models, and the crafts persons will do their crafts jobs, be they a laborer in the tunnel, or driving the tunnel-boring machine, or whatever, the test to me, in my own personal metrics, is when I see specific things happen that didn't used to happen in the past, and it goes by this connectivity from the top to the bottom.

It's easy to talk about arrows going back and forth, and in the iterative process where the bottom's up, is happening simultaneously with the top down, and it iterates

back and forth. As the top says, "Can you do this?", the bottom says, "No, I can't do that, but I can do this over here," and then the top will then decide, "Well, maybe I can do it that way," and it's an evolution where everybody is participating in the common whole.

And the bureaucracy that John talked about is an important part of a disciplined method of change. As we change to the external environment around us, and the internal things that we find inside, the bureaucracy works through the waste isolation strategy, which then gets transformed working with the total performance assessment as to what are the really important factors, that get translated down through the TRW team, into the work plans that actually define the deliverables, and then our control systems kick in, that we will then have defined deliverables that are written down as to what their scope is, what their schedule is for deliverables, and what the cost accountability is, the financial accountability of the managers delegated down, and good reporting systems back so everybody knows where everybody else is at one time.

We've worked very hard to put these together. It's theoretical stuff, but the key, to me, is when I see the fruits of those energies that everybody is doing. An example of one is Chlorine 36 that's been discussed here today. Through the formulation of the waste isolation strategy as to

what are the important parts, focusing on water movement, the driving of the tunnel-boring machine that Rick and his people have done, which, the tunnel itself is not important. It's just the mechanism as, I think, we mentioned here today, to allow the scientists to do the science down in the mountain, so we'll be focusing on our common vision as to how well this mountain and its engineered barriers will be able to isolate and contain and have a controlled release of the material over time, said we needed to do that, get information like the Chlorine 36.

So, what we did from the top, for example, is we asked to move several millions dollars--four million was the number--from what was called infrastructure accounts into science accounts, and when we did that, one of the things that Susan and Dennis and the scientists said, "We really want to do more Chlorine 36." I hardly know what Chlorine 36 is, from the Director's office, but, nonetheless, they do, but yet, by asking the people to shift money into those accounts, we were able to advance that, and I think that's healthy, and I think that's good that we do that.

We've advanced the thermal test on the small--the small-scale test dates have been advanced because the scientists said that was important, and the modelers said that was important, and when Rick was able to mine those alcoves faster with the Alpine Miner, we had to shift money

to allow Dennis and Susan to get the scientists advance money in '96, and we did this in a very constrained funding thing.

These are just examples where I see the actual work at the deck plates, as we used to say in a former life, really starting to count, and that's where it does count, and it's not just intra-Yucca Mountain. I think it's across the program.

We didn't talk much about it here, but we have a topical safety analysis report to the NRC on burnup credit, and the burnup credit works in transportation, it works in storage, and it works in Yucca Mountain in the disposal criticality issues.

So, I am very pleased at what the TRW team, as they pull together the various contractors, and the DOE people being responsible owners of this program have come together in a much more integrative and a planned manner. We have many improvements yet to do, but I'm very satisfied with what the team has done, and I think some credit goes to the Board, who has basically constantly been on DOE's case about improving its integration and its planning, I think, since its conception and some of its first meetings.

So, I think that has been a driving force to help us meet the challenges that the environment is putting on us, and I believe we have many more challenges in the future yet, but I believe, as the going gets tougher, we will get

tougher, and we will get further ahead of the curve, because we've never really, historically, been ahead of the curve.

But, I am very optimistic for the future as we go forward from here, so that's sort of my personal take as to where we are at this time.

DR. CORDING: Thank you very much.

Do we have some Board response or comment or questions?

DR. LANGMUIR: Don Langmuir, Board.

Lake, we went over the thermal loading issue and how that's going to be pursued in the next few years rather quickly, and, I thought, too quickly early in the meetings, and, of course, it's been an overriding concern of all of us, and I think it still remains that until we're persuaded otherwise.

Maybe the answer's going to be it's a political thing at this point, but we have a two-year test in mind coming up, one year warm, one year cold, and we were never told that that was going to resolve the major questions regarding the effect of thermal loading on performance of a repository.

Can you candidly tell us what's gone on, and why, all of a sudden, this is our only goal at the present time? We aren't looking beyond that in terms of anything that's codified as a plan with regard to looking at thermal loading

effects on a repository, unless I'm wrong.

MR. BARRETT: It's my understanding--and I have very limited knowledge of this--is that the emphasis on the thermal issues over the next couple of years are very important to the engineering design aspects of the '98 assessment, as to what can we do, how much material can we put in that mountain, but it does not stop in '98 or over the next two years.

There will continually be work refining the engineering models as we go forward, but we should be able to get the bulk of the engineering technical feasibility of building the model and address that issue very well in the next couple of years, but it's not all done at that point, and Rick, if there's something that you would like to add, or something I've missed or have misstated, please fix it.

MR. CRAUN: Richard Craun, DOE.

There's two different elements that I think you're touching upon. One is the thermal test, and one is those performance elements that are keyed or driven by temperature, humidity and temperature, corrosion rates, temperatures, et cetera.

A lot of those models are not two-year models. Those tests are going to go well beyond VA, so the two-year time period, as it relates to some of the tests that we're putting together to support our model development for TSPA

and for the waste isolation strategy are much longer than a two-year period.

I'd turn to Dennis to address the thermal test alcove itself, as far as it's period.

DR. LANGMUIR: Well, let me re-craft the question a little bit, and focus on one of my concerns.

My sense had been that these were going to be critical to the determination of whether you went with a low-loading or a high-loading repository. Performance, which would be a consequence of that choice, was going to have to be key to the choice, and it sounds like you've almost made your choice of thermal loading, at least for the time being, without having the insights you might have gained or might gain from a long-term set of tests.

MR. DENNIS WILLIAMS: Rick says this is probably leading into thermal testing, like we talked about a little bit yesterday, and for the purposes of this schedule that we were dealing with, to go through viability assessment and get to the license application, I think a lot of the problem has to do with that bar where we have a two-year test planned. That's the length of the activity bar, and I think that's giving you some concern. It's given a lot of our people some concern.

But, again, as I mentioned yesterday, we're planning on turning the test on. We don't turn the test off.

We evaluate it annually to see where it goes, to see if it goes according to our predictions.

One of the predictions that I showed today had to do with the Buscheck prediction, and one of those was out to four years, so we're looking out at that distance in time.

Also, recall that we have our thermal testing strategy. The drift scale was one test in that thermal testing strategy. The next test on that that we are still discussing, possibly in a performance confirmation period, is that long duration large scale.

Exactly how we go about implementing a test like that, when we would implement a test like that, whether we could possibly use one of the early emplacement drifts with, I hate to say this, but actual spent fuel in it as part of that testing program, I don't think we know for sure yet, but we know that we had to get a large-scale test started, started as early as possible. We elected to go with the drift scale. We elected to set it up on an activity bar, because of scheduling, and we have committed to reevaluate that on an annual basis to see where it's going and whether or not we should cut it off, let it run longer, or move in to the large-scale, long-duration test.

That's basically where we're at in our thinking on it.

DR. LANGMUIR: Is the drift-scale test you're proceeding

with now so designed that it would give you the kinds of answers you need to have regarding a thermal loading choice?

MR. DENNIS WILLIAMS: It would give us some of the answers.

DR. LANGMUIR: Is the flexibility there anymore in a thermal loading choice? You've already decided on one.

MR. DENNIS WILLIAMS: No. We've decided on that one. We think that there are things--it's going to give us information on a lot of things; however, we still have people, we still have part of our group that is standing out there saying, "Hey, it's not the large-scale, long-duration test. It is not the big, big test, which would be the best thing that we could possibly do."

I hate to say funding constraints, but, right now, the funding constraints say, "You aren't going to be able to field that real big test early." We dropped back from that. We're trying something a little different. We hope it works. If it doesn't work, then we'll be going back to Lake and others and saying, "Hey, guys, we took a chance on this. It didn't work. We need to bail into the bigger test."

DR. CORDING: I think that it will be interesting to discuss some of these further, also, in the session this afternoon. I think we want to discuss some of this, just how do we look forward to decisions that are made after the viability assessment, when you're in a situation where you

don't know exactly what funding is, and the Board is in a situation where we don't know exactly what can be accomplished, and so, I think those are things that the Board is interested in, and I know you are concerned with.

We very much appreciate the presentations we've had. We're going to have the session, the roundtable session this afternoon. We are going to take one hour and ten minutes for lunch, as planned, so we'll be reconvening here at five minutes after one, and we would appreciate the speakers and people that are involved here to be with us in the roundtable, as well as the Board, the Board members and consultants and staff.

So, thanks. Five minutes after one.

(Whereupon, a lunch recess was taken.)

AFTERNOON SESSION

DR. CORDING: Let's get ready for the roundtable discussion; speakers, Board, guests.

Well, we're pleased to begin our discussion this afternoon, and we very much appreciate learning more about the way the program is being focused. Waste isolation strategy is evolving. Much is being accomplished in the exploratory studies facility in real time, and we're learning about that, and that's very important; the flux of the mountain, what we're finding across various fractures, really, a tremendous increase in understanding of what is occurring at the site in terms of the behavior of the site and flow in it.

Obviously, the project is moving ahead simultaneously in several areas; in the areas of exploration testing, working towards that '98 viability assessment. Now we're focusing on designs, getting ready for the designs for license application.

There is a convergence here, and it reminds me somewhat of a situation we have in Illinois when we're going down a country road. My wife will ask me do I know where I'm going, and they're all either east/west, north/south, and usually, you can tell pretty much where the sun's coming and

which way you're going. You may not know exactly where you are, but you know where you're going, and then you come up towards a crossing and you see this freight train coming down, and you know you're on the right road, and the big question is, "Can I get there before the train does?"

For those of you who perhaps live on the coast and don't understand the Illinois topography, it's somewhat like Jean Younker's and other sailors in the group here, who are on a course, and they're on the right course, and they're watching that angle between not a freight train, but a freighter, and trying to make sure that angle doesn't close on them as they come across this path. And if the angle starts to get smaller, they're going to have to do something to tighten things up and improve the trim, and then, of course, they're always concerned for what's going to happen with the wind. Is it going to shift?

And so, I see some analogies, and perhaps you don't want to carry them too far, but I see some analogies with the program, and we, as the Board, I think, are very much wanting to be of assistance in helping this program get to the point of being able to establish site suitability and to assist in any way we can as a Board to get to the technical conclusions that allow you to make that crossing safely, so we appreciate the participation here of the people in the group.

We really want to discuss any of the topics that

we've been considering the past few days, or things that are of concern directly to those of you who are on the panel here.

The primary item is: How do we put all this together; the design, the science, the performance assessment, the quality issues? How do you put all that together, the management, and come up with results? And, I think, looking at various issues, the corrosion issue, the waste isolation strategy, and how does that relate to defense in depth, the thermal issues, and packing very many different areas, the backfill issue, ambient moisture of isotopes, how do you explore for that, how do we evaluate what the flux is in faults and adjacent retardation, the other things that the natural environment can do or is expected to do for the isolation, those are all issues that are so heavily dependent on this integration, and we would like to be discussing that, then, in our time together here this afternoon.

In terms of planning, I intend for us to terminate this portion at close to the schedule we had, by three o'clock, certainly, so that we can make 4:30, 4:45 type of commitments we have for flights out.

The other thing I'd like to do is introduce several individuals who were not making presentations, but are part of this panel, and so, one is Margaret Federline. We're pleased that you're with us.

MS. FEDERLINE: Thank you.

DR. CORDING: And she is Deputy Director of the Division of Waste Management of the USNRC, and she's been working in industry and science work before joining, several years ago, the NRC.

We also have with us Bob Williams. Bob has been in many of our meetings over the years. He was with the Electric Power Research Institute and was, at that time, Manager of High-Level Waste and Transportation Technology. He's now acting as a consultant of Williams Technical Associates, so we're pleased that you're with us, Bob, also.

MR. ROBERT WILLIAMS: Thank you.

DR. CORDING: We'll be asking them to make some introductory comments, and then, also, we have with us Warner North, who is a former Board member, on my right, and he's a consultant to us at this point. We'll be asking him for some comments, as well as Dennis Price, and Dennis Price was, again, a Board member, and is presently a consultant to the Board, further to my right.

So, I think perhaps we'll proceed in that order, with some introductory comments from those individuals as they wish to make them, and then we'll go to a somewhat unstructured general discussion of some of these integration/interaction issues.

So, Margaret Federline.

MS. FEDERLINE: Thank you.

We appreciate the opportunity to come and meet with the Board today, and, particularly, the opportunity to hear DOE's new integrated and structured program.

We're really encouraged by what we hear about the improved focus and integration between site characterization and design, performance and regulatory compliance. We believe that a focus on the key hypothesis for waste isolation is an appropriate approach at this point in time. In fact, in early 1995, NRC restructured its own program in this regard.

We are currently focused on what we refer to as ten key issues for safety at the Yucca Mountain site, so we have made many similar changes to those that are described by DOE today, and I think the topic came up earlier in the meeting of, can bureaucracies change? And I think this program is a good example of how there was a recognition that there needed to be a change in the way the program was being organized, both on the developer and the regulator side, and I think some of those changes are being made for the better.

We, at the NRC, are focusing on vulnerabilities in the waste isolation strategy, because we feel that that's appropriate for our role as a regulator, as the developer is focusing on proving the positive hypothesis for waste isolation.

One thing, as a result of the meetings we've heard over the last two days, we would really encourage DOE to finalize the waste isolation strategy and make it available as soon as possible. One of our concerns is that it's going to be very difficult to evaluate the effectiveness of the program plan until the waste isolation strategy is made available.

We applaud the integrated team concept of bringing together site expertise with engineering and performance. Back as far as the site characterization plan, the NRC had commented on the need for improved focus, the communication between the site folks and the design folks, and the performance experts.

Now, we have also done this at the NRC. You're probably aware that we conduct our own independent performance assessment, and through the Center for Nuclear Waste Regulatory Analysis, conduct some independent analysis. We have also formed integrated teams, and we think that that's the only way to go.

There are some drawbacks in that regard, because, as we all know, those different disciplines have different approaches to problem solving, so I think it's going to be a challenge to use that approach, but I think we're convinced at the NRC that that's really the only way to go.

If I had to talk about what our key concern is at

this point in time for the NRC, it's the need for DOE to document the data and the assumptions and the decision process for its key technical and programmatic decisions as a basis for licensing. We believe that the integrated program document is the way to go, the PISA, as referred to in the presentations.

I guess our concern is that, from what we understand, it's not going to be available until 1998, and we would prefer an iterative approach of the PISA, starting out with what level could be supported, but then continue to refine that document to assure that there's a good flow between the data assumptions and decisions.

Based on our current experience with iterative performance assessment, we encourage DOE's use of consistent and documented databases between design and performance. The one thing that I did not hear a lot of is the documentation of assumptions. We're finding in our own performance activities that it's very important to decide upon a consistent set of assumptions so that you're able to do importance analysis as you move through the process, and inter-compare the significance of relative processes and events within the performance calculation, so we would urge DOE to focus on that.

We share Dr. Langmuir's concern about DOE's plan for thermal testing, and the planned two-year duration. We

believe that longer term testing is going to be necessary as a basis for the choice of thermal loading strategy, and we have met with DOE, discussed it in management meetings, and are looking forward to an opportunity to be able to review that thermal loading strategy.

Regarding the recent Chlorine 36 data, the NRC staff has not had an opportunity to review the draft report at this point in time, but we will be following the continuing work and evaluating the significance of the results when the work is completed.

We are pleased to hear that that LANL studies are going to continue and be completed and reviewed, and that additional sampling is planned to include other isotopic analysis as well. We think that's an important confirming technique.

We believe the hierarchal approach that was discussed here, including process to total system PA models, is very appropriate and sound. We're encouraged to see the strong role of the subject matter experts in defining the process level of models. We think that's absolutely key to ensuring that all key processes and parameters are represented in the model.

We also applaud the inclusion of disruptive processes in the TSPA for the viability assessment, as well as for the license application. That's going to be very

important.

Another concern, we're concerned about the trend that we see to limit investigations of the geological setting to the controlled area. Depending upon the high-level waste standard that comes out from EPA, it could be very important to do some additional site investigations beyond the controlled area to understanding the appropriate boundary conditions for the models.

And, finally, we recognize DOE's desire to evaluate the viability of the site to realistically project costs and schedules. We endorse that and think that will be a valuable input for Congress. However, we think because of the tight target that's been established for a licensing application, that DOE needs to stay focused on licensing, and not depart far from the licensing requirements.

In that regard, we also think that continued interactions with DOE are extremely important early on in the process, and we're trying to work out more streamlined, more efficient ways that those interactions can be conducted, and one of the main priorities of NRC's program at this point in time is to bring feedback to DOE and the other parties on any concerns that we have early on in the process so that additional data could be collected, or the input could be considered in the design of experiments.

Thank you.

DR. CORDING: Thank you very much. There's some good items there, I think; interesting items, and important ones that we need to be thinking about or remember as we continue with the discussion later.

I'd like to go now to Bob Williams.

MR. ROBERT WILLIAMS: Thank you. I'll try to be brief, and elaborate on these points in my letter to the Board.

First, let me compliment the DOE staff and many of my friends of years standing for continuing to maintain technical progress while restructuring the program and reorganizing and downsizing. I think you folks are getting pretty darn good at this. I think I've seen you do it four or five times, and you reveal good practice.

I guess as one example, I was particularly pleased to hear of the reprogramming of $4 million from infrastructure to study of the Chlorine 36 issue on short notice. In a time of downsizing, it's refreshing to see that there is some flexibility to cover new items.

I'd like to underline a couple of points that I feel particularly strongly about, and most of you will know why. One relates to the EPA criteria. I think it will be a mistake of the first order, a historical mistake if you base your evaluations on a 10,000-year cutoff, even if a Congressional body can be persuaded to enact that this year.

The whole principle of the American judicial system

is that issues significant to safety have to be evaluated, and I think you're going to have to figure out some way to conduct an evaluation out to the time of peak dose. To do otherwise is to lead the whole program down a primrose path, and I'm sure that there's enough creativity in this group to figure out a way to address that issue.

The second item I feel equally strongly about, and that relates to privatization. Let me compliment on your market-driven approach to spent fuel storage and spent fuel acceptance. I think it's the only way to proceed right now in times of reducing budgets.

The basis for my question earlier today is my own premise, that I would not enter the business if I didn't have control of my storage interface. I would not trust the DOE to come up with storage while I was committing to delivery schedules, so I would want to build a storage facility on a federal site, and have that federal site be part of a buy-back agreement at some date certain, like 50 years. I think if you would structure your RFP in that vein, you might get some major participants; for example, big utilities, or a consortium of utilities and a transport company.

Finally, just a couple of points on integration, then I'll save the rest of it for the roundtable. I've watched four attempts at rebaselining. Rebaselining has the effect of forgetting history and starting over again, and I

think, at this point in the project, it would be very helpful to be talking in terms of, "We have spent $3 billion, and we still see $5 billion to complete."

I think that would connote the long-term nature of a 15- or 20-year construction activity, so I would hope that the rebaselining does not result in resetting all of the counters and making the presenters forget about the accomplishments that they have made, and they are several; the seismic and tectonic work, the volcanic work, the work that went into getting permits to do all the on-site activities, so I think that sort of presentation would connote progress in a way that doesn't come across when you're in a rebaselining mode.

I have one comment on design, and then I'll save the rest of my notes for later. The mention of 11,000 drawings, 1100 specifications gave me shudders, because it conveyed an order of complexity that isn't justified, given the status of the design. I think the only way to manage that amount of complexity is to make some design decisions now--when I say "now," I mean by the end of this fiscal year --and then proceed on a design basis.

If it were up to me, I would give the program managers an incentive. For every 10 per cent you can cut the drawings and specifications, you get a 10 per cent raise. I think it's that important, because I've participated now on

some other DOE projects, where just managing the interface of that complexity ties them in knots.

So, most of you who know me realize I have a dozen other ideas to lambast you with, but I'll quit for now. Thank you.

DR. CORDING: Thank you very much, Bob.

Let's go next with Warner North.

DR. NORTH: Thank you. It's a pleasure to be back here after two years, and to see many old friends, and to see much progress in the program.

Since I'm returning from this absence, I will concentrate on, shall we say, the big picture views, and I find much that's very commendable and a real pleasure to see. It's great to see the evidence coming from the ESF, which, while I was a member of the Board, we talked a great deal about, what could be found down there, what we would observe, and how it might be interpreted, and now you're in the middle of it.

No Aztec princess has been found, but you did find some bomb pulses of the chlorine. This will pose a very interesting challenge to the scientists who will interpret which of the models may fit that data, and how to include it in the performance assessment.

I will add my voice to others commending you for the four million reprogramming, and I'd like to hold it up as

an example, because I think that's really where the program has to be. You have to be flexible, and you have to let this evolve, rather than getting involved in very elaborate rebaselining, where it appears that major things are being thrown away.

Rather, you are making some adjustments on the sails, in Ed Cording's analogy, to stay on course, making adjustments to what the available science has now given you. You also have adjustments you will need to make with regard to the evolution of the regulatory criteria.

In the wake of the National Academy report, I will strongly endorse Bob Williams' statement a minute or two ago, that I think it would be a horrible mistake for you to cut off at 10,000 years. I think you are simply going to have to address those issues. You're going to have to address them in a quantitative way.

Clearly, the level of precision may be less, but, in a nutshell, I think you're going to have to deal with the acts--this may be a topic we want to come back to later on in the discussion.

I am reminded of the rethinking report from the National Academy, which was done shortly after I became a member of the Board. It stresses the need to expect the unexpected, and maintain flexibility. Now that we're finally to the point where underground construction is proceeding,

and we're learning a great deal, it seems to me that needs to be reiterated.

I am very pleased to have heard the summary by Steve Gomberg on the dialogue with EM with regard to the defense waste. That strikes me as being an extremely important step forward for the program, to be talking to your colleagues in another part of the Department of Energy, and investigating these rather complicated issues with respect to the diversity of materials out there that the policy makers, at some point, may want to put into Yucca Mountain.

From the performance assessment perspective, it strikes me that some of those materials may be advantageous. You have less actinides, and you have containers that may be even more robust--vitrification, for example--and that may give you some important credits. It might even lead to some reconsideration as to whether, perhaps, Yucca Mountain might be better suited to taking more than the 7,000 metric ton equivalent. I'm still not sure, given the complexity of these materials, how exactly that might be measured, but it certainly seems to me an interesting area for a great deal of further exploration.

The cost estimate for cleaning up the weapons complex, last time I looked, was well in excess of $200 billion, and there are a great many states with those facilities who seem very anxious to get that material out of

their state and into a permanent home. It strikes me that that is a very important policy context for proceeding with Yucca Mountain, and the more you know about it, the more you may be able to attract friends and supporters, as opposed to detractors as your program proceeds.

Now, I'd like to make a couple of comments about the Board's recent report on interim storage. I was really pleased, and very impressed by the excellent work of that report. Perhaps more might have been done to distance the Board from some of the concerns of a few utilities about an immediate problem with storage space for nuclear fuel for that particularly plant.

Clearly, you didn't have an ability to address those near-term tactical issues, but in terms of the longer-term strategic issue, and the integration between the budget, as allocated to interim storage and transportation versus finishing what needs to be done in the characterization of Yucca Mountain, I would very heartily endorse what the Board did, and I think it is of great benefit to the Department of Energy to have had the Board say those things.

The tightening up in the DOE program is clearly something that needs doing. The Board's report pointing out that the nuclear waste fund may be used up, and then some, between development of Yucca Mountain and an interim storage facility, I think, ought to give everybody some basis for

concern that money is going to remain extremely tight, and extremely controversial, and that the program is going to continue to be under great pressure to be lean and mean.

I like Lake Barrett's comment about, "We need to get tough," and it strikes me that that's exactly what is needed. It's time for the coach's speech to the team about how these are very difficult opponents, and if we're going to win, we've really got to get our act together. We've got to think positive. We've got to look for opportunities. We can't just do the same old thing, and my sense is you've gone a long way in that direction, and I applaud this progress.

But, on the other hand, it strikes me that you've got a long way to go. This is really a difficult situation, and I will confess to being disappointed. I had hoped to come to this meeting and hear the latest plans, and much of what I heard, instead, was a plan for making a plan, rather than the plan itself.

In particular, as Margaret Federline has already noted, there isn't a waste isolation strategy there that her agency can look at, or that those of us looking in from the outside, from the TRB direction, can look at, and it seems to me you really need that, and you need it with all possible speed.

From that will be derived a plan for the design of the repository, and I pick my words, because I don't think

you can design the repository until you know more than you are going to know very soon on thermal loading and some other issues. I would strongly endorse the comments already made about the tens of thousands of drawings. I didn't see, in this two-day period, a good sketch of what the design might look like with some provision for flexibility that, as we learn more about the science, whether that's the one drift, two-year thermal test, or it's a period of decades, with either real or simulated spent fuel containers numbering much more than one.

It strikes me that you're going to have to evolve in that area, but you need something to evolve against. You need to be portraying a strategy, a way of thinking of how you are going to do this, rather than making the material available at the last minute.

Margaret Federline commented on the PISA becoming available in 1998. It strikes me it is a very serious problem for you that makes your job a great deal more difficult if the integrative strategy appears only at the last moment, supported by enormous amounts of detail. It seems to me we're much better off if you bring forth a strategy, you acknowledge the need for flexibility in the implementation of that strategy, but you bring up now the big, difficult issues on which there is going to have to be a consensus that you have the right strategy, and that if you

don't get that well underway, you are going to run out of time.

As I see it, you have two years to the viability assessment, and a year after that to the major programmatic decision to proceed with essentially the site is suitable, and we're going to proceed toward a license application. Certainly, the way I read the discussion and the legislative proposals in Congress, you have a great many people that you've got to convince that you have a good program, that it's worth continuing to spend the money, and that there is a good chance of success in having a home, not only for the utilities' spent nuclear fuel, but also, all of that material coming out of the weapons complex.

And I think a lot of people who are not close to this feel that you have a very large burden of proof to meet. That leads to my last major point.

I have the sense, listening to the discussion in these two days, that much of your effort under the heading of integration tends to be inwardly focused. The team is talking to each other, improving its relationships and its communications, all very commendable, but you have an external audience that you have to deal with. It certainly includes NRC. It includes the utilities. It includes a great many interested and affected parties, some of whom are represented here in the audience, and, basically, at some

level, they are going to have to understand. They may disagree, but, basically, you are going to have to meet a burden of proof as determined by people who, at this point, don't know you very well, and so you're going to have to practice communicating what it is you do, and why it makes sense.

I'd like to focus specifically on the idea, or on the expert elicitation. I heard that mentioned several times by Abe as, "Here's how we might deal with difficult issues in the performance assessment area."

My concern is that if you don't get a good start on that and allow yourself time to do it, it may prove much more difficult, and may be even a reason why you won't manage to avoid that oncoming freighter.

The experience, I think, from the earlier exercises in that area that I watched as a member of the Board, is that it took several iterations before the experts really understood what you were asking of them, why you wanted it, and you could communicate back and forth in the same language.

As the Board said a number of times when I was a member, it would be an excellent idea for you to involve experts outside of DOE and your contractors. You need to get a buy-in, and an understanding by the greater professional community, and I don't think the TRB is a substitute for

that. I think you've got to get out in the professional society community. You've got to be working with the leading experts in these various areas, and you've got to understand their point of view and have them understand yours.

That's not a simple process. I realize the money is extremely tight, but it seems to me it's really critical to be able to spend those extra few thousands of dollars to get the right people to come to your meeting, understand what it is you need in the way of judgment, and then provide that judgment to you while you still have the flexibility to change and adapt accordingly.

I would also like to note the other exercises that have been going on; the waste isolation pilot plant, and the low-level waste site in California, called Ward Valley. Since I've been sitting inside the National Academy lately on the board on radioactive waste management, I've had a chance to follow events in these areas more closely than, perhaps, I did earlier, and it seems to me there are some very important lessons to be learned there on the importance of performance assessment, and the difficulty of going ahead with a program based on performance assessment in terms of the understanding that other people have of it, and the potential for miscommunication and misunderstanding, particularly out there in the public.

I think you can learn a lot from the successes and

failures of similar programs, and you should be studying that very carefully, and laying plans for how, over the two to three years you have before the next decision point, you can have your team put on the best possible performance in order to be successful in your endeavor.

DR. CORDING: Thank you very much, Warner.

And now, Dennis Price.

DR. PRICE: Thank you.

I'm not going to scatter my shots. It's a pleasure to be back. I really appreciate the Board's inviting me back as a consultant. I get to see everybody, and renew old acquaintances, and so forth, and I've been away from the program for a little while, and really enjoyed this opportunity.

Yesterday, Abraham of Yucca Mountain talked of plans to model performance of the repository in order to predict host and engineered barriers' performance over thousands and thousands of years.

I couldn't help but think that the Abraham of Genesis, long ago, probably had no such ideas in his mind. I suppose he did not classify the parameters of the geology on which he stood, nor did he wonder if they were linear or nonlinear over the next ten millennia, and I'd suppose he had very little concept about 200 or 300,000 years, and that earlier Abraham simply lacked our geonuclear perspective.

But, this is, indeed, true of all of our predecessors, because, as John Cantlon said, this is a prototype kind of thing, the first of its kind, so before we pat ourselves on the back about our sophistication that we've gained in the few thousand years since that first Abraham stood on some mountain somewhere, and because of our sophistication, venture to predict repository performance for the next thousands of years, I think we need to face, frankly and honestly, our readiness to do so. Is our science ready for the production mode?

Yesterday, Paul Harrington said that if the DOE goes to the NRC with the wrong product, then we are in real trouble, or words to that effect. If science and engineering are not prepared to adequately address the repository, then the repository is not the right product at this time.

The skills and knowledge of some of our nation's best scientists and engineers are on this project. If the skills and knowledge of the best do not match the product, then the product needs to be changed. Is science ready to support the repository product as adequate for 10,000 years, or, perhaps, if necessary, 200 or 300,000 years? Can the scientific method rise to support hypotheses that border on the everlasting? Can it be there by the year 2002?

The work of long-term futurists is in its infancy. Can we reach into the future with our models? How can we

support the validity of long-term models that come from relatively short-term data, in some cases? For example, "long-term" thermal tests, that are really thermal tests based on less than a half a dozen years.

In simple regression models for prediction, we all know that you can get an r that's not significantly different from zero if you sample way down in a narrow corner of the range, which, in fact, is a function over a long range, where you may have a function that is significantly there, and so I think that it is, in general, very dangerous to project far into the future from short-term databases.

We learned yesterday that at least one geochemist is challenging the ideas about neptunium solubility. Is geochemistry really at the point to be ready to be talking about 10,000 years or long-term performance of a repository?

I raise the question: Will we be ready with enough information about site-specific science, hydrology, in situ corrosion processes, rock mechanics, site stability? Is the present state of reprocessing ideas and technology sufficient to advocate non-retrievability now? What will it be, that idea, in 100 years or 1,000 years? Will nonproliferation be revealed to be a myth that cannot and will not be reality? Will energy needs or technology changes require future retrievability?

Do we have the science and engineering for the

repository product, or is the product wrong? Why should we be bound, at this time, to produce Dr. Brocoum's 10,000-year product, or an institution's 200 or 300,000-year product? If there is uncertainty sufficient to raise doubts about validity, can we adjust the product to reasonable scientific certainty, and should we do so?

If the DOE has embarked on a production mode without the support of ready science, the product is wrong. We should build what we know how to build, and not pretend to know what we do not know. The long-term future is hard to know, I think. The long-term direction was set by declaring that we will solve this spent nuclear fuel problem in our generation. That's a noble myth. The reality is that the waste will require the attention of future generations.

We need to get off Cloud 22, there's a catch in it. We need to plant our feet firmly beneath the ground, with accessibility, retrievability, monitoring, and doors that open and close until science and engineering are ready for the long term. We should build what we know how to build. When we decide to do that, we are ready for the production mode. The science should match the product by changing the product to be compatible with the state of science at its best. To do others, may be to have a fatal flaw.

We are building something right now, but I don't think, in the long run, it will be the repository that we

know of as now. That's a polite way of saying, do we really know what we're doing right now? Should we be talking about keeping packets open as long as possible, instead of closing packets? Perhaps the greatest unpredictability, both short term and long term, is human behavior, and human intervention.

In the short term, we have already seen multiple program directors--Dr. Dreyfus' tenure is already exceptional--each changing the direction of the program because they're directors, and institutional, political, funding changes that affect the ability to pursue an integrated program.

Russ Dyer spoke yesterday of the need to be able to maintain a long-term schedule. In this case, long term means, I think, over a couple of years, but this has not occurred.

Given the unpredictability of human interventions, and the interventions of human institutions, what can we say or predict about the effects of the interventions of humans and human institutions over the very long periods of the repository existence? Perhaps these uncertainties are sufficient at this time to warrant a reconsideration of the product, because if the repository, as presently conceived, is a wrong product, then we will have trouble in the near future, or in the distant future.

Jim Carlson spoke of the many policy and funding changes that he's observed as an OCRWM survivor. I think we see Jim without much gray hair. We see a program that's changed an awful lot, and yet, we're talking about producing a product that will be almost unchangeable for thousands of years, and the question I'm raising is, are we really ready to produce that kind of product?

DR. CORDING: Thank you, Dennis.

We'd like to begin the general discussion on some of these topics, and DOE's role. Certainly, we'd be interested in discussing these or responding to some of these. We did improve from freight trains to sailboats to Abrahams, and so we can continue to advance here.

One of the things, I think, on the waste isolation strategy, Margaret Federline brought up their concern about having that prepared in a way that could be used, and I think Warner North was commenting on that as well. Also, the waste isolation strategy itself, much of it, in its early stages, at least, was focusing on--or the developing strategy was focusing on what is it going to take to get to a reliability assessment?

And I think one of the things the Board is very interested in is, as part of that overall strategy, is what has to be done beyond that, and, particularly in the defense in depth sorts of things, recognizing that a strategy may not

be strictly a linear strategy. You may have to have several; some redundancies there that allow you to take into account things that you learn as you develop.

But, anyway, let's go with comments on some of the things that have been said, and perhaps starting with the waste isolation strategy.

Russ, would you like to give us a little feel, at this point, for what you see with the waste isolation strategy, as how it's developing, or what your philosophy is on that?

MR. DYER: Russ Dyer, DOE.

The Board has heard before at least the broad outlines of waste isolation strategy, and it still centers on five principal points. Now, in Abe's diagram yesterday on the performance assessment talks, there were seven key areas of performance assessment. They cover, roughly, the five major things or components of the waste isolation strategy, and different words are used by different people, but we all characterize it as low influx of water, a robust waste package--and I'm going to ask you to help me with that in a minute--slow releases from the engineered barrier system, a slow transport of radionuclides, and dilution of the radionuclides in the groundwater system.

And, at a high level, I think there's agreement within the project that these are the key elements that were

really in our program in the SCP. They've evolved over time. We've changed some of the emphasis, but they still make up the major parts of the multiple barriers that constitute this system.

Now, whenever you get past that, then we get into a question of, how much performance are you going to allocate to, demand from, expect from, wish from different elements of the system? And, let me throw something on the table that we would like some feedback from both the NWTRB and also the NRC.

One of the things going on right now has to do with if we use the waste isolation strategy to help prioritize the program, where do we put, allocate performance, if you will, to the various sub-elements of the system?

In the engineered barrier system, let's say, the waste package, if we're looking at a robust system and we're looking potentially at a very long-term standard, 100,000-year standard, how much--this is a two-part thing--how much real reliance can you put on an engineered barrier system?

I'm sure Abe could crank in a number for a failure mode for a waste package that would give us waste packages that last 100,000 years. Does that really make any sense? There's really not much data that supports that.

There's a certain amount of, I guess I'll go to Dr. Price's comments, there's a certain amount of arrogance

that's behind that. I'll call it intellectual arrogance. Can we really support that? What can we really support, intellectually, technically, and, also, in a licensing arena?

Let me give you another example of some of the things that are being debated now. We've had trouble in the past in really justifying some of the geochemical elements of the system as being the barriers in the system, because there's a considerable amount of uncertainty with the permanence, the location, the horizontal/vertical continuity of some of these features.

Well, one way to perhaps get around that is to, let's say, in the inverts of a tunnel, construct them out of some kind of material that could give you an additional geochemical barrier. It could be a diffusion barrier. It could be some other kind of barrier. Does it make any more sense to make an engineered geochemical barrier, take more credit for that than from a natural barrier?

These are some of the things that are behind working out the details of the waste isolation strategy. At a relatively high level, we concur that there are certain system elements that the system must rely on, will rely on. Now, which elements are the really critical parts, and then, how do you really fine-tune a program to really go after those critical parts? And that's where the dialogue is going on right now within the program. It's a very valuable, very

charged dialogue, but it's going to take awhile to come to closure.

We'll be able to come out with something relatively shortly that will be able to address, certainly, a level of detail beyond what you will see in the program plan, which is a page and a half or so, roughly. We'll be able to complement that with the next level of detail down, but you're going to see this as a continuing dialogue. This is going to evolve just like the testing programs evolve. As we find things, we're going to go back and revisit this. It's not going to be a one-time through process; it cannot be.

DR. CORDING: Margaret Federline, you had said we need to finalize it. You'd like DOE to finalize something and make it available. What Russ is saying, is that compatible with what your thoughts are? Russ is saying it's a document that's still moving, or is not a document, it's a concept that's going to change, and how does one resolve that?

MR. DYER: Well, I understand Margaret's situation, and what we have to do is to get something out that--out on the table for comments, suggestions on it, and it may be something that has a consensus part, and one or more dissenting opinions in the back of it, but to get something out to stimulate the dialogue and the debate.

MS. FEDERLINE: I think we see the waste isolation strategy as an evolving document that's going to depend upon

the analysis of uncertainties. The success in a licensing hearing will come from identifying the uncertainties, and compensating or having redundancies in the areas of greatest uncertainty, and so, really, what we're looking for DOE to do is put this strategy on the table so that we can identify these key areas of uncertainty, and that we can begin to have a dialogue.

DR. LANGMUIR: I guess I'd like to encourage the dialogue by a question. It strikes me that these are perfect kinds of questions to be quantified, if possible, through TSPA, and Abe on the Mountain should certainly, I would hope, have some thoughts right now, given that he's done TSPA. TSPA should be providing some quantitative measures of the importance of each of these, and, also, suggestions as to which ones we need to focus on, and perhaps, as well, how much we could gain from focusing on them. I'd love to know to what extent we can get that now.

DR. CORDING: I think Abe wanted to say something.

DR. VAN LUIK: In fact, I can kill about three birds with one stone here.

First of all, a comparison with the old Abraham is unfair, because he had a performance assessment from God that said, "Your progeny will be as numerous as the grains of sand on the seashore," but let me say there's a big difference between me and that Abraham. One, I am not a polygamist,

contrary to rumor; and two, I am not ready to sacrifice anyone on my mountain.

Let me talk about something else. I happen to be saddled, through Steve Brocoum, who is conveniently absent. Actually, he had to meet Congressional staff members on the mountain today.

I am saddled with the responsibility, which means blame, for the WIS, and the way that I see what's happening with the WIS right now is we are in agreement on what's in the program plan. There's no problem. When you go down to the next level of detail, there is a problem.

For example, on containment, everyone agrees that containment is important. It's the duration of containment that we can defend that's the issue, so it's the second level down.

What's more interesting, though, is if you remember the WIPP experience, when they first instituted their first phase of the systems prioritization method, and we followed that very closely because it was an interesting exercise of taking performance assessment results to reorganize scientific programming. Some of their scientific investigators came to them and said, "But your models don't properly account for my process. Your process level model is wrong."

They actually made some changes in their models,

and these people were right. In the majority of cases, they were not, and work was terminated. It was a very unpopular thing to do.

We are having the same type of heated discussions at that level within the Yucca Mountain Project. It is nothing but healthy, because, I shouldn't say this, but, in one case, I think they're right. We have not used the right process level model to look at whether some things are important, that, by using the equivalent continuum model that we've used, we have dismissed.

So, part of the answer is to use total system performance assessment in the prioritization of work. The other part is feedback from the site program saying, "Is your process level basis for that modeling correct?", and I think that's the dialogue that's going on now.

In response to the real nature of these disagreements--these are not just stovepipe disagreements. These are basic, scientific disagreements over the interpretation of what we have so far--we have reorganized the WIS. We are in agreement at the top level that's in the program plan, and what we are doing is putting a change request in place to be approved by, hopefully, the AMs and Russ Dyer to redo this product with representatives from each of the larger functional areas, and to have a product out for DOE review in the July/August time frame. It's slipped a

couple of months from the original schedule, but we think this is such an important dialogue, that we need to do it well, and we need to take it serious.

DR. CORDING: Thank you.

Warner had asked for a comment, and then we'll come over to you, Pat.

DR. NORTH: Let me respond by encouraging further that you are going to have these discussions and debates. It'll be wonderful if you can get a consensus internally on these issues, and so when you go out and you talk to the outside world, you're all of one mind, you've all agreed on it, but out there, they haven't participated in the debate. They don't know the issues nearly as well as you do, having polished your insight and understanding by having the debate in the first place.

So, I'd like to urge that you open it up with deliberate speed. Obviously, you can draw critics. You can expose yourselves in ways that, perhaps, you don't want to, but try to learn from the experience of WIPP and Ward Valley in terms of how you can move some issues toward closure.

From what I have heard, the issue that seems to be moving toward a reasonable degree of assurance that the risk is small, and it's very well-documented, is the volcanism issue.

There was a meeting two years ago that I attended

with the Board in which we were commending what a great job DOE had done in that area, and now you're finally getting a document out, putting that in a nice package that NRC and everybody else who's interested can review, and you will probably get criticized on it from a number of people.

Maybe, over a period of time, you can convince them that you really thought about it carefully, and that their criticism isn't on target, and that your analysis concluding 10^{-8} is really robust, and they should believe it, too, and perhaps many of them will.

My concern is that there are so many issues on which you have to do this, and when I hear Russ talk, "Well, tell me what you need to do," I think the answer to that is if you've got seven systems, you ought to be pursuing an approach that all you need is four of those, and you get performance that is quite acceptable.

If, in fact, there is some overall show-stopper that might make the repository's performance in question, even with all seven of these at some level, then that's the one you'd better find out about very quickly and attack it vigorously.

If you need three orders of magnitude on neptunium because now you've got to worry about the actinides post-10,000 years, that says that's an area where you better be shifting money and shifting attention, just as you did on the

Chlorine 36, and the performance assessment, as we've discussed many times, can be a guide to those issues.

I guess my sense is, what you need is a PISA brochure laying out the big pieces of this. If there are seven blocks, here's what they are, and here is, in general, what they look like.

I reflect on the Swedish program. They had documents like that out ten years ago, and they've been iterating ever since, and as far as I can tell, they've gotten a great many people within the interested and affected communities in Sweden to understand the details of their repository design, and then, as those details have been shifting, there's been, shall we say, a progression of the debate. They've got a long way to go, too. They haven't settled on a site, and much may go wrong on their program.

But, in terms of my judgment, as an outside reviewer, their act looks really tight. I go in and review their performance assessment, and I have a deuce of a time thinking of a question that they don't have a good answer to. I would like to see us in a similar position shortly.

DR. DOMENICO: I think we understand the strategy. Obviously, if we don't have any flux, you don't have any problems, you don't need engineered barriers. If you have much flux, you have a need.

I think what I was going to say is that I'm having

some problem with some of the conclusions that you've gotten from, from running your models, and one of them which is when you go to long time frames, say 100,000 years, it shows that the Calico Hills is unimportant, retardation is unimportant, and since you can't take any credit for it, it's not important over the long frame. You don't have to look at it.

I think nature would like to take some credit for it in the event that the 100,000-year framework is sort of breached by the radionuclides themselves, so I think when you come to those sort of conclusions easily from performance assessment, where you say certain physical attributes of the system that we all admired years ago no longer are important and, therefore, not worthy of study, that's a little troublesome, I think, in the sense of reality, because looking at--you know, trying to predict over 100,000 years is difficult. I think Einstein once said predicting is very difficult, especially if it's about the future.

DR. VAN LUIK: If I can respond to that very quickly, when I told Don Langmuir that there were certain issues that I have some sympathy with, you have just put your finger on the exact one.

When we look at the process level modeling being done by Los Alamos, when they run their transport calculation from the repository to the saturated zone for very long times, including a million years, they do show influence of

certain processes that are more abstract models and PA have suggested are not that important, so that is the exact issue over which we are having some very warm discussions at this point, and I think they're very healthy discussions, and I think we will do the right thing.

DR. CORDING: That is part of that defense in depth, literally and figuratively.

Rick Craun.

MR. CRAUN: I'd like to just address, just briefly, some comments I heard on the engineering issues.

Engineering, right now, is very tied to the TSPA analysis, the sensitivity studies. It is affecting our design as we talk even today in areas of backfill, in invert material, selection of materials of construction that we might want to use in a repository.

It is not my intent, at this stage, to say all of those decisions are behind us. I think they're in process. As Margaret pointed out, in order for us to focus on a license application in 2001, we do truly need to focus on that, and the only way I do know how to do that is to lay out a detailed schedule that will identify what the product is that we're trying to build, or trying to create, the engineering that we're trying to produce.

That must be balanced very carefully with the TSPA process to make sure that we are building, or, excuse me,

designing--that's a better way to say it--designing the correct product that can be usable. If, however, in my mind, if we don't focus on trying to initiate that design, and lay out those steps now, 2002 becomes impossible for me. It's a very ambitious task now. To not start that layout of the steps necessary to get there doesn't seem like success to me, either.

Again, though, but it must be integrated with the TSPA, and it's a balancing act, to me, and, right now, the balance currently, there's a lot of interaction, a lot of studies going on in engineering to make sure that we have the short-term defense in depth.

Defense in depth gets very natural barrier to me in the year, 300,000 years. There aren't very many of my engineered products that are going to be around to help neptunium, so my issues are much more short term.

Maybe my focus today, over the last couple of days, has been too focused on a shift in focus to a design product. I called it a production product. So did Paul. Maybe it's really a design process that we need to initiate to try to build a license application design, but the laying out of that process is important for us to initiate now to attempt to build that product by 2002, if all of the supporting science will support that aggressive schedule.

DR. CORDING: Thank you, Rick.

Any comments on that? Warner?

DR. NORTH: As an emeritus, I'll be happy to debate on that one, because I think what I'm feeling isn't there, is I don't have the confidence that there is the flexibility to proceed with the detailed design, and have the ability to track the evolution of science as that may cause changes.

I think of it an analogy as commissioning a building, a rather large one, and, at this point, I don't really know what the shape of it is, and I don't know how many offices it's going to contain, and when I hear you propose to design, for example, the heating system, in gory detail, I'm concerned that if we're locked into detail in that area, will we have the flexibility to be able to accommodate, for example, more or less offices in the office building?

Now, maybe you can see that very clearly as to how you're going to do that, that, in fact, one heating system for an office building whose square footage and use have yet to be determined will accommodate just fine, because you have the flexibility to make modest changes that will make it work, but you have to convince the rest of us, and I don't think I'm going to be able to go through 10,000 drawings and make any sense of it. I need the sketch. I need to understand the basic strategy and be persuaded by a relatively simple and easily digested argument that what you

propose to do is the sensible way to proceed with that aspect of the design, and I think you should do that before you go to the trouble of making 10,000 drawings.

DR. CORDING: Lake Barrett.

MR. BARRETT: Maybe I could try to comment on--bridge this, because I think a lot of the discussion here on this production and engineering is you're almost all in violent agreement on this, but you're just looking at it from different perspectives.

The overall sketch, I believe we're working on that, and the conceptual, we have just completed the conceptual design of the repository, documents about this thick, that sketch out where we are, and Rick's people just produced that last month, and I believe the Board has copies of that, so we are working in the broad realm of things.

When we've used the word "production" for these 10,000 drawings--and I wish we wouldn't use the word "production," because I think that connotates something different in different people's minds--is what I believe they are talking about is for a license application, which is a documented, institutional process, where you lay out your safety case, and your case to describe to the independent regulators our ability to protect the environment and meet the requirements, whatever they may be, is a very disciplined process which demands written documentation. That is no

small thing, but it's not a detailed design that has everything in it to build a repository.

I think Paul had mentioned, you almost need hundreds of thousands of drawings to actually go build this thing, so it's a lot of work, and it needs management discipline in producing these documents, and you need to kind of scope it and narrow down just to make the safety environmental protection case that we'll have to, but we don't mean to foreclose on all of the detailed design, but I think some of the comments that Dennis made, staying within the capability of science, that's what we are trying to do with that, but it's not production, per se.

It's production of a safety case and an environmental protection case which is really based upon the waste isolation strategy, guided by the performance assessment activities, with many iterative feedback loops as we go through it, so I don't see there's a big disconnect from a different perspective. It's just different people looking at it from different perspectives, which is good. It gives us a better corporate understanding of what it is that we are all about doing.

DR. CORDING: Don Langmuir.

DR. LANGMUIR: Just coming back to Russ's list of five components in the strategy, low water content, robust waste package, slow releases from the EBS, slow transport of

radionuclides--if I can read properly--and dilution of radionuclides.

I look at that list and I see two key directions for site characterization and related work, and we've talked about them for the last two days. One, again, is critical, and that's the infiltration, distribution, and amounts, and that's something, hopefully, we can get our hands on with some very focused site characterization work, and maybe in six months to a year, through isotopy and working together between the transport modelers and the geochemists.

The second one is a killer. We've been bypassing it the last two days, and that's thermal loading. It cross-cuts every item on that list, and until you know what it's going to be, or you've thought about, you're going to have to write a strategy that incorporates both low and high, and doesn't really resolve anything yet. At least, I don't know when you're going to resolve it, but without doing some work to know what it's effect will be.

You know it's going to impact every single item there. You don't know exactly how. Some you can guess more than others, but they're guesses, and so, what's the strategy going to say that doesn't leave a lot of gaps because you haven't resolved the effect of thermal loading on each of those items?

MR. ROBERT WILLIAMS: Ed, if I may?

DR. CORDING: Yes. Bob Williams.

MR. ROBERT WILLIAMS: I'd like to perhaps help DOE respond to that question, and to the challenge posed by Dennis Price. I always never feared to tread where angels fear to tread.

It seems to me that the way we answer Dennis's question in its broadest context, is we had, basically, two strategies in any design. You proceed with a very conservative design, and where you don't have data, you proceed with a conservative hypothesis that will be validated by data that you get after you start working, and that's where you have to get the regulators to buy into it, and that's what people have variously called a phased, or a two-step, or a multi-step licensing process.

Secondly, you need some way that solaces the public. You need to--and, ultimately, in the repository game, that has been retrievability. You promise if all this turns brown and icky, that you're going to pull out of there, and that there will be no long-term harm done, and that's what's called retrievability.

Now, superimposed on that, I would like to suggest that your waste isolation strategy is really an issue of what we do now before the viability or suitability decision, and what we plan to do later, after a viability or a suitability decision, and what we do later is confirmatory testing based

on confirmation of the conservative hypothesis that we went in with.

Now, I think your whole discussion of waste isolation strategy would be clearer, and you wouldn't have warfare among the troops if you would agree that these are all the tests we're going to need some day, and some of them we're going to do up front, before suitability, and some of them we're going to do later, after suitability. Some, we're not going to do at all, but at least have the full suite of issues on the table.

DR. CORDING: Thank you.

DR. LANGMUIR: See, they've been taken off the table. That's why I'm moaning and bitching, because they were on the table about six months ago.

DR. CORDING: Okay.

MS. FEDERLINE: This is exactly our concern in the thermal test area. We would like--and Bob has talked about phased licensing. We see the normal licensing process as using the confirmatory items. It did in reactor licensing. We know that there are going to be uncertainties at the construction authorization stage, which we're going to bound, but the regulator wants to have confidence that a test program is in place that's going to secure the necessary data by the time that it's needed, and I think that's what we're feeling insecure about.

We're hearing about a duration of a two-year phase in thermal testing, and I think Dennis has indicated that there is no predetermined cutoff to that test, but I think what we would like to see is more vision, that, yes, DOE realizes that this long-term test data is going to be required eventually, and sort of an acknowledgment that over some period of time, the confirmatory items are going to be collected.

DR. CORDING: Thank you. I think that's a feeling the Board has had, in looking forward to when the viability assessment time comes, how would we be looking at it at that time, and having--even though we need flexibility, having something that's there that says, here is how we're approaching this, a plan, and I think part of it is, you know, we've been focusing on '98 because that's the nearest date and you have to focus on that, but I think I sense that you are starting to look a little more broadly, a little further down, and I think that point is very good from a perspective I've seen of my own concerns with regard to the strategy.

Russ.

MR. DYER: Let me follow up a little bit on some of the previous conversations.

As the program has evolved over the past five or six years, it has obviously moved from a very ambitious

program that did a lot of things in a linear sequence, a logical sequence, and we now have a program that has a lot of things going on in parallel. It is a riskier program, admittedly, and the nation, as a whole, has told us that they've been willing to underwrite that risk.

We think it's still a viable program, but the key is that you really have to have these meaningful checkpoints along the way, where you really stop and check, make sure that you're ready to go on to the next step.

One of the big steps that we have coming up is this thing called a viability assessment, and this is going to be one of the first times where we've put together a common basis. This is a repository design, a repository design, not necessarily an optimized repository design, but this is a repository design. This is a performance assessment that incorporates this repository design with what we know about the behavior of the natural systems at this time. It's our best guess of how this thing will perform.

That's going to be the launching point, really, for what we do next. We may be able, at that point, to go directly into a licensing mode. We may not be able to. I think we're reasonably confident that things look good now, but you can't close out the eventuality that something's going to come up. It's just part of the reality of this project.

DR. CORDING: Thank you.

Pat Domenico.

DR. DOMENICO: Back to thermal loading, one case for testing, in general.

We seem to think that if we really want to know something, all we have to do is run a test. That's nonsense. I think we've demonstrated this morning, you wanted to know something about the dilution potential of the rocks, so you put something in and you lose 80 per cent of it, so, you know nothing about the dilution potential.

We seem to think that we can run a thermal test and design a thermal load, and we have to ask ourselves, what are we going to observe during that test? Maybe, with luck, we'll observe some moisture movement, maybe some response of the rocks, but I don't really think that out of any length of thermal test will you come out with a definitive thermal load. I frankly think the thermal load is set. I think it's going to be a high load, and it's been decided some time ago that it's going to be high thermal loads, and I do not believe that thermal test is going to give you information where you can say, "Ah-ha, now I know what the effect of this load will be." I don't believe so.

Like I said, if we want to know something, we think all we have to do is run a test, and there are some hidden details that we're never going to measure, never going to

see. It's called hidden geologic detail. I'm sure we've all heard of it before. That's my sermon, Ed.

MR. DENNIS WILLIAMS: Dennis Williams here.

Perhaps one correction, sir. We lost 70 per cent of the tracer, not 80, but we don't know where it went.

DR. CORDING: I understand Pat's perspective, and I think Pat's statement, to me, means that we don't count too much on the tests, but it doesn't mean we don't perform the tests, and I think we have one program, which has, late in the program, and we're moving ahead faster than most other nations in coming to a decision on a site, and we have had less opportunity to do the sorts of testing that others have done.

Some people have done testing that, perhaps, you know, may not be critical to their programs, but, certainly, I think, you know, I see a need to get in there and do some of this, but to count too much on it--because a lot of insights that we can get--and our models are limited and don't describe, you know, tests only give us a view of reality through the instrumentation itself, which is limited, and so, obviously, we're working on a time frame on a scale that's obviously short, so all those things we have to look at, but there's a lot of things we need to be doing, I think, to put it together so we really have a good perspective.

DR. DOMENICO: I agree. You should get in there and do

something, I think, but, you know, when I read things like the testing is going to provide us with thermal loading alternatives, we're not fools. Yeah, the testing will help you out on the mechanical properties, but you could do that in a laboratory just as easily, so I don't really think you're going to have a test that's going to follow fluid movements around and show the umbrella effect and all, and ponding up above, all the things that people are worried about. You're not going to see that.

DR. CORDING: Okay. I'll discuss it later with you, Pat.

John Cantlon wanted to comment, and we have others here.

DR. CANTLON: I wanted to sort of put us back on the track of the subject of our meeting, which is the integration. We can get mired down in the debate of these details, which those debates are going to be here ten years from now, I think.

The Board has asked, as Lake Barrett acknowledged, that DOE show us the evidence of trying to pull this together around a waste isolation strategy that meant something, and I think I'm very pleased to see the kind of synthesis that's underway. It clearly is an iterative process.

Everybody recognizes that this is not a production item we're into. It's a prototype. It's an emerging thing,

and, like in all prototype operations, whether you're building space vehicles or carriers or whatever, whenever you're in a prototype situation, you have two giant hurdles. One is keeping the funding going, and the other one is making sure that the design is not going off in a direction that is an irretrievable direction, and can be brought back into the central focus.

As I see it, the initial '98 decision that DOE is mesmerized by at the moment--and logically so--is essentially the first issue, and that's the funding stream. If Congress does not see legitimate evidence that this program is on a success oriented trajectory, they're going to shut it off. I don't think that that particular decision is a license decision.

NRC may be interested that this has driven you to a kind of synthesis, and bringing together of data for your own comfort, and for persuading Congress, but you surely don't intend that to be up for NRC review, and, indeed, I don't think the Board expects it to be at that level yet. You've got another couple of years of data and research and so on before you begin to get to the point where you expect to see something that will be ready for NRC and for our critical analysis of whether that site is really suitable when you recommend the site.

And, it seems to me if we keep in mind that that

decision is, again, another decision on a longer trajectory, it's only the initial decision, whether or not that site is the place that one ought to start constructing.

There's another set of decisions up the way, which is the receipt of nuclear materials which, in my view, is really the one the public ought to be concerned about. When do you start putting dangerous materials into my Nevada real estate? I'm a native Nevadan.

That point is well up the road, and there is time to get a number of these things together to get this synthesis that we're into along the way. Clearly, one strategy we talked about yesterday would be to start off in the initial stages of the design to be very, very conservative, to over-engineer the barriers, to design a system that you may not, in fact, build because it's too expensive, or a lot of other reasons.

Nevertheless, if you can persuade Congress that this very expensive Cadillac version can be trimmed down to a Willys or something like that, after you've got enough data to reduce the uncertainty levels, it would seem to be that's a fairly persuasive thing, and I guess what I'd like to see is whether DOE--whether I'm mentally along a trajectory that is at great variance to where you're headed.

I'd like to hear from Lake, and from Rick, and Russ on that.

DR. PRICE: But you don't want to give them the Willys.

(Laughter.)

DR. CORDING: Lake.

MR. BARRETT: Well, this is a balancing act, as Tom Grumley puts it very dramatically one time, you know, of competing goods. You try to balance one versus the other.

One would say, in simplicity of this, was building a simple engineering structure that we're familiar with, that lasts for decades, or a hundred years or so, let's make it conservative and bring it down. There's two things, I think, that make that difficult to do.

Number one, if you're dealing with time periods of peak concern, if we end up with a EPA criteria that sets the period of peak dose which is multi-hundred thousand years from now, over-designing the engineered aspects to it may not make that much difference. What you could do by over-design is, well, more investigation in the mountain, in the natural, but that's time and money, and you get this thing too expensive or taking too long, they'll shut it down right now.

We are very mindful of the interchange between Senator Johnson and Senator Domenichi last fall about, you know, if I don't see it go quicker, I'm going to shut it down now. We think they've become more enlightened since then, and I hope that sentiment's not as strong, but, nonetheless, that sentiment, it was real, and it is there amongst members.

So, we have to balance this thing one way or the other, and it's not a simple thing to do, and I'm not sure that we even could over-engineer things for these peak doses out at multi-hundred thousand years, no matter how conservative we tried at this stage.

DR. CANTLON: Let me just put into your thinking, this point: As you know, they've been talking about the depleted uranium, which you really could, if you put that in in particular kinds of way, you could, in fact, get very, very long stability for the migration of many of the isotopes, if my geochemistry--

MR. BARRETT: I'm not sure that that would help.

DR. LANGMUIR: I've got a different slant on that. Depleted uranium is UO_2, and, a better choice would probably be the enriching the backfill in silica, which you've got, and calcium, which you have, and limestone to slow down the movement as an oxidized form of uranium, as a metal called uranophane, that would do that.

I'm always looking for things that are thermo-dynamically stable, because of all the things we have as geochemists in our grab bag, that we'd like to apply to anywhere like Yucca Mountain, it's equilibrium concepts, because they are infinite. I can defend them at a court for 10,000 and a million years, so I can apply them here to hold back movement of radionuclides, so I can comfortably--and all

geochemists will support me if I can argue it's a stable system, that nothing's going anywhere, so that's a little different slant on that.

Could I shift gears?

DR. CANTLON: Well, I wanted to hear Rick on this, and Russ.

DR. CORDING: Let's continue this, then we'll get back to that.

DR. LANGMUIR: I was going to come back to that.

MR. CRAUN: Richard Craun, DOE.

In my mind, the short term is truly, as Lake indicated, a balancing act of the engineered features and the cost. We are exploring, with the system studies, and the interfacing with the TSPA folks a whole series of sensitivity studies to try to find out what features could we add to the repository--backfill being one, invert structures being another--that would give us an engineered enhancement over a period of time, whether that be 10,000 years or 20,000 years, and I think that's important for us to do that.

You've also brought to the table an issue of an evolving design. Would I expect the design to continue to mature beyond VA? Clearly, yes. As I approach an LA, whether it be two drawings or 10,000 drawings, I would expect that design to be far more mature. As I go beyond LA to the construction permit, I would expect the design to even be

more mature, and then into the operating permit, so that I'm starting to load it, and one might even think all the way out to the closure permit, as to one really does, then, actually close the repository.

At that stage, I think the design will be very well understood, hopefully, and that bases will be a lot more focused on that, but the uncertainty in the beginning is diminishing with time.

DR. CORDING: Thank you.

Russ.

MR. DYER: To close it off, I agree absolutely with what Rick and Lake have said.

The scenario you laid out, though, with essentially bringing something forward in '98, and changing it substantially with time has some attendant risks with it. I mean, there could be a perception, on some people's part, of a bait-and-switch operation. If performance costs, trade-offs are substantial one way or another, that's something we will have to face.

DR. CANTLON: Down ought to be easier than up.

MR. DYER: As long as it's cost.

DR. NORTH: Again, I'd like to jump in here from my time away from the Board, and enmeshed in the details of this problem, as most of you are.

When you get out and talk to people that have

passing acquaintance only with Yucca Mountain, one of the issues is: Can it be done at all? Is there any way to build a repository in that mountain that's acceptably safe?

And it seems to me if you have a very good argument, based on defense in depth, perhaps at some high cost, that it can be done, that is a very important step forward for some of those folks that you've heard discussing in Congress whether or not it ought to be shut down, and I'd really like to see something that you can give to them, and not in 1998, very soon, that says, essentially:

"We know how to do this. We didn't find an Aztec princess. We found things we expected, like a little bit of infiltration, and we know how to do it, but there are a lot of ways it might be done better or cheaper, and we need more time to develop those in detail. But here's the big picture, and here's why it's going to work."

And if people start believing you know how to do that, that the big picture is there, and you really do know how to make it work, and you've got the technical community backing up that they've looked at it, and they say, "Um-hum, looks pretty to me. I think it'll work," then you're really going to make a lot of progress from where you are right now.

DR. CORDING: Don Langmuir.

DR. LANGMUIR: I wanted to talk in a way related to all of this, but also to answer Pat, as well.

I agree with Pat that you probably are not going to design long-term thermal tests which you can really monitor-- we don't know how to monitor them at this point--and learn from them what we would like to learn about refluxion. You're probably going to have to learn these things over decades and decades.

I guess my biggest concern has been that, just today and yesterday, DOE folks have been unwilling to suggest there's any life beyond '98 for thermal loading, and we all know that's not true. I appreciate that you're in a political arena, and that you have to try to bring closure, in the view of everybody that's supporting you in the Congress, or not supporting you, but I guess I would just like to have you acknowledge publicly that maybe there's a life after '98 for looking at thermal loading, just to give you some confidence in what this Board might be willing say, and I guess I'm speaking for myself at the moment, but I think we've talked about this.

We're prepared, with our own definition of site suitability, which is, if I remember it correctly, "Confidence that the repository has a high probability of successfully isolating high-level waste." I think most of us would be willing to agree to that and sign a piece of paper that said that in a couple years if you pursue, as effectively as you have, and protectively as you have getting

answers to key questions.

And I would that, since that's all any of us are going to be able to say, is high probability in '98, that you'd have enough comfort with that, regardless of the choices of thermal loading that you might come up, to persuade a Congress of it.

Now, I understand that they want black and white, but that's not the real world. Can we all agree that high probability is a comfortable place to be? Is it an adequate place to be when approaching our funding agencies and Congress?

MR. BARRETT: Let me comment, then I'll turn it over to Russ.

It's necessary, but not sufficient, in my opinion of that. First of all, there will be thermal testing and activities post-'98, and I want to let Russ explain what that will be, and we will document it and make it clear to everybody what that will be in the testing evaluation plan and other things.

But, back to the suitability, and where the thermal loading issue comes in here, if you were to tell Congress that we have a high probability of building a repository that will hold 10,000 tons of the material, or 10 per cent of the material, and it cost, you know, somewhere like we're talking, the $20 billion thing, it's DOA. It isn't going to

go.

So, it has to be one of reasonable size to solve the nation's problems. That doesn't necessarily mean 100,000 tons, but at least several decades worth, in my opinion, this is what they expect to see. So it has to be--and Dreyfus, when he speaks: "A repository of useful size," is in the phraseology, and it's in the words you'll see in the viability assessment and in the program plan, so it's a useful repository, not just a theoretically suitable, that, yes, we can put away a very small amount. It has to be a practically useful one for it to pass, I will say, societal muster, as defined by the United States Congress, willing to fund it.

And the thermal, Russ could--because there is a lot of thermal things we're going to be doing.

MR. DYER: Yeah. Let me--I see Dennis over here prowling through the schedules, because he's looking for the details that I don't have at my fingertips.

But, let me start off by addressing the '98 date. There is thermal testing beyond 98. I think you're thinking about the thermal/mechanical tests, the first tests, which we will initiate this summer. It has about a year to heat up, about a year to cool down, so we get the results by '98, but the large test, the drift scale test starts, I think, next summer, '97, summer of '97, with a heat-up phase of two to

four years, so there's testing that goes out until around the turn of the century. That's just the heat-up phase.

DR. LANGMUIR: I've been asking this question repeatedly, and I hadn't gotten an answer yet, so that's why I kept asking it. It sounded to me as if things had been disconnected from what had been long-term plans, so I'm glad to see they have not.

DR. CORDING: Dennis Williams.

MR. DENNIS WILLIAMS: I'd like to make a comment, because Susan's presentation of yesterday, on page 15 and 16, shows the thermal tests going out over the longer duration, and, of course, that's what I keep in my mind whenever we're having this discussion, and those are some--maybe I wasn't listening as well as I could have to your concerns.

But, to again provide a little bit more elaboration on this situation, we set, or we put in place a test, a thermal testing strategy last year, and I think we reported to the Board on it. Our strategy was to go from small to large, simple to complex. We started it off with the lab testing, and we ended it up with a large-scale, long duration test. That's the whole plan that we would have liked to have put in place.

It included the large block test in there. It included some laboratory blocks. There was a single element heater test, which now we have called the thermal mechanical

in the first alcove in the thermal test facility. The drift scale was a piece of that. Again, the large scale, long duration was a piece of that.

What we've tried to do as we have moved into this new program phase of more risk and reduced cost, is pick out the pieces of that that we think might do the trick on the front end; the single element heater test, the thermal mechanical one, and the drift scale.

One of the questions that was raised: Why not bail into that large scale, long duration test, regardless of cost, you know, force the organization to come up with the money to do that? Well, there is a lot of risk going into a large scale test that is very complex.

One of the things that we didn't want to do was bail into that, get a lot of results that we would have a difficult time understanding, so we preferred, then, to drop back to the drift scale; the drift scale, again, starting in '97, a one, two, possibly three-year, or even more of heating. That's what I've, you know, I've been talking about. We turn it off when we get ready to turn off.

At the same time that we're following this heating pattern with the predictions, we'll be feeding that information into performance assessment, and also into design, so they will understand something, possibly something about their thermal loading strategy.

When we get to the point we feel that we can cut it down or shut it off, or move over to a large-scale long duration test, then we will do that, but I must admit, the end of this is kind of fuzzy right now because we haven't put a specific cutoff on this thing. We have some criteria for making those decisions, and we've got a two-year bar that we've said, "We know we will heat it for two years." So, that's kind of where we stand on it.

The last point I'd like to make--and I think Bill Boyle, one of my staffers, made at one of the last meetings--the thermal part is about the only thing that we can control on that mountain. The geology is given to us. Basically, the hole in the ground will be given to us, but the thermal loading is something that is controllable.

We find it very important to understand thermal, the thermal response of the mountain. We've had a lot of discussion with the waste isolation strategy because of that, the perturbed environment. The ambient environment we feel we can figure out fairly readily with a little bit of time, and possibly a little bit of luck, but the perturbed part of it is definitely thermal. That's what we need to test. That's what we need to know, because that's about the only thing we can control out there.

DR. CORDING: I want to give opportunity for others who want to make some statements, and I think, also, Jeffrey

Wong, did you want to make a statement; a comment or a question?

DR. WONG: I just have a simple question. You talk about continue funding of all the tests, and I look at the TBM. First, I saw the term "daylighting," and now I see "outholing" is what's going to happen in a period of October of '96 to January of '97, looks like it crosses fiscal years.

Is the January, '97 date a pessimistic date, or, I guess my question would be, what happens if that date slips a month, or two months? What will that do to funds available for further scientific studies, such as thermal testing?

MR. CRAUN: This is Richard Craun. You added a little twist at the end. I was much more willing to jump in.

Clearly, we are looking at ways to get it out sooner. The sooner we can get it out of the ground, whether we call it "daylighting" or "outholing" or "hole outing," it doesn't really matter. Once we get it out of the ground, a lot of the infrastructure associated with the operation of that machine can be--the funds associated with that can be redirected.

There is, as there is in '96, a balancing act in order to not ask for more funds from the balance of the program in order to operate the machine. That will be on us again in '97. The more I have to try to produce the funding profiles to operate it through November, December, January,

more pessimistic, depending on how pessimistic you want me to be, February, March, if I lose a main bearing, April, May, the price tag becomes progressively larger, and progressively more difficult.

That balancing act is taking place now. Those discussions are taking place now. From my standpoint, both engineering and field operations, I realize the amount of engineering work I need to get done, so I think--and so do the scientists. That truly--there's a balance of priorities that will be established by the program, and we will march to those priorities, but we must make sure that we continue to support both engineering and science, and that's been a lot of the objective in '96, and we've put a lot of effort into improving the efficiency of the operations of the machine, the productivity of the men.

For example, we've had a 300 per cent reduction in cost in the steel sets that we use on the machine. There's been a lot of very tenacious effort gone into making the operation of that machine less expensive so that we can run it from now, effectively, for the same amount of dollars, through the entire year, versus just half a year, so we're heading in the right direction. The longer it takes to get the machine out of the ground, the more difficult the issue is.

DR. WONG: If you go beyond January of '96, it'll be a

true test of integration.

MR. BARRETT: Yes. If we get our '97 budget as requested, I have full confidence in the Yucca Mountain team, that they will be able to get that machine out and control the costs--if it takes longer, whatever--that it will not adversely impact on the planned science programs in FY97.

If we get budget reductions out of this cycle, we have to go back and then balance it all and see where we're going to be.

DR. CORDING: Russ.

MR. DYER: Russ Dyer, DOE.

Let me follow up a little bit. I'll second Lake on that. The challenge is to make sure that we program adequate funds for '97 to do the scientific program that we need to do. The highest priority on that list is the thermal testing program. There will be some contingency built into that. There'll be some contingency associated with the ESF operations, too.

This year, we had the, I guess opportunity is the word, to reprogram some infrastructure funds to accommodate some high priority scientific work. If we have high priority engineering construction work that comes up, we'll also get a chance to do some creative management and reprogram some funds in '97.

DR. CORDING: I think a continuing look at costs and

trade-offs is, obviously, key, and I appreciate that you're looking at that. There's always places you can continue to work on those adjustments.

John Arendt.

MR. ARENDT: After listening here all afternoon, I've got one request I'd like to make, and I guess it's an action item, and I'm not sure I'm in order to do that, but I'll try it.

I'd like to give Bill Barnard an action item, and it's to get a listing of the five priority items, or the priority items that will determine suitability--not suitability, viability, and I would like to have a list of five items, prioritized. I'd like these to come from the DOE. I'd like them to come from the M&O, and I'd like them to come from the Board, and I don't know what the time frame is, but I'd kind of like to see this in the next couple of weeks, because I'm sitting here all afternoon, and I'm not sure what the major issues are.

I think there are differences of opinion, and I'd appreciate--if that's in order, I'd like Bill to do that for us. Is that appropriate?

(No audible response.)

DR. CORDING: I think we have a yes. Thank you.

Are there any other comments from staff?

Woody Chu.

DR. CHU: I have to bring up a question of a different kind on the regulatory framework.

Yesterday, Steve Brocoum, in his presentation in the morning, talked about the initiatives that DOE is undertaking vis-a-vis regulations, and these are initiatives not only with respect to 960, which is DOE's own, but working with other agencies as well, and, particularly, in working with the NRC on Part 60.

And the emphasis there, it seems to me, or from my reading, was to somehow modify Part 60 so that it brings the focus onto system performance, and so I have a question for both DOE--I guess it's Abe of the Mount, as well as Margaret to comment on. In her opening statement, I seemed to hear that she's endorsing the notion that performance assessment shall become the centerpiece for proving the safety case, and so I'd like to hear from them on that score.

MS. FEDERLINE: Yes. Just to bring you up to date on what we have been doing in that regard, the National Academy report, you're familiar with, was published in August of '95. EPA started an active effort immediately to begin to develop standards, and we formed an official liaison relationship with the EPA.

We have been doing detailed technical analysis on the implementability of the standards, and providing that material directly to EPA in the formulation of their

standard.

As we see it--and we have briefed the ACNW and others publicly on this--the National Academy of Science does call for a risk dose-based standard which would focus on performance. You're aware the Commission, in the past, has favored sub-system requirements. We believe that the sub-systems will need to be understood, but based on the direction of the Energy Policy Act and the National Academy report, we do not, at this point, see quantitative sub-system requirements as part of this standard.

Our plan for developing this, we've been working with EPA. They're planning to go to OMB in the next couple of months with a proposed standard. At the same time that the proposed standard goes out, the NRC staff is developing a conceptual implementing regulation that the Commission can consider at the same time, and we're going to be proposing two approaches.

One would be revising the existing Part 60, and the second would be to develop a new part, which would be a Yucca Mountain-specific part, which we believe is, you know, consistent with Congress's direction in the Energy Policy Act, and that would be a performance-based standard.

DR. CORDING: Abe, any comment on that?

DR. VAN LUIK: I think our comment would be that we are in the process of a rule making to review 960 to do exactly

the same thing, which was to focus on system requirements, because the bottom line is health safety, which is a system performance measure. I think to say that we're working with the NRC and the EPA is a little strong. We are taking advantage of every opportunity to provide comments to those agencies, but they are independent agencies.

DR. CORDING: Thank you. Warner North.

DR. NORTH: I wonder if I could draw Margaret Federline out into commenting a little more specifically on the time frame issue, the post-10,000 years? Has NRC made a recommendation of that type? Do you have your group working on the implementability of the Academy report in that dimension? And do you have anything that you would like to add as a comment on what was distributed to us in the form of DOE's letter to EPA?

MS. FEDERLINE: We have been working on the time frame issue, and we have provided several analyses to EPA in that regard, just out of courtesy to EPA. Those deliberations have been between the two regulatory agencies, and we could certainly come forward at an appropriate time and brief the Board. We'd be happy to do that on all the positions that we've taken with EPA.

MR. NORTH: In making my speech to NRC rather than DOE, it seems to me this decision's ultimately going to be made by the public and their elected representatives, and it'll

probably be a very good idea to have it discussed in public as to what is the implementability of the Academy's recommendation, and how it is you propose to do it.

MS. FEDERLINE: Right.

DR. CORDING: Thank you very much, and thank you all for your participation this afternoon.

We want to also give time for any public comment. I didn't see any people sign up on the list, but we do want to ask if anyone wishes to speak at this point. Please come forward. You're welcome to come and speak.

(No audible response.)

DR. CORDING: All right. Well, thank you very much. I'm trying to get some other sailing analogies, sort of like the rudder is in the water, and all those things, but I've been in Illinois for two years, and I haven't been out, so I'm going to turn this over to John Cantlon, our chairman, for his closure.

DR. CANTLON: Well, let me thank everyone for what I think has been a very productive session. I think this is a reassuring trajectory that we're on, and I just think that, as we all know, it's an iterative process, and we're going to be following very closely the progress that's being made on synthesis coordination, integration, and, hopefully, the picture that is emergent will keep the money flowing so that the program can continue.

So, thank you very much for your participation.

(Whereupon, at 3 p.m., the meeting was adjourned.)