NUCLEAR WASTE TECHNICAL REVIEW BOARD

MEETING OF THE PANEL ON STRUCTURAL GEOLOGY & GEOENGINEERING:

ESF/REPOSITORY DESIGN AND CONSTRUCTION

Las Vegas, Nevada
June 13, 1994

BOARD MEMBERS PRESENT

Dr. John Cantlon, Chairman, NWTRB
Dr. Edward J. Cording, Session Chair
Dr. Garry D. Brewer, Member
Dr. John J. McKetta, Member

CONSULTANTS

Dr. Clarence Allen
Dr. Donald Langmuir
Dr. Dennis L. Price
Richard Bullock
Alden Segrest
Dr. Jean Younker
Jack Lemley
Antony Ivan Smith
Robert Matyas

NWTRB STAFF

Dr. William Barnard, Executive Director, NWTRB
Dr. Carl Di Bella, Senior Professional Staff
Dr. Leon Reiter, Senior Professional Staff
Mr. Russell McFarland, Senior Professional Staff
Ms. Nancy Derr, Director, Publications
Ms. Linda Hiatt, Management Assistant
Ms. Donna Stewart, Staff Assistant

ALSO PRESENT

Kal Bhattacharyya
Steve Brocoum, DOE
Bill Simecka, DOE
Dennis Williams, DOE
Dean Stucker, DOE
Robert M. Nelson, DOE
Alan Berusch, DOE
Hugh Benton, M&O/B&W Fuel

I N D E X

P R O C E E D I N G S

DR. EDWARD CORDING: Let's get started. I'd like to begin our session this afternoon. I am Edward Cording, Board member and chair of today's session. I would like to welcome you to this meeting on the exploratory studies facilities. This meeting today is sponsored by the Board's Panel on Structural Geology & Geoengineering.

I'd like to briefly introduce the people that are at the table. Starting on the outside, Clarence Allen, John Cantlon, Board Chair, Garry Brewer, all Board members, Dennis Price and Donald Langmuir, consultants, and John McKetta, Board member. We also have with us staff members from the Nuclear Waste Board. Bill Barnard, our Executive Director, is still in the room at this point. We have Leon Reiter, Carl Di Bella, Nancy Derr, and Russ McFarland is participating in the program, and he may be out of the room at the moment as well.

Russ provided me a draft, and I just would like you to know that the first words were "Good morning." So I'm on my own.

I'd also like to introduce consultants that have joined us. We're pleased to have them join us as consultants to the Board. They're here today.

On the left, we have Jack Lemley. Jack has just completed his duties as Chief Executive of the Trans Manche Link, the Channel Tunnel, where he was really in charge of the design, construction, the commissioning, procurement of equipment, as well as the construction of the project itself. He was invited to join the Trans Manche Link, the Tunnel contractors, by the consortium, which was combined of both the British and the French.

Jack has been involved in heavy construction, worked with Morrison-Knudsen, did the King Khalid Military Center of 70,000 inhabitants in the Near East. He's been engaged in underground tunnel construction. I first met him on a project where he asked me to help on a geotechnical problem; I think it was back in 1972. So we're real pleased to have you here with us today, Jack.

The others, next to him is Tony Ivan Smith. Tony is a consultant. He's been involved in design, application and operation of tunnel-boring machines; involved in 45 different tunnel projects over the years, 12 raised boring operations; designed the first totally automatic raised boring machine. Tony, we're glad you're here, also.

I'd also like to introduce Bob Matyas. Bob is a retired Chief Operating Officer at Cornell University. He was formerly the Associate Director of the Cornell Laboratory of Nuclear Studies. Bob, a few years ago--I think it was approximately fifteen years ago now--established a tunnel review panel for the SSC project. He was one of the original group that started the SSC. I think the success of a lot of the underground work there is largely due to his efforts to get that group started.

We also have with us at the head table some of the presenters today: Jean Younker with the M&O; Alden Segrest, who has joined the M&O in the last, I think, approximately six months, next to her; and then Dick Bullock with the M&O also, and Raytheon Services.

It was in this room, I think you may recall, the last time we met to discuss the ESF. That was approximately --I thought it was two years ago, but the weather was a lot cooler at that time than it is now, so it was only a year and a half that has passed since that time. But a lot has happened in that period, and I'd like to describe some of it.

First, as a result of that November workshop, the Board wrote its report on the DOE's plans for underground exploration and testing. This report was released last October, and the Board took a look at the DOE's plan for constructing the underground facility and for exploring and testing in that facility. We made a number of suggestions and recommendations about the technical program, many of which have been acted upon by the DOE. There are many items within this report, I think, that are still applicable, and we'll talk about some of them in a few minutes, as well as, perhaps, covering some of these items in the presentations and discussions that will follow the next two days.

Secondly, the DOE has been working to make its design and construction plans more efficient and more cost effective. In addition, a qualified and experienced construction contractor has been brought on board, and is brought on board to build and construct the exploratory facility. This trend toward increasing program efficiency is promising, and the Board commends these initial efforts, and really, I hope that they will continue and be enhanced.

As a matter of fact, now, we will be hearing today from Alden Segrest of the M&O of the efforts to get a better handle on some of the high costs and on the length of time it takes to accomplish design.

The Board is pleased to hear of the progress at the site. The tunnel boring machine is being assembled. I understand it is scheduled to begin operating sometime late this summer.

The third item, we understand the Yucca Mountain project is undergoing a management restructuring, and the role of the M&O has been enhanced.

We will hear a presentation tomorrow morning from Bob Nelson, acting project manager, on the new management approach. As you all are aware, or probably aware, the Secretary of Energy has announced a financial and management review of the Yucca Mountain project, which tentatively is scheduled for completion by the end of this year.

Finally, we find ourselves again in the midst of a serious effort by the DOE to rethink the civilian radioactive waste management program. During recent months, several alternatives to the current program have been under consideration. Scenario A, which is now being called the administration's Proposed Program Approach, or described here as PPA, has received the most attention.

Jean Younker will be presenting the proposed approach this afternoon. We're particularly interested in hearing how it could affect the exploration and testing program.

After the April meeting in Reno, the Board assembled a number of questions about the new approach, and we plan to discuss these at our full Board meeting in July.

The objectives of our meeting today can be described, perhaps, in three items. One, to review the progress being made in the design and development of the ESF itself, the Exploratory Studies Facility. Secondly, to assess the impact of the Proposed Program Approach, or the PPA, on the site characterization program. And third, to hear about the progress being made in the development of the advanced conceptual design, the ACD, of the repository and the basis for key assumptions that are being used to guide this design.

We've reserved some time in the schedule so that we can have discussions after the presentations and at the end. So I hope we have opportunity for a free exchange among DOE, its contractors, people in the audience and the consultants, as well as the Board.

I believe that the--we've seen that as the design and construction of ESF has progressed and time has passed that options are narrowing. We're getting near our constructions, there's less flexibility and what one can do at this point. But I believe also that the current climate of potential change offers us a unique opportunity to take another look. And I think in some areas this is really a last look at some of the critical issues related to exploration and testing at Yucca Mountain. I'd like to take a few minutes to outline what I believe to be some of the

critical issues.

Why are we building exploratory studies facilities?

The ESF had its origin in the Nuclear Waste Policy Act. Congress passed the NWPA in '82, establishing the Office of Civilian Radioactive Waste Management, and the basis for this program. The act includes a description of a test and evaluation facility, which is defined as "an at-depth, prototypic, underground cavity with subsurface lateral excavations for research and development purposes." The underground exploratory facility will allow the DOE to characterize the candidate site "to establish the geologic conditions and the ranges of the parameters of a candidate site using borings, surface excavations, excavations of exploratory shafts, limited subsurface lateral excavations and borings, and in-situ testing ..."

Because underground exploration and testing are critical for determining the suitability of the site and for designing the proposed repository, the DOE developed in its "Mission Plan" in 1985 a program of both surface-based and underground exploration and testing. Surface-based testing has been underway at the site for several years. Surface mapping and surface-based borings are a very important part of the exploration. But underground access must be obtained to permit observation of structural features, the joints, faults and bedding, over significant distances at the depth of interest. It is particularly important to use horizontal excavation to cross and then test faults and joints which are predominantly near vertical features at the site.

Based on a series of studies conducted in 1991, including the ESFAS, or the Exploratory Studies Facilities Alternatives Study and the Calico Hills Risk Benefit Analysis--with those two studies, the DOE concluded that the site requires significant tunneling above, at, and below the repository level.

And now the DOE is looking at the proposed program approach, and it certainly appears that it will be bringing about changes in the exploratory and testing program. These changes, however, should result from a thorough analysis of the technical requirements of the program, or the science that is necessary within the program to achieve the results needed to be able to characterize the site.

We look forward to learning more of the Proposed Program Approach. It should focus exploration efforts and set needed priorities for exploration and testing. These priorities should be related to the site suitability and licensing issues. And I believe, appropriately, it should allow certain investigations and some of the decisions on design alternatives to be deferred. However, the Proposed

Program Approach should not lead to a truncating of necessary investigation in an effort to meet a scheduled licensing date, despite accumulation of delays in the start-up for any execution of the investigations.

As we all know, underground exploration and excavation has been delayed several times during the past few years. And the Board itself remains concerned about the potential for continuing delays. Delays in the excavation program mean delay in initiation of important hydrologic and thermal testing planned for the underground. It means added costs to the program, because there's a lot mobilized now, and every day the clock continues to tick on a mobilized project is costing a lot of money. And there's also a potential delay in meeting key decision dates.

I would like to review a few of the suggestions and recommendations the Board made in its report a year and a half ago. Some of these recommendations have been followed, or DOE has been moving in similar directions and has already achieved some of the things that we were suggesting and recommending in the report. Others are in the process of continuing or being investigated for potential in the future, and some there may be differences of opinion as to whether the items should be performed or whether there are other alternatives. And so I hope that in the next day here, today and tomorrow morning, we'll have the opportunity to discuss some of these issues. I'd like to now look at several of them.

The first one that we have is related to the exploration, exploring across the geologic block. As investigations have been planned, there has been some substantial underground tunneling planned. But there are some key items within these program that, as I see it, are items that ought to be considered in looking up the exploration program that's needed in the next few years. The plan was to bring down from the North Ramp a drift that comes down on a relatively flat ramp that comes across to the South Ramp. That would be done with a 25-foot machine that is presently being mobilized.

This exploration then allows observation of conditions in the layers above the stratigraphy that exists above the repository level. It won't be directly above the repository at that point, but there will be opportunity to see some of that strata as one comes down into the facility.

Other high-priority items are to be able to obtain a full east-west traverse of the geologic block. This is principally the area of the geologic repository itself. Most of the major structures, as one can see here, are running north-south. And so obtaining an east-west traverse of that

allows these major structures to be encountered.

If one were to come through and excavate across with a drift from the North Ramp to the South Ramp, at that point you would have seen the major structures, perhaps, located on this side of the pen, the structures that are coming up in this direction. But, in fact, that orientation's a little bit off for the present plan. It comes across like this. And so, one has an opportunity to see structures here, but you are blind, really, to all the structures that are running through in this direction. So that's why the importance of the North Ramp extension as part of the present plan, and also the South Ramp extension.

There are other opportunities to, as one goes along various faults, though, perhaps the Ghost Dance Fault, and to be able to take small side drifts off and to explore into those areas and then to perform tests, hydrologic tests, across those surfaces, to be able to find out what the moisture content and degree of saturation is across surfaces that go adjacent to some of the structures that are being observed. Being able to first, then, find and fix the underground structures, and then test across those features as one finds them.

This is just a profile, looking across. It was presented to us as a preliminary draft in the last meeting, in April. You can see as you come down in the cross, with a cross drift at the north end of the facility, of the geologic repository area, that you go through stratigraphy above the Topopah Springs level, which is the level at which the repository would be placed. And then as you come across, you do get through into the lower levels of the Topopah Springs formation itself.

In addition, then, one would be able to see the major structures that are crossing, that are principally running north-south, in the geologic block.

Another area that we've discussed as a priority is to find out what the conditions are like in the much softer and less heavily fractured and less jointed material below the repository level, basically within the Calico Hills formation. And being able to obtain an east-west traverse across it, and for comparison with conditions above, is something that's been talked about as a high-priority item, and I think it would serve as a very useful purpose to being able to help characterize the fractures, faults and conditions at the site. Not just at repository level, but in the flow paths below the repository level.

Well, we've talked about exploration across the geologic block. The other major purpose for getting underground is to begin some of the testing that needs to be

done. We've briefly mentioned some of the testing that would be done with the hydrologic-type tests, where you can find the actual structures and then test across those to obtain information on the geochemical characteristics as well as flow characteristics across those surfaces.

In addition, I think one of the other major items is to look at the thermal behavior of the rock. And this has turned, I think, as many of us realize, into a much more major concern in the past two or three years than perhaps was anticipated prior to that time.

Since 1991, a strong rationale has evolved for the argument that thermal effects will be the main cause of vapor and water flow in the repository, no matter what the age and burn-up of the spent nuclear fuel is and no matter what thermal loading strategy ultimately will be chosen. This rationale is based on models that are backed by very limited data obtained from approximately a year of testing in the G-Tunnel back in about 1989--G-Tunnel at the Nevada test site in Rainier Mesa. No additional testing has been conducted since that time. There hasn't been an opportunity within the program to get underground. And the data gathered then, which is really very limited in scope, is the only underground thermal test data that's available to the program. Because of this five-year hiatus in underground thermal testing, the program currently lacks sufficient field testing experience, proven instrumentation for underground testing, and a well-developed strategy for testing thermal behavior.

The large block test underway at Fran Ridge is a step, and it provides an opportunity to develop instrumentation and acquire field testing experience. But there is still a need for testing within drifts to be able to improve our understanding of the phenomena of the interaction between the thermal environment and fluid and vapor flow.

Given the potential for the delay in the construction of the exploratory facility, and further delay in start of the thermal testing underground, there's a need to reevaluate procedures for initiating thermal testing, either in the geologic block or off of it, perhaps with very small diameter tunnel-boring machines. And there's a need for an excavation plan that's designed to facilitate machine excavation rather than build a large core test area which has a large number of intersecting drifts and alcoves.

I think the last item here is the summary that says we should really be looking at a comprehensive strategy, an overall program plan and schedule, with interim milestones, in order to be able to carry out the exploration testing. We need those goals that will help guide the program and help

establish the schedule that is needed in order to accomplish the work that's required for evaluating site suitability, site characterization.

There needs to be time within the program for, obviously, not just to obtain tests, but to be able to integrate those into the analyses and the models and to understand what the results mean.

There are several items that we had on the ESF report that had to do with the more construction-related items. And certainly, in terms of excavating underground, the objective is to be able to understand what the site is, to be able to characterize the site. An objective is not to achieve high tunneling rates or to advance the state of the art of tunnel technology. The tunneling technology is quite capable of being able to accomplish the things that are being required of it on this project. But in order to be able to get to the testing at the appropriate time, and to be able to get the testing done prior to decision dates, it has to be very closely correlated with the construction operation.

One of our recommendations was to delay competing excavation until completion of the five-mile loop. And so that when one is operating a tunnel-boring machine and has mobilized for that effort, delays in completing that loop are going to be very costly. And if you're trying to carry out operations that are interfering, it can be a very difficult process and cost the project money, and delay the time at which you can actually get in and have access to do testing.

Now, I think that there are some options here that we need to look at, and that are being looked at by DOE, the M&O and the contractor. And he has a double track tunnel at this point. There's the possibility, and the opportunity, perhaps, to be able to tunnel or to do drilling on one track and then still have access through on the other track. But I think the main point here is to minimize the interferences that will cause the progress to slow to the point that money and costs are basically continuing and progress is not being made.

One of the items that we recommended was use of rail to support the tunnel-boring machine operation. And we're very pleased to see in the last year the M&O went further and was able to do things that even I hadn't anticipated. And that was not only to be able to reduce the grade across the repository to something on the order of two percent, but also to reduce the grades of the ramps coming down. That will provide much more efficient support of the tunneling operation, and also has the opportunity to provide support of the actual repository, if it were to be built, to be able to bring in large diameter casks, heavy casks, that

might be used for, for example, a drift-in-place facility.

Then, the other item is that as this tunnel-boring machine goes through, there's going to be opportunity, at some point, to bring in smaller diameter tunneling machines. And I understand there's some discussion about even using some very small mini TBM's or even micro TBM's to be able to excavate out small alcoves, to be able to do some of that without interfering significantly with the advance of the tunnel-boring machine. Some of those things need to be looked at, and there needs to be a plan at this point, now, to be able to bring these things to the project so that there won't be large delays and that will even be able to follow on to the actual work that's been done with the initial tunnel-boring machine to get to the point of being able to cross the faults, to maybe make an east-west traverse of the facility.

The small diameter machines are quite useful, not only because small means less volume of material excavated and better support conditions, but they're easier to use over short lengths of the tunnel. You can advance them a short distance and pull them out, and do that much more efficiently, much more rapidly, at less cost than trying to move a big machine in, stop it, and then pull it out. The machine that's presently being planned for the five-mile loop, the 25-foot machine, really would be very difficult to move and back up any significant distances underground.

And then this is an item that I think is something that the DOE has been working very hard to accomplish, to reduce and simplify the surface and subsurface facilities and utilities. I think early in the program there's a feeling that the money would be there, that one could do whatever one wanted to to build this facility. But we recognize that this project is one in which there's certainly a limited budget, that a very relatively small proportion of that budget is available for actually doing the underground work, and that using those funds to build permanent facilities, when one could get by, for example, with temporary facilities, is not the wisest use of the limited resources that are available on the project. It's important to be able to get in and start finding out information underground.

And so the things that the DOE is doing at this point--for example, using temporary trailers and temporary facilities, such as trailers, that are available to the government, and using those at the surface rather than building more permanent structures that might come later in the program of an exploratory facility, or perhaps in a permanent repository, if it were to be built.

Those are some things that I think are helpful, and I think there's a lot more that can be done on that--looking

at testing requirements, looking at the support for the testing, for example. Is a comprehensive data collection and optical--fiber optic system necessary? What is going to be best able to support the underground testing and the data collection efforts? Those are all things that I think need to be looked at, and there's more to be done there, but I am pleased that there have been some significant efforts to try to bring this project more to what one normally thinks of as an exploratory facility.

Certainly, expenditure of large capital costs, large capital expenditures, for an exploratory facility is something that I don't think the project can afford much of.

There are several other points here that I'd like to bring out. Developing the repository design in tandem with the evolving ESF design, you can't do all of the repository design all at once. There's not enough resource to be able to do that. There are still things that need to be studied and evaluated before that can be done. But certainly enough advance has to be made with the repository--and we've been told this by DOE and the M&O--they need to go far enough with the repository design to be able to handle the interfaces between the repository and the exploratory site facility. And a good example of that was the effort that was made to reduce the gradients of the ramps and to make them fit an efficient ESF as well as a potential repository.

Another item that I think we're very interested in is the establishment of a geoengineering board. Some of the issues that the Nuclear Waste Technical Review Board has gotten involved in have seemed to be items that could have been handled within a DOE venue, within the DOE itself. The geoengineering boards are usually three or four individuals who have had quite a bit of experience in underground construction. These type of boards are commonly used on projects such as the large hydro projects, they were used on many of the metro systems with subway construction, and these individuals are quite experienced. They don't replace the competent staff that's present within the M&O, within the contractor's organization that understand underground construction, but they serve to, I think, assist management. Not direct the program, but to assist and serve as advisors, to help give a perspective, to give some confidence that the project is moving ahead using the best approaches within the state of the art of the industry. And I think many of these individuals have been involved in projects where that interface is so crucial--interface between testing, the science, in other words, and the construction, to get the scientists to those points that are important for the

characterization. That interface really is extremely crucial in this project.

And then there are items here, some of which were recommended--in fact, all of these were items that were commented on, very briefly in some cases, in the report on the exploratory facility that we did in October--and some of these things are being addressed. On the management structure, the cost of the program and the cost of the construction, to be able to get as much as we can for the money--to be able to economize on the actual cost of the underground exploration itself so we can get to the end and actually do the testing and the exploration. And then the other item, to be able to look at the costs of other parts of the program and see where the priorities are and how the funds are allocated.

Those are issues that go beyond just looking at the exploratory site facility, but they are issues that do control our ability to do the technical things, to do the science, and to do the things that the Nuclear Waste Technical Review Board is concerned about.

We come on to contracting practices and incentives. It's not just an incentive to keep the contractor going, but certainly, if he knows that he is getting paid for meeting a schedule and for meeting costs, he's going to have a totally different attitude than if he's getting paid as a percentage on everybody that he has on the job, and the more people he has on the job, the more money he makes.

So those are some things that even within a program where there's science and there are things that have to be coordinated, those are things that I think need to be looked at very carefully.

One of the other things is that having a contractor with specific contractual goals also puts an onus and some effort, a different perspective, upon the owner. He realizes that he has to let the contractor do his work and get the project done. So if it were that type of a contract, the contractor wouldn't be able to bring a machine on the job, or wouldn't bring a machine on the job, and then have it sit there and not operate for several months, or only be able to use it on a one-shift basis when he's mobilized to the point that he could use it on a two- or three-shift operation. The money continues to be spent in a situation like that, and if the progress isn't being made, then that's one of the most major costs that can occur to this program. Equipment acquisition, the ability to obtain the equipment in a timely manner, in a cost effective manner, so it can support the work.

Well, those are some of the comments that I had. I

will be interested in hearing your comments in regard to the things that we are saying, as well as we're interested, certainly, in hearing your presentations today. So with that, I think I'd like to move right ahead, because we are ready to go ahead, in terms of time, with the next session. We're a few minutes behind already, and I would certainly, however, be interested in hearing your comments and reactions to the things that the Board has been saying on this.

At this point, then, I would like to introduce Jean Younker, who is going to be presenting a "Proposed Program Approach: test program, site suitability, advanced conceptual design, Title I and Title II design for the repository, 100-year retrievability." Now, that's a title for--Jean's given an hour and a half for this, and I've already take a few minutes of it, so thank you, Jean, for being willing to cover more than enough.

DR. YOUNKER: Well, the first thing I'm going to do is change the title on what Dr. Cording just told you. It looks like I'm going to hold this, too, since my pocket isn't big enough to fit it into.

I represent, really, a lot of different people today, because from top to bottom of the program, as you probably could guess, with something as all-encompassing as this new approach that we're evaluating. There are people involved--the DOE top management have just been at an off-site last week where they were looking at various aspects of it from the policy and strategy level. And in the trenches out here, the people who do the very detailed planning and scheduling of the testing program and the design and engineering folks have all been working on various levels of details of planning for how this whole approach might impact the program. And, of course, there are a lot of unknowns at this point.

So what I'm really giving you is just a preliminary status, a snapshot in time, and you can bet that almost everything I say will probably change the next time we talk about this topic. But that's what you asked for, so that's what we're going to try to give you as best we can.

I tried to kind of parallel the title I was given; however, I did make a few little changes in it. One thing I will mention was that I planned it to be about a 30- or 40-minute talk, since that's what was on the original agenda, and so we should have some extra time either that you can gain for your panel discussion this afternoon, Dr. Cording, unless you guys ask me a lot of questions, in which case, then, it might eat up the time. But I don't think time should be a problem with this one.

What I'll do is step back a little bit and just

give you a little bit of background and overview to make sure, for those of you who haven't gone back and thought about kind of where we are and where this Proposed Program Approach starts from. I'll give you just a little bit of background. Then I'll talk about what we've been doing in terms of implementation and planning of the new approach in the testing program from a regulatory perspective and performance assessment.

And once again, in each of these areas, I'm just going to kind of hit on the high points, and then if you do have questions, I've asked a number of people to be present in the audience who can help kind of fill in any details you might like to know, if those details exist at this point in time.

I'll talk a little bit about site suitability, because I'm sure you're aware that over the next four years, until 1998, much of the emphasis in this new approach is toward a milestone called the Technical Site Suitability Determination, which is a new milestone for us. We're attempting to understand it both from the top down and the bottom up. What is the content of that Technical Site Suitability Determination. We'll give you, once again, a snapshot in time in terms of what we think it is, how we're looking at it right now, and certainly that's open to change as well.

Most of what I have to say about ACD or Title I and Title II will really be just pointing to tomorrow's discussions that Dean Stucker will talk with you tomorrow. And the same thing's true, really, for any details on ESF construction status. Bill Simecka's on tomorrow to tell you about that, so I won't be saying very much about that at all, except for a few things as it relates directly to the implementation of the new approach.

Title I and Title II for waste package and repository is really the same thing. We have people in the audience who can answer specific questions when I get to that part. But in terms of any new developments in that area, I don't have very much to give you, because I think a lot of our emphasis has been in other aspects of the Proposed Program Approach. But there is probably some thinking that could be shared with you.

On the 100-year retrievability, probably about the same thing. Steve Brocoum gave you a presentation about a month--or I guess two months ago, maybe--where I think he probably said just about everything I have to say about that. But we will go ahead and go through that with you, and if that generates some questions, there are people who have been trying to carry it further, but I don't have anything really

concrete to tell you that takes it much further than what Steve talked with you about in Reno.

Okay, as I said, I wanted to start with this overview that is one that Steve Brocoum has been using to describe kind of the overall stepwise approach that we're thinking about for suitability. I'm going to focus on suitability for a few minutes. I'll come back to it a little bit later in the talk. But I will end up spending a little bit more time on that, maybe, than what you had asked for, since this is supposed to be kind of ESF construction or ESF-related talk, but I think it makes sense just to keep you thinking about where we're trying to put our emphasis in the next four to eight years.

I want to make sure that I give you the caveat that this is preliminary. You know that the Department is committed to a major stakeholder involvement on the whole process for evaluating suitability. A meeting was held back --I guess it was just prior to the high-level waste conference. I think some of you sat in on it. And a lot of good input is being received, and I think there's every chance that a fair amount of change and evolution and improvement in this process will occur as we factor in the input that we're getting from the various stakeholders. So, I think the best thing for you to understand is that this is just a snapshot in time, and a lot of the things I'm telling you will evolve with the input that we're receiving.

The main reason I laid this out for you is so that I could, on the next three or four view graphs, pinpoint a couple of specific points that I wanted you to think about with me. One is that remember, as Dr. Cording mentioned, we did lay out a site characterization plan in 1986--or '87 and '88, which set us on the way for some surface and underground testing. We had an environmental assessment prior to that, in 1986. I want to mention that simply because that's one of the bases, one of the precedents, if you will, for how we do this Technical Site Suitability Determination in 1998. That's very important, and we have to recognize it there as our foundation.

The concept that comes along and is new in this site suitability approach that you're seeing laid out as a part of the Proposed Program Approach, is shown by this little ripple effect of new milestones. And the idea here is that as we have a good scientific basis for any one of the Part 960 guidelines to be evaluated and essentially closed, or a higher level of finding reached, as the jargon goes, then the DOE is committed to going ahead with official--or at least that's the thought right now--assessments that would be presented to the public, reviewed by the public, and would

then become a matter of record that that particular guideline, the scientific basis seems to be sound, and the DOE then leads up to this Determination of Technical Site Suitability, which I will come back to and talk about more.

But the idea there is that the reason it's called Technical Site Suitability, for the most part, is that we're talking about the technical guidelines, meaning--take Part 960, and I'm assuming now that the evaluation will be done against Part 960. I suppose if the input received from stakeholders was very, very strong, there could be even some change in that. But I think our assumption has to be that we're going to use 960. That is DOE's siting guidelines that they developed per the Nuclear Waste Policy Act's direction.

I think that the technical site suitability, then, just to be sure that you're thinking about it similarly, is that you leave out the environmental, socioeconomic and transportation guidelines. So set those aside and let those go through the NEPA process, the Environmental Policy Act process, the EIS process, as you would expect they would, and look at just the technical aspects of Part 960 compliance at this point.

I think I've heard it expressed by various DOE people as a management risk decision. It's a point in time where in 1998 it makes sense, if 2001 is still a feasible date for a license application, it makes sense at that point in time to take a look at where we stand, determine what our status of compliance with Part 960 is, for the technical guidelines, where you can. You won't be through with your EIS process, so at that point it probably wouldn't make sense to do that against your environmental guidelines, but at least for your technical guidelines, determine how you stand, and then proceed on with your environmental impact statement process, or your EIS process that you must do per the Nuclear Waste Policy Act.

In terms of the way the rest of the program then supports that concept, that leaves us in a situation where the Advanced Conceptual Design phase for a repository and waste package both probably would be what would serve as our basis for that Technical Site Suitability Evaluation. And you might think that there wouldn't be that much engineered system input into that technical evaluation, but there actually is quite a bit. When I get a little bit later in the presentation, I will mention a couple of points where the fact that we would rely on an ACD phase of design does have some impacts and is something that we need to take into account as we plan for that.

As far as the other work that we have to do to get ready for writing and issuing a license application, if

that's the decision, we'll continue our process of license application revisions and topical report presentation. But I think it's only fair to say that as we go along, we're going to think real hard about which ones are most important and tend to tailor them towards the ones that we need the scientific basis for suitability as well, so that we're doing the work in the order that it makes the most sense, given that the 1998 milestone has been declared to be the very important milestone by the Department.

This is a little refresher for you now, and some of you have been through this so many times you don't really want to hear me talk about this anymore. But back in the environmental assessment days, the DOE had to use their finding criteria, Part 960, to determine whether the site was suitable for site characterization, at least to make a recommendation, and a nomination was made by the president to go ahead and characterize the Yucca Mountain site.

The way you do that, if you remember the jargon of the guidelines, is that you go through each of the disqualifying and qualifying conditions, one by one by one, that are in Part 960, and you have to reach, for that decision to have been made, at least a lower level of suitability. And if you'll think with me for a minute, a lower level of suitability, we're really just talking about confidence. We're talking about all existing information collected to date, when analyzed, looks as if I comply. The qualifying condition is present, the disqualifying condition is not present. So it's just a status, best available information, where do I stand?

Now, when I talk a little bit later, since you have lower level findings, you obviously have higher level findings. And the higher level findings are exactly what you would guess--moving to a higher level of confidence, where you say, "All of the information I've collected to date, as well as the information I think I could get in the future." So you're betting on the come. You're thinking about what--how wrong could I be would be one way of looking at it. What's my basic level of confidence in my conclusion? The higher level of finding statement is that existing information supports my conclusion, and I don't expect future information to change that. So it's a confidence decision, where you're saying, "Any kind of site information or analysis that I could do in the future, I don't think it's going to change my conclusion." So that's this lower level/higher level in the simplest term that I think I can give it to you.

The next one is just historical. I don't really have a point to make, other than to say that in 1988 we did

issue--DOE did issue the site characterization plan reviewed by the NRC, and although the NRC raised some objections about the content and some specific actions DOE had to take, it was essentially "accepted," I guess, for site characterization to formally proceed, as also was required by the Nuclear Waste Policy Act.

Okay, now, as I just explained to you a few minutes ago, this kind of wraps up what I was trying to say. For that 1998 decision, as we see it now, the question that will have to be asked is, "Are our higher level findings supported on all of the technical disqualifying and qualifying conditions?" And once again, that's that statement that says, "Existing information supports the qualifying condition, for example, being present, and I don't expect future information to change it."

So, if you think in the probabilistic sense, you have to think about what level of probability do I want to place on that conclusion in order to go over to the higher level finding. Clearly, in the lower level, you're talking about interesting information, best available information.

So this one is betting on the--as I managed the early--what was it called?--the Early Site Suitability Evaluation, one of the things that you find with the people that work in these kinds of decision making, the very interesting discussion and debate you go through as you figure out where people are drawing the line for existing information, lower level findings, existing information, plus predicting the future, higher level finding in terms of probability. If this decision is made, then DOE would use that as a--as I said--a management risk decision to go ahead and prepare a license application for construction authorization, which on the current schedule we show as a 2001 milestone.

Now, they can't complete the process. As we said, the Technical Site Suitability doesn't completely address Part 960, because you do have some environmental guidelines, environmental quality, socioeconomic impacts and transportation impacts that have to be looked at. And we're assuming those would be looked at through the NEPA process. And if that process is completed, we move into the next document--or the next milestone that the DOE, by law, has to prepare, which is a site recommendation report. The Secretary would then recommend the site.

And I have a little asterisk here that's a very important asterisk. But for those people who are in policy and the political side of the program, this is a terrible way to show this, so I apologize for that, but I was just trying to say that between issuing the site recommendation report

and submitting a license application, Congress has to issue this resolution repository siting and allow DOE to move ahead. This is probably not the right way to represent it, but this is basically saying that DOE gets the go ahead and submits the license application.

Okay, now, that's the background and overview, just to make sure you're thinking kind of like we are, at the kind of philosophical level.

Let me tell you what we're doing now in terms of implementation.

You know, clearly in our minds, behind all the work we're doing, is the question of what kind of funding profile will we really have, because, you know, there was a funding profile underlying this Proposed Program Approach that Dr. Dreyfus took forward. And I think you all probably hear the rumors, just like I do. It doesn't look real hopeful that we're going to come out at the level that we had hoped for for '95. So I think we're all trying to maintain the attitude that the better the plans are, the better you'll be able to adjust no matter what your funding level finally is for '95. So we're trying to keep our heads up and keep working towards some good plans.

There's a group, as I mentioned, of DOE and contracting personnel working to do both detailed FY '95 planning and outyear planning based on this new approach. And the way it's working, and the way it has worked to date, there was a group of USGS and National Lab people who worked with me, and I was the person who was assigned to kind of take the top level strategy and policy that was developed by the DOE and the Management and Integration side of the M&O and take it and pick up with a team of USGS and National Lab people and kind of carry it forward one more or two more steps, such that it could then be used as a basis for planning. So we had quite a team of people, including some M&O engineering side, as well as the representatives from the participants.

Some of the people were the people that you on the Board that have been around for a while have grown to know. We tended to try to tap some of the people who understood the SCP basis, so we could then evolve the SCP basis into this Proposed Program Approach in a reasonable way.

So that information, then, as much as we could, either on paper or just verbally, was transferred to the planning people, and this includes the people that are doing the detailed planning for '95 as well as the outyears. We tried to help them in every way we could and get the information to them.

The construction schedule for ESF and the test

plans are being analyzed and coordinated by some of the same people, by some of Bill Simecka's people. And I think Bill will tell you more about that tomorrow, so I don't have much of anything. I'll come back to it just with a couple of comments a little bit later.

The near term surface based studies to support Technical Site Suitability are being identified, schedules reviewed, and we're attempting to see if there's anything that we can reprioritize or consolidate that will help us get a better scientific basis by 1998. Clearly, DOE wants to be in as good a position as they can for that Technical Site Suitability Evaluation.

And then laboratory test plans are being looked at. And here, particularly, if you remember what Steve Brocoum told you in the Reno meeting, one of the key areas that we're going to emphasize in the 2001 license application per this approach is going to be high reliance on a robust canister, a canister that has substantially complete containment; you know, very high confidence. And so some of the testing plans that are being looked at particularly are those that will help support that in this time frame.

Okay, as far as Surface Based Testing goes, let me tell you some of the things that we've been thinking about. And this kind of comes from the group that I managed as we handed off the information to the planning people, who have to then worry about balancing dollars and schedules. The things that we in the group looked at kind of what was most important in the environmental assessment, what looked like the major key uncertainties that gave us concern during the early Site Suitability Evaluation, what have we done since then, and where does that leave us.

And so the kind of information that seems to be key to those of us who have looked at this are things such as the nature of the steep gradient and the water tables. Those of you who have followed the program know that the external peer review panel for the unsaturated zone program told us this back in, I don't know, '90 or '91. They said, "You know, you really have to understand what that steep gradient is to the northwest of the site." Not necessarily that it's a real concern from the standpoint of suitability or license ability of the site, but simply that if I don't understand it, if I don't think you understand it, then you're not going to convince me that you really understand the hydrologic system. So it's what's controlling the position of the water table.

Flux at repository level. You've seen in the performance assessment presentations that we've given you that it is the one parameter that is most important, no matter how you look at it. So anything we can do to get a

better handle on and a better definition of the range of flux that should be used in our performance assessment models at the repository level is obviously key.

Some of the new findings that you heard about, I think, in the last meeting, some of the perched water zones that have now been encountered in the deep drill holes. One of the issues from a PA viewpoint, obviously, is where are those zones, how continuous are they, could they possibly represent a scenario for a fast flow path that's a diversion below the repository over to a through-going fault, and then give you a short circuit to the water table such that you wouldn't get any matrix flow through the Calico Hills and allow whatever retardation we can count on to occur. So there's a question of what's the nature and what's the spatial continuity, how old is it, how did it get there. You know, some of those questions are going to be important for us from a Performance Assessment viewpoint to figure out what kind of credibility to give that scenario for some kind of a diversion path.

And then, just the potential for the Ghost Dance Fault as a fast flow path, I think, comes out in everything we've done as one of the key questions that we need to get a handle on. And I'll come back to that when we get to the ESF.

A couple of things that specifically I know are being done. From Susan Jones, the daily manager for the scientific program side, reports that they're going to be able to increase the number of drilling crews by eight in mid-1995. So that will give us some impetus in the Surface Based Program. That's based on, obviously, assumptions of funding, and let's hope that the funding assumptions come true. I don't know what assumption underlies that in terms of distribution or allocation. I don't think anyone's--Steve, did anyone show up from Susan Jones' group yet? We were hoping someone was going to be here, so in case you have questions specifically about the testing program.

And then consolidating testing into fewer deep drillholes. Obviously, any time when you're trying to maximize your return on your investment, that's one of the things you always go through and look at.

Okay, now this is a little advance information on what you'll see from Bill Simecka tomorrow, so I certainly don't have the details that he can give you. But from looking at the plans that are currently in development, the way the plans look right now, there will be four alcoves that are considered critical. We already have one, so that means five, basically, until we get down to the--four alcoves to be constructed concurrent with TBM operation in the North Ramp

to obtain data important to suitability, or information that simply should not be left. You know, should not be passed by during this first TBM phase of operation.

The North Ramp extension, I think you'll see some plans from Bill, and I don't have the details, but I think you'll see some plans to try to see, as Dr. Cording mentioned, if we can't get a smaller TBM operational that would allow us to do the North Ramp extension, perhaps, in parallel with the main TBM driving south. If we're able to do that, then that obviously gives us the possibility of getting the heater testing going. It would be fairly high in the Topopah Spring, but it still gives us the opportunity to get some heater testing going earlier than if we had to wait for the complete five-mile loop and then come back around and start it. So this is being looked at as an option, and you'll hear, I think, a little bit more about it in terms of what the possibilities are from Bill.

Two additional alcoves to be constructed concurrent with TBM operation in the Main North-South Drift that will give us the earliest access to the Ghost Dance possible. And I think the Ghost Dance Fault access, from the planning viewpoint that I was involved in, we think that's really important, because we think that if we do have a through-going fault that can transport flux through the repository area, that's probably our best bet. I mean, it does have fairly good expression at the surface. We may see some at depths that we don't see at the surface, but certainly this one looks like one of our best bets.

And so getting as early as possible information on that and then likewise having a contingency plan for Calico Hills excavation such that, let's say for an example, something that we thought about as the group worked together. If we got over to the Ghost Dance at the Topopah level, found that it was wet, found out that there was flux being transported along it, the next key question that comes to mind in everybody's case is, is that a continuous flow path? What happens to it when it goes into the Calico Hills?

So I think many of us began to realize that probably a decision point somewhere when you get the Ghost Dance accesses opened up, and the ability to then--well, an evaluation prior to that time that flexed the best access option, which I know you have Dick Bullock here to talk about one that his people have come up with. A look at those and then a decision soon, before that time that we need it, to develop the design such that once a decision is made, you can move that direction, procure the equipment such that you would be able to move in that direction at that time if you find out that you have a damp zone next to the Ghost Dance.

You know, this may be naive, it may not be that obvious or easy to make that decision, but it's something at least--you know, I think, most of us felt if you do find that it looks like the Ghost Dance is acting as a potential fast flow path, you know the question of how continuous is it and is it able to transport through the Calico Hills is going to be an important question.

Just a few words about the regulatory and the performance assessment side of this. The performance assessment staff have been meeting and planning, trying to figure out what kinds of analysis are going to be most important to support this Technical Site Suitability Evaluation. I'm going to go into that in just a little bit more detail so I can say a few words about that. But, you know, we want to get our next total system performance assessment or some interim sensitivity studies geared toward the information that's going to be the most useful in supporting the scientific basis for Technical Site Suitability. So some good planning is going into that. We clearly don't want to forget what we need for 2001, but in the shorter term, our focus is going to be getting the work done to support the 1998 determination.

The License Application Annotated Outline, as I mentioned earlier, we're looking at that, looking at what revisions make sense, given where we'll put our emphasis between now and 1998. And this, both for the Annotated Outline and for Topical Reports, it obviously makes sense, if the budget is limited, which we have to assume that it will be, to put our money into those scientific information areas that we're also going to be developing for suitability as fast as we can. So we're going to try to piggyback the work.

Okay, I'm going to talk just a little bit more now about the Site Suitability, since that is the part of it that I know you have some interest in. This is just describing, now, the current thinking on this, and this could evolve a lot the next few times that we meet with you. This chart, which is kind of small, but for those of you who have a hard copy, you can follow along. I can, from this, tell you some of the basic or key aspects of the approach as we've laid it out right now.

Steve Brocoum talked about this in a general way in Reno, and I want to tell you a little bit more about it, a couple of key things about it, that I think might be useful to you in terms of understanding why we think it's a good idea.

You see that the Part 960 guidelines cover all of the geotechnical aspects of the types of information that anyone in your science community would think might be

important about this site. So if you look down through this display of information, you will see all of the earth science aspects of the site in various clusters of information. We put the information together, the guidelines together, that kind of fit together under a surface processes type of heading. We also grouped the ones together--in fact, in this case, it's just one guideline, the preclosure rock characteristics that aims at the constructability and the ease with which engineering measures can be applied in this environment. We grouped the ones that are seismic, hazard, long-term tectonic impacts and volcanic effects.

And this grouping, if you follow on through it, was done for a very specific purpose, and that is that if you think back at the way--in my particular experience--when we had the Early Site Suitability Evaluation Peer Review Panel set up, one of the things that I think the Board criticized us for, and it was a reasonable criticism, is that because we had only one Peer Review Panel covering all fifteen guidelines, then we could only be one or two deep on any one of the disciplines. So that our Peer Review really had to be heavily influenced by one, or maybe two, strong individuals in terms of the outcome on a specific subject area.

This approach is hopefully going to allow us--if we can manage this, set it up and manage it right--to have a Peer Review Panel convene just to address the surface process aspects of Yucca Mountain, or just to address the seismic hazard and tectonic hazard aspects of Yucca Mountain. And by doing that, we think we can get around that one significant criticism, which is that a strong reviewer could really influence the outcome of the peer review. In this case, we would have a three- to five-person panel, maybe larger for the ones that are controversial, that would evaluate the scientific basis for any one of these particular topics that will support, then, DOE's regulatory determination as to whether they believe they can go ahead and make the decision, the higher level finding decision, for the guidelines that are built on that scientific information.

This is another key point, and I want to be crystal about it if I can. In the Early Site Suitability Evaluation, we mixed the regulatory assessment and the scientific bases information together. What we're doing in this planning, at least, is to separate them completely, such that the peer reviewers would be asked to review the scientific bases. Is this good quality information? Are the technical interpretations valid? We would ask them those kinds of questions. We would not ask them the question, is there enough information for DOE to make this decision about suitability of the site.

So you're asking the Technical Peer Review Panel members the kinds of questions that for the most part they're prepared to deal with. I found on the Early Site Suitability Evaluation when we asked the Peer Review Panel members to comment about whether there was enough information to make a decision about suitability, that was something that was completely out of their league. I mean, they just would not --that wasn't something that most of them were prepared to think about if they'd never been in a regulatory environment.

So I think this separation into the scientific bases and the regulatory bases, regulatory information, should give us some real advantage and should help DOE to communicate much more clearly with both the Peer Review Panel, the technical peers in the country and internationally, and with the stakeholders who want to be involved, and who will be involved, I'm sure, in the way DOE takes that information and then makes policy decisions about it.

DR. PRICE: Dr. Jean? Dennis Price, Board. Could you help me interpret this drawing up here. You've got pairs of lines and upside down triangles and explosion symbols.

DR. YOUNKER: Right. Those explosions are DOE making decisions. Draft decisions, however. Yeah, let me walk you through one of them, and take a simple one, like the surface processes one. Idea was that there would be a report, scientific bases, technical bases, for this particular type of information prepared. There would be a peer review, of the type that I described, of that report. And then, in this particular case, DOE would evaluate the results of the peer review, and if the conclusions seemed to be such that they felt comfortable, they would go ahead and make a regulatory assessment or higher level finding. And I have another chart that I can kind of talk about this more easily.

But basically, the idea was that each of these packages of information would go through the preparation of the technical information, the peer review, and then the DOE action, which would then start the stakeholder involvement, full fledged, where DOE would issue a draft finding and put it through a full stakeholder review.

DR. PRICE: So the first upside down triangle is the start of the preparation--

DR. YOUNKER: Yeah. It's--

DR. PRICE: --of the report.

DR. YOUNKER: --sloppy usage of scheduling terms, but that's what it is. It's just the beginning and the end of putting that report and information together. Clearly, there's lots of work going on that feeds data into this area of information. So it isn't as if it starts there. There's

all of the work that's ongoing that has anything to do with surface processes, is feeding information, technical reports being written. At that point, we would begin formally to assemble them into a package that could be prepared for peer review. That was the idea.

It's a little confusing, the details of this, so one more, since Dr. Price asked. Some of them, like if you come down into this area, you'll see a lot of the upside down triangles and not very many of the explosions. There's a reason for that, and that is that when you get into some of these areas of information, like geochemistry, postclosure rock characteristics and, particularly, geohydrology, those are guidelines where if you look at them, you will find that the conclusions on those guidelines are tied very strongly to total system performance. And so you'll notice that on most of these, barring one exception, which I'll come back to, the conclusions related to that package of guidelines don't occur until you get down here and have a total system performance assessment that has been performed on the basis of that information. It's been peer reviewed, and then DOE looks at the results of that and decides whether or not they can support higher level findings.

The one exception to that, which is an important one, is that explosion there, and that's ground water travel time disqualifying condition. That one really doesn't rely, at least not directly, on the outcome of the Total System Performance Assessment evaluation, so that one we've shown as a separate milestone. But for the most part, these qualifying conditions that go with each of the postclosure guidelines, if you think about--I know them by heart, I know you don't, but the wording on each of them comes to something like compatible with containment and isolation, compatible with waste containment isolation. So you're always going back to Total System Performance.

DR. PRICE: What is the dashed line?

DR. YOUNKER: The dashed line says we're going to start on this a little early because it's going to take us a while. We didn't want to start formally until we had information from the peer review of the geohydrology, because that's such an important part of this TSPA. But we received comments from reviewers who said, "Well, you know, if you wait to start until your completed geohydrology report and peer review is available, you really are cutting yourself too short to meet this 1998 milestone," which we barely got into 1998 as it was. So it's still very schematic, but that was the idea.

This is the chart that I was going to show. This is also one that Steve Brocoum has just had prepared and used

for the--I guess it was just for the off-site last week, Steve?

MR. BROCOUM: Yeah.

DR. YOUNKER: Yeah. So this hasn't been used anywhere else, and it's totally preliminary, as I added to the title. And it's one that kind of helps you think about where we are in terms of what the steps would be like once you get that technical information together. Well, we're doing our testing and analysis, we developed the technical basis that I was talking about, then DOE makes that decision that I was talking about a moment ago. Does the information look solid? Are the analyses--did they receive good, solid peer review, or do I need more tests or further analysis? Further sensitivity studies could be needed at that point. So the idea is that DOE formally decides what to do on the basis of the results of the peer review.

And at that point, if they go forward, then a regulatory assessment, meaning regulatory compliance evaluation. Do I have the information sufficient to support a higher level finding on a particular guideline? If they're ready to make the finding, then they go through, issue the finding, and then at this point in time, a set of particular steps are envisioned, public meetings, issuing the guideline assessments, having a Comment Response Document developed on the basis of feedback received from stakeholders. And then the final efforts that would make RW-1, which is Dr. Dreyfus, to S-1, being the Secretary, the formalism of this being a DOE conclusion.

Okay, shifting gears just a little bit over to, what do we need to feed into this Site Suitability Evaluation? I know Dr. Cording and McFarland have both--we have talked about this a little bit in terms of what will it mean when you're basing your information on an ACD phase of design. Well, I was thinking when I was listening to Dr. Cording talking at the beginning, you know, the perspectives are interesting, because if I look at it from an almost tunnel vision 960 viewpoint, the list of things I think I need from engineering are pretty different than the things, I think, that he told you--or told all of us--that he thinks are very important about understanding the site.

So if I look at this kind of from a 960 perspective, what's most important? What are the key uncertainties feeding into the 960 evaluation? Well, one of them is to have some subsystem release predictions--release from the waste package, release from the engineer barrier system--that are credible. That's one of the things, you know, in our performance assessments right now that are very weak, to say the least.

The seismic design basis is one that I'm sure Dr. Cording would agree is very important from the standpoint of preclosure safety and preclosure operation. That's one that if you look at previous 960 evaluations, we've said we need additional information, needed the hard data on fault slip rates as well as the engineering applications of what does that mean in terms of the kinds of facilities I have to build. That's key input that we'll have to have in order to, I think, support the higher level findings for the 960 guidelines.

Another one that's important are the preclosure radiological release. Now, the first one, the subsystem release, I was talking about postclosure. I was talking about meeting your subsystem requirements from Part 60 for one part in 10 to the 5th, you know, engineered barrier release rates, and 300 to 1,000 years substantially complete containment by the waste package. That's what I meant there. Here, I'm talking about your radiological release predictions in compliance with Part 20. So we're talking about Part 60 brings in Part 20; Part 960 brought in both 20 and 60 in this case. 960 says you're going to be able, with some confidence, to show that you meet the Part 20 worker and public health and safety criteria. So, preclosure radiological release predictions, a design that allows me to give some good bounding release data will be essential for this Technical Site Suitability Evaluation.

I think if you look at the Peer Review Panel results on Early Site Suitability Evaluation, what the person who is the expert in this area said was, "I don't think I see anything about this site that will make it particularly hard for you to design a facility that will meet those limits, but show me. You don't have anything to show me in terms of accident and normal operational calculations." So we expect by that time, given the plans that the design side is put together, to have a good, sound basis for those types of calculations in 1998.

One of the guidelines requires you to make an estimate of whether you have adequate good quality rock. So just the lateral extent, and the adequacy of that lateral extent of good quality rock, is one that will be important to us in terms of--this is kind of a short list of filling in the significant holes in Part 960 compliance, if you will.

The last one, rock quality, once again, the issue of constructability and any question of any kind of health hazard related to the rock materials that we have to mine through.

So those are some that--and this is certainly not the complete list, but this is a list for you to think about.

Now, when we talked in the beginning, I said I was going to kind of jump through these topics that were on my agenda item. The other thing that I think, from talking with Russ prior to the meeting, that you guys were most concerned about and most interested in was the thinking behind this whole sequential, from a 1998 Technical Site Suitability to a 2001 LA, to a 2004 Construction Authorization, and then the updated license application in 2008.

The concept underlying this that you heard Steve Brocoum present was that we were trying to look at what kind of information level we believe we had to have in order to give the Nuclear Regulatory Commission the basis that they needed in order to make the decision that they have to make at each of these steps. And so, you remember--I think Steve talked about it, or at least I know he used this chart--where we talked about many of our calculations will have to be conservative and bounded in the 1998 time frame with regard to the repository waste package design.

In the 2001 time frame for this approach, you notice that, as I said earlier, we're going to put a lot of our effort into making the best arguments we can for the waste package compliance with substantially complete containment. You'll see that these abbreviations are terrible for those who don't know the program, but Sub Cmp Con is Substantially Complete Containment, and the idea is that our arguments would be as complete as we can make them for their intended purpose.

And you should always read this chart, when it says "Final," you should always read it as final for its intended purpose. It doesn't mean that we won't learn any more or that we wouldn't update our understanding, but it means that as we were thinking about it within the environment of this program plan, for its intended purpose, we think that's adequate, or that's enough for us to build the basis.

So if you look at one of these I arrowed, because I knew that was one I was going to talk about, I'll mention another one that I know you're interested in. Retrievability is one that you listed on the title for my agenda item. And the idea here is to have a Title I maturity of design for the 2001 application, a Proof of Principle by the time that the NRC grants the construction authorization, and for the updated license application to receive and possess waste, we would have demonstrated that design. I have a couple of other view graphs that follow that give you a little more detail on that.

The other one I know that Dr. Cording mentioned that is such a concern to everyone is the areal power density, which is in the bounded state out through the

license application in 2001 with the decision deferred. Dean, I believe, Stucker, will talk a little bit more about the way we're going to approach that. But I know that's one that--rightfully so--will get a lot of script and a lot of questions.

This is the one where I said I have people in the audience who can answer further thinking on this, but I wasn't really going to go into any more detail. I think I'll leave it for questions to raise anything about this chart, because it's really not my field, and I feel like I would want to refer it to other people if you do have questions. Maybe that's even best to hold for the panel discussion. Is that reasonable? Do you want to take questions on this right now, or do you want to just--

DR. CORDING: Why don't we go ahead, and we can cover that later.

DR. YOUNKER: Okay. As far as specific retrievability goes, let me make the comments that are in here, and that is that for the 100-year retrievability, the way I think the DOE is looking at this--and these statements come right from Dr. Dreyfus' briefing to the Commission, which was a week ago or so, two weeks ago.

Maintain the capability to retrieve for up to 100 years. And this is, of course, a real issue of what's the funding basis for this, if you really designed for it, will the funds still even be around. So there are a lot of questions related to this one. It's a very, very potentially controversial topic. But I think the current wording that I've heard, and some other people can probably update me even more, is that we would design for the 50 that's required by law, but we would maintain some flexibility and an option, if you decided to go on beyond the 50 years, that you could. So I think it isn't that you would design for 100 years, but you would obviously design for the 50 required, and then keep an option open that you could go longer if for some reason that was decided to be the prudent thing to do.

And the wording that Dr. Dreyfus used in his talk as well was that amendment to close would be filed--close the repository permanently would be filed--when confirmation results provide an adequate basis for this action. So this is that idea of keeping the flexibility such that until performance confirmation gives you that level of confidence that you, the DOE, want to make the decision and go to the regulator and say, "I think I have adequate basis to petition you to close this repository," that you wouldn't take that action. And that's where you maintain the retrievability.

DR. PRICE: Jean?

DR. YOUNKER: Um-hum.

DR. PRICE: Does that 100-year clock start ticking when the repository is ready to close? In other words, when it's full or when the waste package is in place?
DR. YOUNKER: No, this includes the 50 years that we would have designed for anyway, so this is just 50 more on top of the 50 that's required by law.
DR. PRICE: Yes, but it says "after emplacement," and I was just trying to understand whether--
DR. YOUNKER: Oh.
DR. PRICE: --that's the emplacement of a waste package--
DR. YOUNKER: Yeah.
DR. PRICE: --or if it is any individual--the first waste package in place--
DR. YOUNKER: I think it's--
DR. PRICE: --and once it's in, it starts the 100-year--
DR. YOUNKER: Yeah, it's of a waste package, I believe. Let me look for a nod back there.
DR. PRICE: Initiation of--
DR. YOUNKER: Initiation, right.
Okay, and then if you look at the information I have backing this up--and this is the kind of information that I didn't think you wanted to detail, but we certainly have people who can answer it. The idea, for those who are interested in this, that 2001, that Title I design would include waste package handling option, drift re-entry option, and off-normal operation plan.
Then, at 2004 on the chart, it said when you're assuming, at the end of three years, so you were getting your construction authorization if everything went according to plan, you would have matured to a final design with a Proof of Principle for selected retrievability position, and you would have any unique equipment prototype built and tested.
Then, when you move to 2008, which is when, on the current schedule, you go in for your licensing application update, to receive and possess waste, then you would have done an operational demonstration using simulated conditions in the repository if possible. Once again, that's open to exactly how you would do it, but the idea would be--it would be best, I think, if you could do it in the actual repository area somewhere.
And I didn't put a summary in because I couldn't think of how to summarize such a diverse presentation, except to say stay tuned. I think there are a lot of pieces evolving all at the same time, a lot of good thinking, a lot of good effort is going on. Hopefully this was helpful to you to give you some idea of where we're heading.
DR. CORDING: Thank you, Jean. Some of the terms are

new to us, and the idea of prioritizing the program and the testing is something that certainly seems desirable. I think one of the questions I would have is to how the schedule ties into this. For example, if the Exploratory Studies Facility is delayed, something happens and it's delayed a year beyond whatever the present schedule is--by the way, I'm not sure what that is at this point--what is that going to do to the dates that have been set, 2001, 2004, 1998?

DR. YOUNKER: Yeah, well, I'll give you my own opinion and then I'll defer to one of the DOE people if they want to make a statement on that. I think it depends on what level of confidence the DOE management in place wants to have. I mean, if the technical community is saying you really do need a certain amount of information from in situ testing or from excavation, then I would assume they would have to seriously consider slipping the dates. But, Steve, I don't know, have you thought about that? Do you want to comment? This is Steve Brocoum.

MR. BROCOUM: Steve Brocoum, DOE. Dan has been absolutely clear, you know, in front of the Commission and all the presentations made. If we go down and do some testing and we find out we've got to do more testing because the results are not clear enough or are ambiguous, then we have a reason to do more testing. He just doesn't want to start slipping dates now, before he has any real reason to do so. So when he has a real reason, the dates will be reconsidered. So he's been very consistent on that all through time, since this PPA has started.

DR. CORDING: But wouldn't there be certain of the objectives at this point where you know that you want to get to certain points and have that information before certain dates, and that if one doesn't attain that program, then you have to end up changing the dates?

DR. YOUNKER: Yeah, well, I think one of the ones that certainly has been, from the group that I worked with, one of our key concerns, is getting access to the Ghost Dance fault and observing whether or not it has any evidence of currently transporting fluid prior to 1998, prior to the site suitability decision. Because I think most of us feel that the ground water travel time disqualifying condition, that the DOE would be on kind of shaky ground if they tried to evaluate that without having some idea of whether that through-going fault is in fact acting as a conduit. And so, that would be one where I suspect the input and recommendation from the technical side of the house would probably be "We're not sure you want to go forward with that Technical Site Suitability if you haven't got over to the Ghost Dance and got some information in situ.

DR. CORDING: I can see how one has to recognize that there are going to be things encountered underground that will differ, that you have to be flexible in the planning on those sorts of things. But at the same time, it seems to me that if one goes into a program and says, "Okay, we've got these dates here, and no matter what happens--" The impression is that this is what the program is, is that you have a certain date, no matter what happens in delaying our ability to do the science, that we're still going to hit those dates and we're going to be able to declare the site suitable. Perhaps that would be true with some issues, but just continuing to delay starts and delay the actual work but holding that other date constant is something that I think would have an impact on the credibility of the program.

MR. BROCOUM: I just want to make a comment here. Maybe you can put that very early slide up that showed you the step-by-step for suitability. And that's a conceptual slide, but the key thing here is, you can demonstrate progress through time by accomplishing those steps. But whether you do one step a year or two steps a year really depends on a lot of things as to how good your information is, how much money you're getting, how successful you were getting underground.

So this strategy allows you to demonstrate progress over three or four years, or for some reason if you need more time, over a longer period of time. The key thing is you're demonstrating progress. That's a very important concept behind this stepwise--as we're calling it--or step-by-step suitability process.

DR. CORDING: Questions from the Board? Dennis Price?

DR. PRICE: You said it was interesting to hear people discussing how to draw the probabilistic line for qualifiers and disqualifiers and the lower and higher confidence. Could you give us a little more insight as to what's going on there? And how are these lines being driven? It seems to me that that is a soft area that's rather important.

DR. YOUNKER: Well, actually, what I was referring to was the way we thought it through and did it as a part of the Early Site Suitability Evaluation. And in those days, I think you've heard about the way we did it there, which was to not be as explicit about the probabilities as what I think some people would have liked us to be, although we did go through some exercises and actually try to attempt to find out what the range for someone to say, "I think the information supports a higher level finding for a particular guideline." We attempted to go through and for the team doing that, find out what the range of probabilities were that they had in their heads. It was very interesting.

Sometimes they were almost coincident, sometimes they were all over the place.

But right now, I think that the effort to kind of put together the way DOE will proceed with those regulatory assessments is just--we're working on it right now. I haven't been involved in any real discussions about it. Steve, have you had some that you could share?

MR. BROCOUM: I want to make another point here, and that is we issued a notice of intent. We had a public meeting on the 21st of May. The afternoon part was all focused on suitability, getting input from the public on how we should approach, including whether and how we should use 960. That public comment period closes on the 24th of June, so everything you're seeing here, really, is almost preliminary.

After we get all those comments, we plan to assess all that, think about it, and come up with a proposed approach, hold two workshops in August, one here in Las Vegas and one back east in Washington, DC, and then we'll proceed from there. We're intending to come up with a process by--we're hoping to be able to put a process in place by November, but that all really depends on the comments and how the workshops go.

DR. YOUNKER: And I think that the way they're going to approach that in terms of the actual step from the scientific conclusions to the regulatory conclusions is going to be one of the key areas that's going to take some real effort. You're exactly right.

DR. PRICE: Another question I have is, how are the estimates of radiological release predictions that are going on for pre- and postclosure affected by the discussions of criticality, and what kind of interaction is going on between those?

DR. YOUNKER: For that one, I need to call on a resource person. Is there somebody here who would like to answer that question? You may have to take the question--oh, there's Hugh Benton.

MR. BENTON: Hugh Benton with the M&O. They are tied together. Our concern over the criticality is tied to our concern over the release. We have not progressed to the point yet of being able to tie these together quantitatively, although that work is in progress. We are making some good progress and expect to make more next year.

At this point, we are fairly well along in establishing the conditions that we have to guard against for potential criticality control, and we have been focusing on that part of the work up front. As we get that completed, we'll be able to more and more focus on the potential results

of some unplanned criticality and what effect, if any, that would have on the overall release.

DR. PRICE: So criticality, then, is a site suitability issue right now as you approach it?

MR. BENTON: We are considering that we are governed by 10 CFR 60, which indicates very restrictive conditions under which a criticality would be allowed to occur. So we are focusing on meeting that portion of 10 CFR 60. If we meet that, that will mean that the probability of a criticality is so low that we would not expect it to have any effect on suitability, or even any particular effect on release rating.

DR. PRICE: I have one more question. When you referred to the canister and lab tests, did you mean by that the canister as a waste package, with the overpack, or what does that mean?

DR. YOUNKER: You mean when I was talking about rethinking the--

DR. PRICE: Yes.

DR. YOUNKER: --testing program? I was just making a very general statement that in order for us to have the kinds of arguments to support the 2001 license application, I know one of the areas that people are really looking at is the near field environment tests and the laboratory tests that support those, as to what kinds of testing can we do that will help us get the best information on materials, corrosion rates, you know, that information, in the time frame. I don't think I was nearly as specific as what you're talking about.

DR. CORDING: Questions from staff? Bill, Bill Barnard?

DR. BARNARD: Bill Barnard, Board Staff. Jean, you showed us a slide that outlined various elements of the ESF. There were five bullets, which include alcoves and ramp extensions and access to the Ghost Dance Fault. You mentioned that you felt you needed access to the Ghost Dance in order to make your Technical Site Suitability Evaluation. How about the other components, the other elements, of the ESF, how are they related to your evaluation of site suitability? Have you looked at that?

DR. YOUNKER: Well, yes. I think that the fact that the two things you see on the slide--well, three things--allow earliest possible initiation of heater testing, access to the Ghost Dance Fault at the earliest possible time, and then a good contingency for Calico Hills--is not a coincidence. I mean, those three are on there because the carefully thought through--as carefully as we could--the complete spectrum of things that could be important in the ESF. And I think the technical group that worked with me, at least, would say those are the key areas that will do the most in terms of

giving DOE a good scientific basis for a Technical Site Suitability Evaluation.

DR. BARNARD: Are you implying that you need to complete the heater testing before a Site Suitability Evaluation can be made?

DR. YOUNKER: No. I think the wording is also important. "Earliest possible initiation," meaning that--I think from the standpoint of 1998, we're probably not as concerned with having had a couple years of heater testing done, but certainly for 2001. I think most of the people on the team would feel much more confident if we knew that we could get a couple of years of testing done prior to the 2001 license application.

I think for Technical Site Suitability, the reliance on the bounding case is just going to have to be understood, because there's almost no way that even with the work-arounds that they're talking about right now--and I think Bill Simecka can maybe address this tomorrow when he talks, or later. I don't know that we could get much time in that North Ramp extension prior to 1998.

This kind of is a roll-up of what's important for both 1998 and 2001 from the standpoint of the team that I worked with.

DR. CORDING: Jean, is there a schedule overall for this now, for the ESF?

DR. YOUNKER: I think--where's Dr. Simecka?

DR. CORDING: Will Bill be talking about that tomorrow?

DR. YOUNKER: Where did he go? He disappeared. I think he intends--I've seen his view graphs, and I believe there are schedules at least that get you down to this point, certainly. Where did he go? Oh, there he is.

DR. SIMECKA: I can't hear you.

DR. YOUNKER: Oh, I'm sorry. In your presentation tomorrow, you're going to cover a schedule that shows the plan schedule at least for the ESF construction, right?

DR. SIMECKA: (inaudible response)

DR. YOUNKER: Right. So you'll get some schedule information from him.

DR. CORDING: It just seems that the linking of this is so key, as how one approaches the construction and what decisions are being made at different times.

DR. YOUNKER: Yeah, I think you're--

DR. CORDING: They're not independent, obviously, and you can't go ahead and set dates without knowing that you're going to get to reasonable points. There may be some adjustments you make underground when you see things, but--

DR. YOUNKER: Yeah, I think you're exactly right. One of the--

DR. CORDING: --you've got to have a plan.
DR. YOUNKER: --one of the most critical trade-offs, I think, is going to be getting the technical basis that you want for 1998 versus trade-offs of how much excavation we're going to be able to do given limited funding. There's no doubt that's going to be one of the most difficult decisions I think DOE managers are going to face.
MR. MCFARLAND: Yes, Jean, Russ McFarland, staff. Jean, am I correct, in 2001, the DOE will have completed preliminary design of the repository, which by definition is all alternatives have been evaluated, all trade-off studies have been completed, and we will have a definitive design, a design that is essentially frozen; is that correct?
DR. YOUNKER: I don't think that's--is that correct, Kal? Kal Bhattacharyya, if you want to come forward and address that.
MR. BHATTACHARYYA: This is Kal Bhattacharyya. By definition, Title I says the design will be frozen, yes, you are correct in that respect.
MR. MCFARLAND: Good. Thank you.
One other question, Jean. In the preliminary site suitability decision schedule, you show the use of peer review boards on seven different occasions.
DR. YOUNKER: Um-hum.
MR. MCFARLAND: Could you amplify the peer review process, who will be selected, where will they be selected from? What's your thinking on that whole process?
DR. YOUNKER: I have not been involved in the details of planning that, but Steve Brocoum has, and let me ask Steve to answer that one.
MR. BROCOUM: Well, of course, again, we're waiting for comments from the public. One of the things we're thinking about is to have a process that is actually independent of DOE. In other words, the stakeholders, various groups, DOE itself can suggest peer reviewers for each of the--we call them--buckets. But this independent group actually selects the peer reviews and manages the peer reviews. So we're thinking of having a peer review process total independent of DOE. One possibility might be the National Academy of Sciences, for example. We had a meeting with them last Friday and discussed those possibilities with them.
MR. MCFARLAND: Then a number of sources, it hasn't been firmed up yet?
MR. BROCOUM: No, it hasn't been firmed up. Some suggestion is to get the international community involved. We had a suggestion from the state to talk to the National Science Foundation, and we're going to do that. There are numerous suggestions along those lines. The idea is to have

a peer review that's credible on the scientific work on which we will make the regulatory assessments. That's the whole purpose.

DR. CORDING: Dennis Price?

DR. PRICE: Dennis Price, Board. You indicated that you'd focus on the earliest possible acquisition and analysis of key suitability data on the PPA, and you talked about fast paths. Some of us don't live as close to the program as some of the rest of you, and I'm wondering, what is the latest of discoveries on perched water, and also the depth of faults?

DR. YOUNKER: Well, let me see. I'm looking for a face out there. I don't think we have anybody that can really give us that. I don't know--oh, Bob Craig, there we go. Come forward, Bob. Bob Craig from USGS.

MR. CRAIG: I thought I had the low-profile seating in the back. This is Bob Craig, I'm a Deputy TPO of the USGS. And maybe I'll ask you to kind of expand. Let's start with the perched water one, and maybe I can fill in the blanks. I'm a little uncertain what it is that I can tell you.

DR. PRICE: What can you tell us about perched water right now? Are you running into a lot of it?

MR. CRAIG: We have two instances I can think of off the top of my head, two different boreholes, both in Drill Hole Wash, where we have found water that one, it has some component of drilling fluid, polymers that were used in the early '80's when we were drilling out there. This is UZ-14 and NRG-7A, one of the ramp exploration holes just down at the curve in the North Ramp, where it approaches into the block.

Certainly UZ-14--and I wasn't in Reno, but I heard the substance of Al Peterman's talk--the strontium isotope data shows the component that suggests naturally occurring precipitation and infiltration in from the surface in the water in UZ-14.

I'm trying to think of anything else. Still getting some analysis such as isotope data, other isotope data, that might lead to information on age and such.

DR. PRICE: How about depths of the faults?

MR. CRAIG: That one kind of threw me. They're deep. Maybe you can expand on that one, that's kind of a wide open--

DR. PRICE: The reason I'm asking both of these questions is I have read in the newspaper reports that you're finding lots of perched water, and that the faults are going much deeper than originally anticipated, like 3,000 feet, and stuff like that.

MR. CRAIG: Yeah, some of the newspaper articles, of course, are from a layperson's viewpoint. The faults, I

would have been surprised if they were just shallow, near surface things. Some of the very preliminary information we've seen, and some of the geophysics is indicating--and they go to some depth--what is the displacement and amount of permeability, the brecciated zones, the fracturing. Those are the things that are going to be important. I suspect some of this was evolving around the Sundance Fault.

That's still kind of an open question. In fact, as we have had some discussions within the Survey very recently, including last week, there was a field trip amassed as a peer review group to go out and look at some of the evidence in the field. This is within the Survey peer review, so I just want to make certain you understand it's not a DOE project wide peer review. Those results should be out in a few weeks. That's probably about all I could tell you.

DR. CORDING: One question that maybe Bob can participate in here is on the drilling crews, the number of crews you talked about, with the eight for mid-1995, does that involve additional drills or more crews for shifts? What sort of equipment is that referring to? Maybe you can answer that, Bob?

MR. CRAIG: I'll have to quickly admit I'm going to speculate some. I think it's additional shifts rather than rigs, but I don't know that for certain.

DR. YOUNKER: I think that's right.

DR. CORDING: Jean, is that--

DR. YOUNKER: Yeah. I saw Glenn Vawter's been involved in the planning from the M&O side, and he was nodding his head, additional shifts would be added.

DR. CORDING: So it would be the LM-300 going to three shifts and then some other rigs that are out there as well?

DR. YOUNKER: I see some heads nodding.

DR. CORDING: Okay. And then the fewer deep drillholes refers to the dry drilling, is that right?

DR. YOUNKER: I think that's right.

DR. CORDING: Are there other questions from the audience or the Board, consultants? Carl?

DR. DI BELLA: This is Carl Di Bella, Board staff. I've got a question about the 100-year retrievability. Three months ago, I guess it was, the paradigm shifted from 50 years retrievability to 100 years retrievability. In the ensuing three months, have you done any design work to indicate what, for the initial repository, will have to be different to get that additional 50 years retrievability, if anything?

DR. YOUNKER: Yeah, I--

DR. DI BELLA: And along with that, are there any additional costs involved?

DR. YOUNKER: I think I'll hand this off to somebody back in the audience. But remember, I said that Dr. Dreyfus was very clear that the way he's thinking about it right now, at least, is 50 years is what you would design for, but with some option and some flexibility maintained to go longer if you decided you need to. But, Kal, go ahead, Kal Bhattacharyya again, if you have some comments on what you all have been thinking about.

MR. BHATTACHARYYA: This is Kal Bhattacharyya. You probably are aware that a system maturity study is being done for this recurrent issue, which started earlier, a little while before this 100-year came by. So that should shed some light on the cost and effective maturity.

As far as if we have done some design, not really. We just basically have taken the position that--our key assumption is that maturity is going to be optional and remains 100 years. I suspect that it will affect the design in some ways, because it does extend the plant life, if you will, from, say, 50 to 100 years, which is more than a typical plant life. We haven't really thought through it, but maybe in a month or two we can tell you a little more than that.

DR. DI BELLA: Should I ask the question at the next Board meeting, then?

DR. YOUNKER: Sounds like it.

DR. CORDING: Bill Barnard?

DR. BARNARD: Bill Barnard, Board staff. I have another related question for Kal. On the 100-year retrievability, does maintaining that capability also involve developing the storage capacity to retrieve and place the waste outside the repository if after 100 years you decide that you wanted to pull it out?

MR. BHATTACHARYYA: That is again being studied in the system studies that I talked about a little bit, and I think Dean Stucker and various DOE people are aware of that, and maybe can add to that. But that's being also looked at as a part of that.

DR. YOUNKER: Yeah, that might be something--I don't know, Steve, did you want to say something about that? Because that would be very much a policy level call, I would think.

MR. BROCOUM: I should have heard the whole--what was the issue?

DR. YOUNKER: The question--well, go ahead, Bill.

DR. BARNARD: If you develop a retrievability capability, does that also include the development of storage capacity outside the repository for all the fuel inside?

MR. BROCOUM: You need to have a retrievability

capability under the current program, okay? And you have as much time to take it out; if it took you 30 years to put it in, you have 30 years to take it out under the current plan, without extending the retrievability option. So you have time to plan for someplace to put it, because you have that amount of time it took you to put it in.

DR. YOUNKER: But is it DOE's role, are you responsible for having a place to put it if you did have to retrieve? Is that what you're asking us, Bill?

DR. BARNARD: That's a related question--

DR. YOUNKER: It sounded like it.

MR. BROCOUM: I think you probably have to have a place to put it, sure, obviously. I mean, you have to have a viable retrievability plan.

MR. BELL: Mike Bell, NRC. Could you help me out with what maintaining the capability to retrieve means in terms of whether or not you backfill drifts or keep them open?

DR. YOUNKER: Why don't we ask Kal again what's the current thinking of your people on that?

MR. BHATTACHARYYA: This is Kal Bhattacharyya. At this point, our inttention is that we'll backfill only after a decision about whether to retrieve or to close it is obtained from NRC. So that's what we are going through.

MR. BELL: In that case, I'm just curious as to how the extension of the 50 years to 100-year capability coincides with the hot repository concept, because I would think the heat generation and heat transfer situations at 100 years would be much reduced versus 50 years. I mean, it looks like an enormous impact on the design.

MR. BHATTACHARYYA: Off the top of my head, I think that there will be some--the area which might be impacted is the maintainability, so we may have to think about something if you do it only 50 years that we did not have to preplan for a regular maintenance. If it is a 100-year, maybe we have to design so that the maintenance could become easier when the maturity has occurred, that we could easily enter the repository and maintain it for the purpose of retrieval. That's the primary difference I see. I don't particularly see that much of a difference.

When you talk about 50 years, you have to remember that this is 50 years after first emplacement. If you add another 30 or so years for construction for maturity and the retrievability itself as of--even previously, you're designing the repository for about 86 years' life. And now you're designing the repository for something like 136 years. But there isn't that much of a difference in time between 86 years and 136 years as opposed to 50 years and 100 years. So at 86 years, a repository could be quite hot, as a matter of

fact. Does that answer your question?
MR. BELL: Well, I think we'll want to take a look at it, but thanks.
MR. BHATTACHARYYA: Okay.
DR. CORDING: Okay, thank you. Jean, I think you took the time, an hour and a half minus my extra time, and thank you very much. And we'll certainly have more discussion on this in the discussion session later.

I'd like to continue, then, in our schedule here, and have our presentation by Alden Segrest, which is on "Application of Commercial Practice to Cost-Effective Products." It's certainly an interesting case study that the M&O initiated to look at the cost of doing work at Yucca Mountain. So, Alden, we're looking forward to your presentation.

MR. SEGREST: I'm going to pass the first slide, get into the second. What are the objectives of trying to apply this more cost-effective engineering and construction method to the facility of the Mountain?

I took a look, the program definitely needs a better approach for managing estimated costs and schedules. We've got the various approaches to all the design requirements, the DOE requirements we're following, but we need to take a good look at whether we're effectively managing what we are doing. As we get into the construction phase, there's got to be a lot more emphasis on cost control so that we can accomplish all that needs to be accomplished with the funds available.

Aside from just managing the costs and schedules, we need to add some consistency to it to make sure that we are time after time doing our estimates in a consistent manner to have a credible basis for all the costs and schedules we develop. And we need, over and over again, to look for potential targets where we can reduce costs, where we can improve our work process as we continue design and construction of this facility.

Now, let me give you some background as to why this came about.

I will give you an interpretation of what that first bullet means. What that first bullet means is that some cost estimates for some facilities, primarily a warehouse, went to Dale Foust for his review. When he saw the cost estimate for the warehouse, he got spun up a little bit about why it costs so much to build a warehouse. That was the high level review of the engineering and construction cost estimates. We also told him what it would cost to build it. And he just really didn't think it was reasonable for anything to cost that much, even if it was associated with

Yucca Mountain or any other project.

So, then, for the second bullet, at his insistence, we did a thorough cost analysis of the design of the construction, what it would cost to design and build that warehouse. We went into all the details, gave that information back to him, he came back to us, we went back to him. So we went through this process of why it was costing so much to design and build that warehouse and what we could do to try to get those costs under control. That is an interpretation of those two bullets.

Now, the third bullet is something that we've got to learn, we've got to remember as we go through this process with a project of this nature. A rigorous application of all of the requirements that are in our requirements documents, that are in the DOE regulations, that are in the regulatory documents, the rigorous application of those requirements is mandatory. It's required, we've got to follow it. But at the same time as we're designing and developing these facilities, we need to look at the requirements, decide whether they are logical and reasonable for what we are doing, and if they're not, we need to question and challenge that. If we go back and question some of the requirements, it may very well be that they can be waived on a particular facility because of the nature of the facility and the purpose. So we, as engineers, need to continuously look at what we're doing, make sure the requirements are appropriate. Sometimes there is a tendency to overapply the requirements, and we need to go back and question those.

The process we used was, first of all, to identify generic approach. We actually identified it as we did it the first time. We identified an approach as to how we would do the estimates, what we would include. We did the initial estimate. As I say, we went through a little iterative process with management. That is what we refer to as "tuning the estimate." We got management concurrence on the estimate.

And now we need to go through with what we've done, develop a plan, so that we can institutionalize the way we approach this warehouse across this program. We're trying to get it first done within the M&O, and as we get that done, then we'll probably move it out to other elements in the program, other participants, so that we can, just as a general rule within this program, be consistent and apply some kind of a method to assure that we are controlling costs.

The initial basis of estimate which was prepared just included the sections identified here. There was a scope of work--and I'm going to walk you through much of what

was in that initial basis of estimate--do a comparison basis for what it would take commercially to design and build a facility versus what it takes on this specific project. Summarize those results, present all the details to go with it. Look at the cost differences. And it's not just a matter of justifying the cost, because some of them I'm not sure you can justify, but it's explaining why the costs are different from a commercial estimate to the cost on this project. Explain why it is that way. Identify places where perhaps we can save some money, save some time and cost with building this. And then we do an evaluation of the approach for designing and constructing the facility and decide if a different approach, a different methodology, should be taken for that facility to try to make it work at a more reasonable price.

Now, the scope of work, as I've already identified, was a warehouse. Now, this is not some kind of a unique, super sophisticated nuclear warehouse. It's a warehouse building 10,300 square feet; it's a 9,000 square foot floor plan with a 1,300 square foot mezzanine. It's got your basic provisions for general storage, some secure storage, mechanical equipment. It's got offices, toilets, lockers. The general warehouse receiving and storage usage is occupancy B2. That's just a designation of non-combustible storage per Uniform Building Code.

Now, if you see anything unique or sophisticated about this warehouse, let me know.

It's Type II non-combustible construction per Uniform Building Code, clear span structural steel. If you've ever seen what's referred to as the Butler Building or Pre-Engineered Building, this looks very much like one of those. Steel columns, concrete foundation and pad, prefinished, metal roofing, siding. It's a twenty-foot eave height. We'll have fifteen-foot shelves in there. There are two recessed truck well/loading docks.

Continuing on with the definition of the warehouse, we have roof canopies over the loading docks, automatic fire sprinklers. That, in itself, is not unusual. There's probably some rather expensive test equipment, so forth, in this warehouse. The last thing to do, electric power and lighting throughout. The offices will be air-conditioned. The remainder of the warehouse will be ventilated and heated. Fully insulated building. That's not unusual. The mechanical systems do require an Energy Conservation Analysis per a specific DOE order. And there is also a Fire Hazard Analysis which is required per another DOE order. We mentioned those for a reason, which you will see shortly.

Now, what are the results. The way we did the

comparison, we wanted to see what it would cost commercially for TRW or someone else needing a warehouse at the site location to build it. So we go to the "Means Construction Cost Data." That's the best place to go. But even when you use Means data, if you compile an estimate using Means data and competitively bid that for a warehouse, you'll be high, you won't win the job. So we chop that estimate by twenty percent.

Developed a cost estimate--I'll show you the numbers shortly--that's based on our experience with competitive bidding. So that is the cost estimate we'll use. Now, in that estimate, we assumed Nevada rates, we assumed union labor, we assumed a distance from Las Vegas. So we tried to match it up to what it would cost at this location to the extent we could.

So, here's what you've been looking for all along, the numbers.

Construction costs. The construction of this warehouse at a Yucca Mountain site, just over a million dollars. Now, if it was just a commercial basis, $376,000. That's based on our Means data, with twenty percent reduction. So you can see about a three to one cost ratio there.

The engineering cost--I don't like to talk about this, because I guess I'm responsible for this--the commercial cost for this would be $79,000, project cost $292,000.

And now, for this type of facility that I've described to you, there are some things that are going to raise the cost of it, but I'll just ask you if you see any reason why I should raise it that much. We didn't when we looked at it, so we felt something should be done about it.

I don't know all the details of the construction, and I'm not going to try to speak for the constructor on some of his costs--I'll give you some ideas--but from the engineering standpoint, we could do a fairly detailed cost analysis, and we did it, and this is just a summary of that. I'll call your attention to certain things.

If you will take and look at Yucca Mountain cost--this is all in terms of work hours, by the way--the Yucca Mountain cost versus the commercial cost, and you look at each of these pairs as to how it compares.

The Common Activities column here, this represents things like supervision, that's common, that's shared between--well, our engineers are designing a warehouse, so an operations facility, test lab, whatever else they're designing. That's kind of hard to pin down to a particular facility, it's spread across a lot of them, but this is the

share that would probably go to the warehouse. But you've got that activity, you've got all the various design reviews, which are done--we have a 50 percent design review, 90 percent design review. Those are very time-consuming. We have a lot of interaction with various participants, with our customer.

One of the things on this particular facility that we spent a lot of time doing earlier is trying to find out how big it was. I think there were--I didn't go read the requirements--I believe there were twelve pages of requirements that we had to meet on this facility, but we weren't told how big it was. So that took some time, a lot of interaction with participants, with the laboratories and so forth, to make sure that we were providing enough space.

So you see generally a fairly big difference between what it should take on a normal commercial job just for supervision, for common activities of that nature, versus what it takes on this project.

Drawings, you see some differences. In the architectural, an extra 50 hours associated with drawings. Structural, not much difference. And the electrical and mechanical areas there are some significant differences.

The specifications required, based on the process that we use here, versus what we would do on a commercial job, if we were building it just for TRW or University or someone.

Calculations. Now, this Calculations also includes analysis. I mentioned earlier some of the analysis associated with Energy Conservation Analysis, Fire Hazard Analysis. You see in the commercial case each time it's 0. That would just be some back-of-the-envelope analysis or some engineering experience applied to it. There wouldn't be a lot of calcs. Not likely to be any, according to this. So you can see how much that adds to the job. Most of that is actually some analysis that is required, more than what you normally think of as calculations.

So what's the justification for all these differences?

Let me hit construction first. Construction, without trying to pin it down to specific dollar amounts, if you look at what's required for this project and this job--and this is a generic explanation, not specific to the warehouse, but to general facilities or construction that is done on the site.

The QA/QC program requirements, if you look at any nuclear program, you've got extra requirements. You can look at the commercial program, anything that was built on a nuclear site, nuclear power plant site, would typically cost

more because the requirements, a lot of them are applied across the board as far as site access, security associated with it, and so forth. And the people you will have on-site working will be fully trained in QA requirements. There are a lot of overheads associated with that. So when you apply the QA/QC program requirements, it affects a lot of costs other than just the QA areas.

Government requirements. There are some significant requirements and orders which apply to this project. Well, to any DOE facility.

Special project requirements. We've got a lot of environmental stipulations, water usage, etc., related to this site, all that are very necessary, they're required.

Remote location. A hundred miles from Las Vegas, and then we've also got special access requirements as far as the security requirements to get onto this site, work on this site, distance travel, so forth.

Then we have a non-competitive situation. On this particular site, where you have a contract for the site, designating the site, you don't go out and compete everything that's done. Of course, that would be difficult to do with all of the requirements associated with security, QA, etc., on the site.

So construction costs are going to be higher, some higher. We've identified approximately how much, but didn't break down the differences like I've been able to do within engineering.

If you look at the engineering cost differences, the commercial design cost, in terms of hours that we would anticipate on this project, would be 1,320 hours. Now, earlier I showed you a commercial cost of $79,000. If we adjust that for the hourly cost associated with this project, it is up to $97,000. There are a lot of reasons for that hourly cost as far as the nature of the people you have working on this job, the experience requirements, a lot of training over here and so forth, that will cause the cost to be higher on this job.

Extra analyses and BFD preparation, 650 hours. That is just extra requirement. We have to do a lot of traceability of requirements. We have to develop a BFD document, a Basis for Design document, for requirements traceability. The extra analyses are associated with the DOE Fire Hazard and Environmental Analysis. Or not Environmental, it's Energy Conservation, excuse me.

Reviews and coordination activities. My engineering supervisor spent a great deal of time interacting with the participants concerning the design reviews and the requirements, resolving comments from design reviews. Some

facilities, perhaps the warehouse, perhaps some others, maybe should be exempted from that requirement. Save a lot of time and effort. Perhaps once we go through and establish the size and location of the warehouse, then leave it alone. Just go design it and build it.

Additional design products--these are additional drawings, additional specifications, so forth, that are required--715 hours.

And this rework due to scope changes, a lot of that is also associated with the design reviews. We will go through, develop a product, get to a certain stage, and then as it is reviewed, there are likely to be changes in scope that causes us to have to rework some of the design. It might change the size, might change the color, the height. Various things can change during that process. It's been our experience they add to the cost. In this case, we've assigned about $50,000. Also, some of that work, by the way, in this particular facility, I guess really most of that 50,000 has already been spent on this facility.

So what do we do? How are we going to get the costs down? We're going to drop the requirements traceability. That saves about $16,000. I will tell you we had some discussions two weeks ago, as we're getting ready to proceed with the design of this. We've already made the decision to modify the design requirements, such that the number of requirements will be substantially reduced. We can still do the Basis for Design, but the Basis for Design, instead of being based on twelve pages of requirements, will be based, probably, on one page of requirements. So rather than eliminate the BFD, we're going to go back and correct the process from the beginning, to try to improve the way we have to approach the design.

We can exempt the design verification requirement. Since it's a non-Q building, I'll just eliminate that requirement. It doesn't take any further authorization to do that. We will eliminate that requirement and save about $25,000 on the facility--on the design of it.

Then we will be making the request to get exemption from the Energy Conservation Study for this warehouse.

Another potential cost savings is to go with a performance spec. I'm going to show you how much we can do with the engineering right now with these numbers. If we went to a performance spec rather than what we've done, we go to a specification which describes the warehouse, describes the requirements of it, go out for bid for the warehouse, go bid it instead of continuing to do the detailed design, the spec itself could be developed commercially for about $37,000. Of course, with all the differentials that apply on

this job, end up needing about $45,000 just to do the spec.

If we still do most of the DOE orders, I guess all the DOE orders, you need another 120,000. We can pull back on some of those, we believe, with some waivers, so that we can actually still reduce this number, but we still come up with a cost of 164,000, 165,000.

And this rework, as I say, most of this has already been done. We've done a lot of work. We've already been through the 50 percent review on the warehouse, made a number of changes, kind of an iterative process in getting the requirement defined for this. But then we come up with a cost of $215,000 versus doing the entire engineering job, all the detailed engineering, versus nearly 300. So we've definitely got some potential for savings here.

Since we've already started some of this process, this will not exactly describe how we're proceeding, because we're making some decisions as we go. We're already taking some steps to reduce the cost here as we work so that we will be approaching this number. It would be nice if we could go below it. But we are working to cut the cost of that already.

Now, we have estimated the cost of construction at the Yucca Mountain site to be $555,000. Don't go challenge REECo with that number, because we have not worked it through them. This is based on some of our own estimating. And I don't want to put them on the spot for that number, because they have not reviewed it in detail.

And what we recommended in doing this particular facility is doing a performance specification--Engineering would do a performance spec. And it also recommends that REECo competitively bid construction of the warehouse as opposed to using their own construction force to do that. There are several reasons to do that. If you go out and look at this type of a commercial facility, there are companies out there that engineer these, and they have, generally, constructors they work with that can put these up. That's their normal practice. They can go in and put one up very quickly. REECo, given this warehouse spec, would probably make the purchase, and then they, in their normal process, would make a decision based on the type of construction force they had available at the time, the amount of other work they had going, and whether they could be competitive doing it themselves. We go through this same decision process. We're kind of second-guessing them here because of the force they've got at the particular time and the work load, and assuming that would be the best way to go. They would have to actually confirm that decision themselves.

The other thing which we saw from the other numbers

would cost about, what, $75,000 more, go ahead, since we've gone this far with the full design package, rather than performance spec, and REECo still competitively bid the construction.

The first option probably would be the most cost effective to apply here.

Now, the implementation plan, we've gone through this in the warehouse, and we're starting to actually apply this, but what do we do from here? We've spent some money going through the analysis more than we probably would otherwise. But to go through the analysis, this has been somewhat of a test case to see what we think we might could do to be more cost effective in our design.

With the implementation plan, we did utilize this Basis of Estimate Outline on that initial estimate. Where should we apply it next? We should take a look at all the major free-standing surface structures and go ahead and apply it to them. There are specific areas of the underground facility we should apply it to. We'll have to do it quick, because design for that is moving rather rapidly, and the TBM is just about six weeks from--the systems, if we look at specific systems, mechanical, electrical, for supporting the ESF, we could apply it there. And then there's portions of roads, drainage features.

Now, the truth of the matter is, I'm already applying it. We've determined that we need to look at the conveyor system. That is an area where we think we can get some immediate payback, so we're going ahead. The next area we're applying this Basis of Estimate method to will be the underground and aboveground conveyor systems. That, we're looking at a very near term purchase as soon as we can get the specification out the door. That was supposed to happen today; hopefully, it did. But evaluate the conveyor purchase and installation. There are some possibilities there because of some used equipment available that we may be able to save a significant amount of money, and perhaps some significant time, if we can go ahead and come up with a better method on the conveyor.

What we need to do in applying that is go ahead and identify, in priority order, where we have the greatest potential for savings in these major job areas. We can look at the Surface-Based Testing facility and Roads. We can do that. What I'll most likely look at first is these lower four, because those are within more direct control of what I'm doing as far as the surface buildings, surface roads, and the various underground facilities and systems. Since I have direct control over those, I can implement the method for estimating, and then go ahead and very quickly implement some

cost savings as we go through design development and release of those packages for construction.

I will tell you that anywhere we've presented this so far, we've presented this--well, it's been discussed with some of the management of DOE, with REECo's management, with some other participants--the response has been very positive that we're moving forward to try to do this. In fact, that's why I'm here today. This presentation was made at the Project Management Review. The end of April, Russ go a hold of the slides from that and invited me to come do it here. So we're getting some pretty good reception as far as the way we're trying to approach this and just the fact that we are trying to improve the cost effectiveness of what we're doing.

With the items I showed you on the previous slide, we will want to take the highest priority item in those various areas where it appears to be the most potential for savings, or the near term items. Go ahead and try to do Bases of Estimates on those, do the commercial costs, look at Yucca Mountain costs, try to compare them. See where we could save the most money and go ahead, follow up to do some things, to develop some recommendations there.

As we go through, we need to continuously tune and finalize our process and our estimates and work very closely to make sure we've got DOE concurrence on the way we're doing it. We have found that if we bring to DOE's attention the costliness of applying some of these orders and the benefits of getting waivers, where those waivers are appropriate, the DOE is being very responsive, they're listening to us. We had some discussions this morning concerning some systems which make it rather clear they're interested in helping us to expedite systems so that we can improve our schedule, or meet our schedule, whatever the case may be, and so that we can reduce the costs associated with this project. So they are definitely on board with us as to what we're doing here.

We want to get to the point, really, where we're applying this method of analyzing the cost to everything we're doing. Then get beyond what the M&O is doing and get that applied to all of the Yucca Mountain project work so that we are routinely evaluating requirements, routinely evaluating our methodology, to assure that we've got the appropriate application, the appropriate method applied, and that we are interpreting what our requirements are correctly, and we're doing it in a cost-effective manner.

That's all I have.

DR. CORDING: Thank you very much. Questions? Tony?

MR. IVAN SMITH: This is Tony Ivan Smith, consultant. I have a question relative to G&A on page 17 and the recommendation that performance specification be utilized and

that REECo competitively bid the construction of the warehouse, etc. Would REECo, in this situation here, hypothetically charge a G&A, or would they change to act as a general contractor or construction manager? Would that change the cost?

MR. SEGREST: I believe that anything which REECo bids out there is still a cost associated with it. I mean, they add some REECo cost to it, whether it be materials, equipment or other labor. I don't know the details of that, and I don't know if Dan--he was here earlier. I don't think REECo is here.

MR. IVAN SMITH: I was leading up to the question you have on the conveyor belt and the tunnel machine, because I do believe, for example, on the LM-300, that the G&A would be applied to the purchase of the machine. So the $13 million tunnel machine might have 49 percent, or some percentage, added to it.

MR. SEGREST: I don't believe it's that high, but there is some percentage added to it, you're right, yes.

MR. IVAN SMITH: So in a situation of purchasing a conveying system for behind the tunnel machine, G&A would then be applied to that?

MR. SEGREST: Yes.

MR. IVAN SMITH: Thank you.

UNIDENTIFIED SPEAKER: Bill--Bill had a question.

DR. CORDING: Yes. Bill Barnard?

DR. BARNARD: Bill Barnard, Board staff. I have a question for Bob Matyas. We're seeing project costs that are about three times higher than what commercial costs are. Is this typical for any government operation, or is this situation unique, based on your experience looking at other government operations, like the supercollider?

MR. MATYAS: Experience I've had is that a government operation is more costly, but not by the degree that we see here. This is a very large factor over my experience.

DR. BARNARD: Thank you.

DR. CORDING: Russ McFarland?

MR. MCFARLAND: Alden, two questions, if I may. One may not be appropriate for you, but try it anyway. About a year and a half ago, two years ago, the M&O, in the Project 2001 report, went through the total program costs, including the 800 million estimate for the construction of the ESF, and essentially vented those numbers. How was the M&O able to do that when really, as you're explaining, there was no clear basis for establishing those costs from your perspective?

MR. SEGREST: I don't want to say that there was no clear basis for establishing cost. We were doing cost estimate back then. I was back in Vienna and Charlotte

instead of out here. The cost estimating was being done, but the approach was not as rigorous in detail and did not look at things the way we're trying to look at them now. There was a cost estimating basis, but what we're trying to do is something different, to assure a more cost-effective basis.

MR. MCFARLAND: But there is a multiplier.

MR. SEGREST: Oh, yes.

MR. MCFARLAND: That apparently had to be used, a Factor 3, Factor 4 multiplier, to come up to the 800 million. How were you able to do that?

MR. SEGREST: I was not involved in that estimate, so I really can't answer that. Paul Pimentel will answer that for you.

MR. PIMENTEL: Paul Pimentel with the M&O. I was responsible for Mission 2001 Cost Estimate. Those estimates came from each of the participants, who provided their own estimates. The M&O did not estimate the job. That was a joint effort of all the participants on the project. So the construction cost estimates came from REECo.

MR. MCFARLAND: You merely added up the numbers given?

MR. PIMENTEL: They actually input them into the system. We used the project cost system, the PAC system, and each participant loaded their own cost and schedule information into the PAC system. And then we integrated the schedules, and we reviewed the cost estimates from a tops down basis. But the effort wasn't that extensive to where we went to nuts and bolts and looked at the estimates in that excruciating detail.

MR. MCFARLAND: Is it your thinking that perhaps the same thing was done by the ICE, the Independent Cost Estimate, done by Gilbert Commonwealth? Are you familiar with the--

MR. PIMENTEL: Well, I listened to their presentation. I can't, you know, respond to how they performed their estimate, but it was an Independent Cost Estimate. I'm sure they used some kind of factoring basis that they have in their data base.

DR. CORDING: Jack Lemley?

MR. LEMLEY: Just as a curiosity--and I have to apologize, because I haven't been involved in this for a very long time--why would not your construction contractor buy all these conveyors without all this analysis? Certainly Kiewit has done an enormous amount of that kind of work as a routine to their normal business. Why would the M&O contractor be involved in it at all except to assign it?

MR. SEGREST: In design of the North Ramp, the M&O's responsible for doing the design for that, and then we provide that information to REECo and to Kiewit as the

constructor. So we provide them the design specifications, performance spec, if you will, for the conveyor system, which then they go out and purchase.

As far as the analysis of what's being done with the conveyor, this project has a lot of requirements that have to be met. We've got some--I'm trying to think what specifically applies to conveyor--but a number of the things we've got to make sure there are requirements on fluids that can be lost, the oils, the lubricants, the greases that can be lost on a conveyor. Because of the type of material, we've got some requirements for dust suppression. Because we're doing the design of the ground support system, we've got various requirements on supporting the conveyor. And then we've got to identify other things, such as the length, the speeds. And then we have to, I guess, do some, at least, sketches or designs, not detailed designs, that show some concepts as far as the conveyor system on the surface, as far as what happens there.

There are some unique features. For example, the various materials that come out of the tunnel have got to be separated into different piles in case it ever has to go back in. So we come up with unique features and--

MR. LEMLEY: That's not an unknown requirement in their normal work routine, though. I'm just curious about how the interface works between these various organizations. It seems to me that there's an enormous amount of duplication and overhead in the management of the process.

MR. SEGREST: I don't think there's any duplication, because if Kiewit was given responsibility for the design and operation, design and construction, at the tunnel, then they would be doing that design. The M&O is responsible for doing all the design of the systems for the tunnel, and then REECo and Kiewit are responsible for constructing it. Realizing that I think Kiewit has the capabilities to do both, but that's not the way the contract's been set up. And I don't believe there's any duplication. Actually, there's a great deal of working together, though, because we interface with REECo and Kiewit at least daily as far as how we're approaching the design and construction of this. There are a lot of things about this facility, as you know, that are unique and require special applications.

MR. LEMLEY: I hate to be a wet blanket here, but I was also an advisor to the superconducting supercollider. It was as big a mess as this appears to be, and it was canceled by Congress. They certainly won't cancel this, but I'm surprised at the bureaucracy here.

MR. SEGREST: Well, that's exactly the point of a lot of what we're doing, is we're trying to work to smooth through

that bureaucracy and make the process work a lot better to actually reduce some of the costs associated with it. And then with cooperation of DOE, we are challenging some of the bureaucratic requirements and processes that have tied our hands or added cost to the project. And as I say, we were in session with DOE this morning trying to do some things so we can get by some of the bureaucratic issues of the system that were about to stop us from saving some money. And they were fully supportive of that.

MR. LEMLEY: At the risk of being argumentative, this is 1994, and this program has been underway for some time.

DR. CORDING: John Cantlon?

MR. SEGREST: I won't try to argue with you.

DR. CANTLON: Can't top that question. You've sketched ways in which you can get around, or possibly get around, certain of the bureaucratic requirements which add cost to the project. However, the very process of doing that analysis is itself a cause. You have some kind of figure about what--when you mainstream the process, are we looking at? What does your auditing add to the cost of the project, I guess is the way to phrase the question.

MR. SEGREST: I would suggest to you that on this warehouse analysis, because we were going through an iterative process, we were asking a lot of questions. We were challenged in the people giving us the estimates. We just were not accepting the numbers that we had. Mr. Foust came back over and over again, not accepting what it was coming up with. That particular one, we haven't tracked the cost, but I'm sure it's added a few thousand dollars at least to the time associated with development of this warehouse. But I think on that facility alone, we will save more than enough to have justified what we went through.

The real issue we want to deal with here is getting--you know, we spent a lot of time getting organized, staffing up, bringing the people on board, getting the QA programs in place, getting the processes in place, getting all the training. Now we better take a look and see how effectively we're doing our job and where we're not doing it effectively and efficiently. We need to improve it. And that's what this whole thing is about, is trying to be more effective in what we're doing from a cost standpoint, and we're going to try to continue to make as many strides in that direction. I hope we save a great deal for the project, but we have not estimated that, sir.

DR. CORDING: Bob Matyas?

MR. MATYAS: Yes. Mr. Segrest, you're the M&O.

MR. SEGREST: Yes, sir.

MR. MATYAS: And yet you say your requirement is to do

design. That's an unusual role, in my experience. You actually do A&E work?

MR. SEGREST: Yes, sir.

MR. MATYAS: I see.

MR. SEGREST: We are responsible for the design of the waste package, the surface facilities and the underground facilities. The M&O was also responsible for the MRS, if there was an MRS.

MR. MATYAS: Let me draw a comparison to the supercollider. The supercollider had an M&O, and supercollider had two components. One was to develop the facilities, the underground chambers and the 67 miles of tunnel. The other component had to do with laboratory facilities, development of magnets, superconductivity, and the like. I worked for a very short time for the M&O, which was a scientific organization, and for construction, we did not do any design, perhaps because there was nobody there that had that capability. The decision was to hire an AEM, an Architect Engineer Manager. And all of the underground facilities were designed and contracted for by the AEM. We did not supply any material to them. The record shows that the underground work for that period of time broke records that will be a long time before they're surpassed.

The other component was handled by an agent of the M&O, or a partner, and they went about designing and constructing buildings all on their own. Part of the problem that lead to the criticism was they were building buildings without having clients. A very large magnet research building was built, and nobody in the Magnet Division was ever contacted.

The building was finished, it was a huge facility, and among other things, there was barely enough delivered power out in that part of the country to keep the emergency lights on, and the building was never used. So, on one hand, they may have done an effective job of designing and getting their money's worth, but they were doing the wrong thing. And I think--as a matter of fact, Secretary O'Leary did say that the only thing that worked was the underground works of the supercollider. It was a matter of getting your money's worth.

The partner for the M&O that did all the surface work, for example, they were building a laboratory and treating it as a laboratory long before it would ever be a laboratory. It was a building project first, then it would someday become a laboratory. The whole approach was to build this instant high-energy physics laboratory before there was a facility for a laboratory mission to use.

So we had two different things going there. We

considered it an absolute capital sin to supply anything to the contractor for the underground work. And we got extremely good prices. It would be a long time before somebody gets those prices.

DR. CORDING: Going back to the comments that Jack Lemley was making, is it possible on something like the conveyor--there are certain criteria in terms of, for example, leakage of oil and things like that. Is it possible, as the M&O, to provide an overall criterion, and then let the contractor select the equipment that will fit that criterion, rather than going through the full design and all its detail, but let the contractor then select something that would then fit his operation? Is that a possibility in the conveyor? And then thinking through to other aspects, where you give the contractor the responsibility for his operation and for his efficiency and his safety.

MR. SEGREST: We're not designing the conveyor. We're not going out with a detailed conveyor design, we're going out with a performance spec. We prepare the performance spec, the evaluation criteria. There are certain elements of the design, where necessary, that we define in more detail than others, where it's required because of the unique requirements of this project. We're very, very careful about what materials are underground, knowing what's there. We'll have some requirements. I don't think we're all that unique about the belt material being a fire retardant material, about the types of bearings, sealed bearings, things of this nature that we will require that I don't know that are that unusual from what you would normally have in an underground facility.

But we will give them a performance spec, probably slightly more detailed than they might normally see, but not a great deal more detailed, such that the constructor can go out and purchase a conveyor--in this case, it could be a new conveyor, it could be a used conveyor with some upgrades--and provide it.

DR. CORDING: Will the constructor then provide the equipment? It won't be DOE purchase, is that--

MR. SEGREST: Oh, it will be purchased, yes. The constructor, REECo and Kiewit, will purchase the conveyor for this project through their purchasing process, which I'm sure has to be DOE approved, and I guess--

DR. CORDING: Why couldn't it be just that that equipment's provided; however the contractor wants to provide it, he provides it? I mean, he could use used equipment, rental, whatever will fit that criterion, he provides, and it's basically a rental to the contract.

MR. SEGREST: The constructor is operating under the

requirements that they are given from the Nevada Operations Office. I don't know the details of those, and I don't think I have the right construction people here to answer those. In fact, I'm sure I don't. But they have a process which they use which is approved by the Department. I can't give you details on it, I don't know them.

MR. LEMLEY: I'm a little unclear as to you say the constructor, REECo, Kiewit; are they in some kind of a venture together?

MR. SEGREST: REECo is the test site constructor, and Kiewit, because of their tunneling expertise, is a subcontractor to REECo for the ESF.

MR. LEMLEY: Does that mean that REECo has crews in the tunnel along with Kiewit?

MR. SEGREST: Yes. REECo will be operating the TBM.

MR. LEMLEY: What do you have Kiewit for?

MR. SEGREST: Excuse me, Kiewit. I'm sorry, Kiewit will be operating the TBM, not REECo, I'm sorry.

MR. LEMLEY: It seems like a confusing kind of an arrangement.

DR. CORDING: I think one thing that would be interesting that perhaps even tomorrow we could have some discussion of this procurement policy. And that's something I think we've had some informal discussions in the past on, as to the opportunities for obtaining equipment in such a way that the capital costs may not have to be absorbed by the project. One can do this, for example, for TBM's as well as other equipment.

MR. SEGREST: That's one of the things we want to do, is go through as we design, procure, working with the constructors, we want to try to make sure that we are selecting the best strategy to proceed.

DR. CORDING: Any other comments?

MR. VAWTER: Could I make a comment?

DR. CORDING: Yes.

MR. VAWTER: I'm Glenn Vawter with the M&O, the Deputy Manager here. I think you're right. Just to answer a couple of things, this is a unique M&O concept that you probably wouldn't find in some of the other DOE facilities, and we'd be happy to take some time to brief you about how that contract was awarded and what it covers. It is unique to the extent that in our work scope there is not only the integration management functions, but there were performer tasks that were put into that contract, and that's why we perform them.

The team that we have as the M&O here includes some folks who are obviously very expert in that field, MK and Fluor-Daniel. And so, you know, we have the expertise to do

that.

I would just suggest, because Bob Nelson isn't here, and I might commit him to this--he's going to be here in the morning--he would be the best source I think you could have to understand the procurement policies at NVOO, that REECo, because they're the contractor and they are subject to--and just because we don't really have much choice in that. I think all of us who come from the commercial sector would see ways that this certainly could be improved. A lot of restrictions that are placed on this project for a number of reasons, and we're doing the best we can to improve that process.

DR. CORDING: Okay, thank you.

MR. IVAN SMITH: Just--

DR. CORDING: Just briefly, yeah. Tony?

MR. IVAN SMITH: Tony Ivan Smith with a final comment. Going back to the Sandia days, when I was a member of the expert panel on costs and scheduling, these questions came up there. The tunnel-boring industry is a mature industry. It's a multi billion-dollar industry. It is continued worldwide. And I feel, and have always felt, in this program, to use the words, for example, "commercial practice to cost-effective products," is that we're not emulating commercial practice. And I think it's a matter we'll discuss tomorrow in more detail, but I wish to make that point right now. It's a very mature industry, and if you make a comparison to the work done by the Bureau of Reclamation, which is in tunneling, a Central Utah Project. The nursery for the tunnel-boring industry was the Central Utah Project. It's a whole different thing. We'll discuss that a little bit later. Thank you.

DR. CORDING: Yes, Jack Lemley?

MR. LEMLEY: One last comment. All this procurement policy and all of the other issues that seem to be difficult from a cost-effectiveness standpoint here all pale when you start looking at it in light of the schedule. And it seems to me that the schedule will probably be the most significant aspect of this program ultimately, because these costs, fixed costs of operation, are astronomical compared to progress.

DR. CORDING: Okay, thank you very much, Alden, and I'm pleased to say that we're beginning to look into these things, and thank you for your presentation.

I suggest at this point we take a fifteen-minute break and be back at 4:00 for the next session. So we're taking the break a little ahead of what is shown on the schedule.

(Whereupon, a break was taken.)

DR. CORDING: Okay, as requested, we do make sure we

speak into the mikes when we're answering questions or asking questions.

Our next presenter is Dick Bullock, with Raytheon Services. He's going to describe a "Preliminary Study to Improve the Entry into the Calico Hills Formation for Site Characterization." Now, this is a study that was done, and one which I think gives some interesting options for getting down into the Calico Hills.

MR. BULLOCK: Thank you, Ed. Can you hear me, is this working?

(No audible response.)

MR. BULLOCK: This study was completed last fall, in 1993. It began when Dr. Bill Simecka requested me to do this study to see if there weren't some different ways, and hopefully better ways, to get to the Calico Hills. What's in the view graphs, and I must apologize, I didn't learn of this presentation until last week, and I was in Denver all week. I called back to the office and had them put the slides together I used last December. So I'll try to make corrections where corrections are due if things have changed in the meantime.

The purpose of the study was to take an independent look at a simpler method and more cost effective to get to the Calico Hills. It was a preliminary study--I'd rather call it conceptual study--and therefore nothing was really optimized. There's no doubt in my mind that as the M&O goes through the design, and if they do choose an option such as this, that they'll find many ways to improve over what I've said is a conceptual study.

I did use "drill and blast" for the ramp, primarily because I didn't have good cost estimating methods and knowledge myself of tunnel-boring a ramp. So I used drill and blast for the development of the ramp, and a "roadheader," which the DOE owns, an AM-75 Roadheader, for the haulage away on the Calico Hills. I really feel that a TBM and conveyor system would prove even more cost effective.

Why enhance the baseline? Well, one of the things that could very well be virtually improved is the time factor. The present schedule, which, again, back in October, was that they were going to start the Calico Hills South Ramp 7/98. I think now they've decided--it's not a baseline, but the planning is to start it in '97 from the north side. The Main Drift, then, was 11/98. The cross cuts were completed in 2001. Testing was to start in the year 2000, and completed, probably, in 2008, because there's about eight years of testing. These dates have been moved up somewhat, at least maybe a year or two, so I'm not real sure in the latest planning that the M&O has done, this has been

accelerated somewhat.

Another reason to enhance the present baseline was I think it would be ideal to have no connection to the Potential Repository. Option 30 was selected by the Management Committee of DOE for the reason that there was 2000 feet of horizontal distance and 200 feet of vertical distance from the take-offs, where you drove the ramps down to the Calico Hills. What is baselined doesn't have near that distance, and the new enhanced Calico entries are about the same level as the repository. There never can be a direct pathway of man-made opening between the two horizons if the entry to the Calico Hills is completely separate. You're not coming from or through the ESF.

There's also hope to try to reduce the amount of footage that's necessary on the Calico Hills. The baselined configuration is about 31,000 feet and the enhanced configuration is about 32,000 feet. What I have laid out in the final analysis is, though it does not necessarily hit all the targets hit in the other two options, anyway, it's about 21,000 feet.

Just as a background to doing the study, I went back and reviewed the Calico Hills Risk Benefit Analysis, because I thought some of the things in there--this is what came out of the study that was detailed to the Calico Hills. That information then was fed to the ESF Alternatives Study.

They eliminated all options which did not connect with the ESF. So they took a different approach than what I'm taking. And they eliminated ramps, which, of course, is different.

For the benefit of those who have not been sitting at these tables as well as some of the rest of us have, this is sort of what's baselined as far as the ESF. There would be a North Ramp, the main access--and now this was the baselined case back in October, and I'll show you an enhanced version of this in just a moment--and it came out to the South Option. And what was also baselined was the drive down the North to the Calico Hills, across the block, and back up to the South Ramp in the Calico Hills.

Let me jump down here. This is what the enhanced version looks like. Now, the main Topopah Springs Drift parallels the Ghost Dance Fault. There still is a take-off to go down to the Calico Hills, across the block, and back up to the South extension.

Does that explain it, Russ?

(No audible response.)

MR. BULLOCK: And I'll get to what I'm proposing in just a moment. You know, that's the one you just showed me, the enhanced version.

The targets for the Calico Hills as defined by the Risk Benefits Study were the laterial facies changes in that area from the ziolite to the vitric, which occurs someplace towards the middle of the block. The Ghost Dance Fault is certainly a target. The Solitario Canyon Fault is one of the targets. Drill Hole Wash is identified, and the bounding structures on the east and southeast. This is part of the Imbricate Fault and the echelon faulting.

Their recommendation, just numbers, was 2 and 5, which I have an example. This was one of the Risk Benefit group's recommendations, was a shaft to be sunk here, drifted to Solitario Canyon, drift to Ghost Dance in two places, and hit the Imbricate and the Drill Hole Wash. The Option 5 was the same thing, except the shaft was up here.

That information was turned over to the Sandia, who were the sponsors and leaders of the ESFAS, Alternate Study. They, in turn, developed 17 options, at first, for characterizing the Topopah Springs. And when they accepted the recommendations of the Risk Benefit Analysis group, they doubled the options from 17 to 34, and the increase in development from 12,000 feet from the Risk Benefit Analysis up to 18,000 feet in the Alternative Study.

Option 30--well, there was a strong influence, if some of you were around and remember, for early testing in the Calico Hills at that time. And that was a very strong influence. Option 30 was selected because both of the isolated take-offs to the Calico Hills, and it also was the option that had the earliest testing in the Calico Hills. So those things must have been important at the time.

There was Option 30, and you can see the take-offs were quite a ways back up the ramp for Option 30 as it was pictured back in that time, even though it was an artist's conception, and that's what was given to the Management Committee to make the decision, and that's what they were looking at.

Why was a separate entry never considered before? Have gone along many years, and one has not been seriously proposed before. All the concepts to characterize Calico Hills have considered additional openings coming out of or through the potential repository level. The reason was they were trying to follow 10 CFR 16, which states: "The number of exploratory boreholes and shafts must be limited to the extent practical, consistent with obtaining the information needed for site characterization."

However, the way it's been applied really has nothing to do with the practicality of the system. A development system, which in no way is connected to the opening to the potential repository, might be much more

practical and acceptable than one which creates two man-made openings connecting to the repository and the Calico Hills.

Furthermore, you can't look at part (2) of that section of 10 CFR 60 without looking at part (1), which says: "Investigations to obtain the required information shall be conducted in a manner as to limit adverse effects on the long-term performance of the geologic repository."

Well, certainly, disconnecting the man-made opening between the repository and the Calico Hills in no way should have an adverse effect on performance assessment, and I think it probably should be even better.

So I was given the task to try to find a separate way to get to the Calico Hills. I apologize for the busyness of this view graph, but what it is, is several things superimposed. It started out with a Scott & Bonk fracture mapping. And I don't like to lay out underground openings unless I do it on something that's got faults and fractures mapped on it. Basically, you can see on your handout, or look up here, this is the main block of the ESF potential repository, and the smaller block, the downcast block right over here.

I decided to look at ways to get to the north end of it, to get to the west end of it, and west side, and to the south end of the potential repository block. I looked at three sites to the north, one in the west, going to this western edge of the block, and five sites to get to the south.

Now, you don't have the next two view graphs, I apologize. Just bear with me. This gives the distance of the ramps it would take to get between those points that I showed you, or you have on your map there, and to the points in the block. And the ramp grades that would be required with these distances to reach those elevations on the block. Also indicated are the number of major faults--not faults, but fractures, at least where there are map faults, I guess, that one would be crossing to get to those points.

So, you see, some of them have quite a few major faults, including those that come from the west, crossing the Solitario Canyon Fault zone. I'm not a geologist, but I consider looking at this canyon as being a fault zone, and I'm not sure exactly how wide it is or what one might get into.

Also, there were some very good areas down in the south, where it looks like very few faults will have to be crossed. And one in the south where I think one's going to encounter considerable echelon faulting.

In trying to make that one-man decision as to what probably would be the best place to come in, the three sites

in the north, you're coming from a geographically high area to the stratigraphic low end of the Calico Hills. That's why the ramps in that area were very long and very steep. They're not impossible to get to, but it's difficult, and it would be costly and cost time and money to get to the north end of the block from the surface.

The three areas that you could have gotten to the west point, west side, all of which cross the Solitario Canyon Fault area. And I believe this could be very costly to do. Not impossible, and maybe the tunnel-boring experts in the group might argue with me that there would be no problem, we could sail right through it.

Site 9, which has a very favorable grade and distance, is in the area of this, where it looks like echelon faulting, and I think it's a less than desirable place to locate a ramp.

Sites 7 and 8 have acceptable grades and distances, and a very minimum of faulting indicated. There's a good quarter that you can go down through and hit very little faulting. I picked Site 7 as being the optimal case in which--bear in mind, I was thinking of drilling and blasting the ramp using a roadheader for the Calico Hills excavation. And if one were looking at a tunnel-boring machine, you might be willing to go a little bit farther, get a lower grade, and Site No. 8 would be the ideal condition.

What the ramp would look like or, again, laid out on a--and bear in mind, these view graphs were made for a much smaller group than this. I looked at the topography, laid out a pad between the stream flows or the drainage flows on this side of the mountain located, came across two probably fairly minor faults, and then there's a quarter down through here, until you reach the block up here, where there are no faults indicated on the Scott & Bonk. Now, that doesn't mean that they're not there. There's just no surface indication of them being there.

DR. CORDING: How does that fit with that pork chop shape of the repository?

MR. BULLOCK: Let me go to the next slide and you'll--

DR. CORDING: Okay.

MR. BULLOCK: --see where this comes into the pork chop shape.

DR. CORDING: Oh, okay.

MR. BULLOCK: That just gets you down to the edge of the pork chop. I don't know whether you can see that, but this is ramp coming down this corridor, where there's very little faulting indicated, and here's the edge of the block, at the Calico Hills level. And then you would come across, drive to the Solitario Canyon, drive to the Ghost Dance and, if you

wanted, drive to the Ghost Dance here, so you can hit it in two places.

Now, what's in the cost estimate, that we'll get to in just a moment, is a short drive down the ramp. This is 7.6 percent, about 7,400 feet. And then drive across the block 4.4 percent. If you went down to the Ghost Dance at this point, that's about 3,000 feet, at a -11 percent. And go up to the Solitario Canyon at this point, that's 14 percent, and the Ghost Dance here would be a -10 percent, about.

Does that answer your question, Ed?

DR. CORDING: Yeah, thank you.

MR. BULLOCK: What about the question of single opening? Will a single opening be allowed? The project has always tried to pay attention to the MSHA requirements. The MSHA requirement says: "Every mine shall have two or more separate and properly maintained escapeways to the surface from the lowest level ... A method of refuge will be provided, while a second opening to the surface is being provided. A second escapeway is recommended, but not required, during the exploration or development of an ore body."

Well, this is not an ore body, and this isn't a mine, but one might say that the site characterization of the Calico Hills might very well be likened to the exploration of an ore body. And many times, many, many times, we've gone down an exploration shaft and driven it out to the ore body and put in dozens of diamond drills and drilled and drilled and drilled, and finally decided it wasn't economical to proceed and abandoned the whole project. And this has happened all over the country. This would be no different here. You go down, you drill it out, or do whatever you have to do, map it, run your tests, stay there as long as you have to, and then get out and abandon it.

What does California Administrative Code require? By their definition, this would be classified as a tunnel. And as a matter of fact, there's no mention of a second opening in the tunnel safety codes. And what you're really talking about when you're talking about a second opening is how to get people out of there in case there was an accident. That's the main thing.

By comparison to what was baselined last October, there was 24,600 feet before you would break out. Let me get that back up here. This isn't a very good diagram to show it, but if you started down here and came around, by the time you got here, you would have 24,600 feet before you got the person out. And the same is true of the enhanced version. If you were driving from the north end around and coming out

here, you'd have to get the person all the way back out to the surface. It's a long way.

And what I'm proposing, it's about half of this, 17,000 feet. It's still a long way from the very end, but it's a lot shorter than the other proposals to bring them from here out. And that's what you're really looking for, is the true safety of the thing.

The advantages to the recommended development. It allows the Calico Hills to be developed at any time. You're not waiting. As Jean pointed out earlier today, in the first place the decision hasn't been made whether or not to develop the Calico Hills, let alone how to do it. But that decision will be made after some logical reasons, say, the intersection of the Ghost Dance Fault, which may trigger it. But at any point, when a decision is made to develop it, it can be developed. There's no waiting for another tunnel-boring machine to go by any opening or anything.

There's no connection with the ESF, which has the potential for becoming a repository. The separate entry should compare better from a performance assessment point of view.

And should an accident or emergency occur, it would be a shorter distance to travel to get the people out of there.

And the cost and the amount of development is far less than the recommended separate cases that I've discussed which were baselined.

And speaking of the cost, this is what was in the baseline as of October. I do not know what's in there now. This is the footage which was in the baseline case. There was 30,992 feet that characterized the Calico Hills, or the ramps. It was going to cost $103, almost $104 million. That does include two 18-foot tunnel-boring machines with trailing gear, so I want to be sure and point that out, that that is in that number.

I did a cost estimate on what I had laid out earlier, and I didn't do the surface estimates. I had someone with more expertise at that, who normally does them, from Raytheon. And the cost of what I'm proposing, with a 42.62 percent contingency, was out $32 million. I presented this last October the first time. No one has come back and said, "You're way off," so I assume that someone's probably seconded it.

My recommendation was that Site 7 be used as the Portal Site. One point I forgot to mention, on the south end of the block, the beds tend to flatten out. The location of the portal, of Site 7, is that it's nearly the same level as the repository. With the beds flattening out, and you're

going beneath them, there's no way you could do anything to that ramp going down there that could ever effect the repository. No matter if you lost fluids, if you lost oil, whatever you lost in that ramp, it's not going to effect, in my opinion, the repository, because it's a good distance away. It is on the block, so from a performance assessment point of view, if it still has to be QA, it has to be QA.

I feel that it needs to be considered for classification as: not important to waste isolation, not important to safety, not important to test interference. It should at least be considered to see whether these things are true or not.

And I think one of the best things going for it is that the construction of the ramp could be completely separated from the activities. It could be done as a separate, even a hard money contract, to go over and do that. I see no reason why, over there, you're not on the test sites, you're on Bureau of Rec land, you have a separate entrance. You're not even coming in through the security gates. The facilities over there will be more temporary than they will for the ESF. I think the hard money contractor could furnish all the utilities you need over there. There is a water well over there that could furnish water if you put a pump and a generator on it.

So that's my presentation. If you have any questions, I'd be glad to try to answer them.

DR. CORDING: Thank you, Dick. I know, as you said, it's a preliminary estimate, but I think it's encouraging to see these sorts of numbers. Looking at this as an option seems to be one that certainly is worthwhile, and I appreciate you presenting it to us. We have time for questions and comments. Yes?

MR. NATARAJA: Mysore Nataraja from NRC. This is a comment related to the last statement you made about recommending this not to be considered as important to safety or isolation or test interference. Not important to safety, I can buy that. But not important to waste isolation, I'm not quite sure how you can consider it not important to waste isolation, number one. Number two, if it is a part of site characterization, it is going to be important. So, regardless of how you treat it, it is going to come under certain requirements of quality assurance.

MR. BULLOCK: Thank you. What I'm saying is, it should be considered, it should be looked at, it should go through the procedure, and let the performance people assess it. I'm not saying it shouldn't be assumed that it's always safe, but study it and look at it and see if it should be important to waste isolation, site characterization and test interference.

And I'm only talking about the ramp. I'm not talking about the level under the block, I'm talking about the ramp getting to the block. That portion should be considered for this. And I realize that's just my opinion, and I'm not a performance assessment person.

DR. CORDING: Other comments? I notice there have been people here from the construction group, with Kiewit, and you're presently looking at the possibility of doing it from within the facility. Do you have any comments on that? I'm not sure they're here

MR. BULLOCK: I think they all left.

DR. CORDING: They didn't want to hear it. Okay. I think one of the issues has been this number of accesses, and certainly, as I understand, OSHA, it doesn't refer to multiple access, and you're indicating some real savings because you're not having to come out with two ramps or two connections to the surface. And I'm also wondering to what extent that could apply to the entire exploratory ESF facility in the situation where one is trying to get information down at the repository level before the machine, for example, completes a loop. So there's an opportunity there also, I would think.

MR. BULLOCK: It certainly needs to be looked at again, reassessed.

DR. CORDING: Other comments? Russ McFarland?

MR. MCFARLAND: Dick, I'm trying to recall, from the last cost estimate, including all costs allocated to Calico Hills, it was about 130 million. You had 103 plus.

MR. BULLOCK: Yeah, this--

MR. MCFARLAND: And you would, by coming separate, come down to about 31 million, about $100 million difference.

MR. BULLOCK: Right. From the 103, you'd have to--to be honest and fair, I said in my report it's closer to 50 million, because there are two tunnel-boring machines and trailing gear--

MR. MCFARLAND: Um-hum.

MR. BULLOCK: --that really should not be in there. It's apples and oranges if it is. So you're bringing, say, 20 to 25 million out of there, and then subtract my figure from their figure. It's closer to 50 than it is 100.

MR. MCFARLAND: Thank you.

DR. CORDING: Can you tell, Dick, at present, is this study going to be looked at further in terms of an option, or do you know what the status would be?

MR. BULLOCK: I don't. Dan has been working on these things.

MR. MCKENZIE: There is going to be a system study. It's an early FY 95 start that's going to look at this. This

is one of the options, obviously, and the baselined Calico Hills layout will get another, and maybe some variation of the baselined Calico Hills would be another yet, and those three, at least those three, options would be looked at. Bill Simecka will touch on that tomorrow.

DR. CORDING: Good.

MR. MCKENZIE: Just like one chart that's just going to say that we're going to do that.

DR. CORDING: The other one might involve only a single access, or a single ramp down from the repository level?

MR. MCKENZIE: Right.

DR. CORDING: Would that be a possibility?

MR. MCKENZIE: Right, that would be one of the logical third evaluations.

DR. CORDING: Yeah. Okay, thank you very much, appreciate that.

Well, we've had our break, so we can't do that, but we are ready for a Round-table discussion of people within the audience as well as the Board and the presenters. And I'd just like to at this point open it up to comments and discussion on some of the things that we've been getting into today. I think the issues that we've been discussing today certainly have to do with how we tie together the Proposed Program Approach with the various requirements for testing and evaluation, the science that needs to go on to accomplish that. And that's one issue that Jean Younker was addressing.

The very interesting approaches that are being looked at now to try to cut costs on the project is another, and as to how the program can be organized to do that. That would be the second.

And then some of the other times here, again, going to the Calico Hills, I think that brings us in again to this issue of what are some more effective ways of carrying out the underground construction, and how can some of these high costs and long schedules and interferences that can take place with multiple operations, how can those be minimized?

So I think those are the items that we have, and I'd like to at this point open up to people on the floor, people in the audience, as well as people here at the table, and perhaps going to the first item, related to the testing that's being carried out and how it can be carried out within this Proposed Program Approach. Any comments from the Board on that issue?

(No response.)

DR. CORDING: I guess one of the items, I think, is, in looking in your own areas, does it look as if we have the possibility to obtain the information that's needed if, for example, there was access underground within the next two

years, that there are more borings going on? Are we going to be able to get, for example, the geochemical information that's required to understand the site? Is that something that seems to be feasible to fit into the program, or what are your concerns with respect to that? This is the kind of a question I'm throwing at Don Langmuir, at this point. I'm not asking for your conclusion as much as some thoughts you might have in that area.

DR. LANGMUIR: Langmuir, Board. I think the thermal loading issue is the big one, because geochemistry depends so much on what the decision is in terms of a choice of thermal loading. So there's the cart and a horse business here. And the thermal tests, if we could get the thermal tests going sooner rather than later, that's certainly a plus. And to the extent that construction could provide an earlier start of those tests, if there's any way to get them sooner, because that then impacts the fluid transport flow, condensation, perched water gains, the information needed for those models and for validating those models. The geochemistry doesn't go anywhere without water, without fluids, and so the thermal effects, which are so key to what's going to happen to those fluids have to be understood. So if you can get us underground sooner to do those heater tests by changes in the engineering, I think that's a real plus.

DR. CORDING: Bill Simecka, I was turning to you as you walked up, and I appreciate any comments you might have on this and on schedule.

MR. SIMECKA: Well, we've talked all over my presentation today.

DR. CORDING: And we apologize.

MR. SIMECKA: So I feel compelled to come up and finish it off. Don, we are going to show an approach where we can get the heater tests started earlier than we had talked. But you've got to remember that to follow your edict, or your desire, to complete the loop before you do anything else, that means that the heater tests are going to come after the loop. And I don't think that's the best way to go. I think you need to start the heater test before you complete the loop. And if we get adequate funds, we can do that. I'll show you a technique tomorrow that I think we can do it. So it's not an either or. You can have competing things, and it's usually competing on money.

DR. CORDING: You know, I think that comment on competing, it has to do with interferences. It makes the operation inefficient to the point that it's costing more than it should, and it's delaying the needed testing. And I think that the principle is more important than saying you

absolutely have to complete the loop. One has to look at this point now. There are some options that I think go beyond what we were even discussing last year, or a year and a half ago. For example, the opportunity to have two tracks operating in the facility. And if one is going in and saying, "We're going to be constructing alcoves and cutting off all communication through that area where the alcove is and not being able to advance the operation," then the more alcoves you put in, it just continues to delay a lot of progress.

MR. SIMECKA: I'll show you--

DR. CORDING: But there may be some other ways of handling this--

MR. SIMECKA: I'll show you that--

DR. CORDING: --with modern machines.

MR. SIMECKA: --it is significant. Although, if you're only going a short distance, it takes a lot of time to get a machine unless you can get one that is designed to come right off the centerline. We're looking at all of those.

We also are looking at drill and blast. But the drill and blast to get you off the centerline far enough to where you can resume operations is very critical. And there might be a way to do that in a very quick way so that over a weekend, possibly, you can get far enough away from the centerline with blast curtains and so forth to be able to continue in.

We're looking at all of those, because what you're trying to do is optimize in totality the progress. The one thing we want to do is get the Ghost Dance. Besides the heater test, we want to get the Ghost Dance as soon as possible, because that's a key decision point on whether to go to Calico or not. And if we find early that we have to go to Calico using Dick Bullock's approach, we can go on down there and it won't interfere with anything that's going on in the upper level. So these things are trade-offs as we go.

DR. CORDING: I would agree with those approaches, and I think that all the expertise in the organization that can be brought to bear on it is certainly going to be helpful to try to integrate that excavation process with the science.

MR. SIMECKA: Well, you see, we've got enough power for two headings without question. And we plan to buy an 18-footer, or a 16- to 18-footer, as soon as we get money for it in '95, so that when we get down and get the stub done with the big machine, right after that disappears around the corner, we can put the 18-footer up against the face and go on into the north extension. As soon as the north extension passes the area where we want to put in heater drifts--and by the way, we are thinking of moving MTL over to the north

extension and do those tests over there. Much simpler, much less cost. You don't have to dive down 150 feet, etc. So we're trying to get all of those things done. And the key items are not only finish the loop, but we've got to get the Ghost Dance, start the heater test, and decide to go to Calico.

DR. CORDING: Okay.

MR. MATYAS: Bill? Bob Matyas.

MR. SIMECKA: Yes, sir?

MR. MATYAS: Question. You said to buy an 18-foot machine. Why would you have to buy one?

MR. SIMECKA: No, we don't have to buy it. We have not limited the procurement people. They are to look at lease or buy, new or used.

MR. MATYAS: Get a contractor, and he'll bring his own machine.

MR. SIMECKA: Get a contractor in there; we could have Kiewit go get the machine. These are all options.

MR. MATYAS: Okay.

MR. SIMECKA: And as you said earlier, or somebody said, we want to move this thing as fast as possible. Not because we want to push the science out or anything, we want to give them adequate access, because that's the only reason we're doing it. But for every day we delay the project, there's more money. To save a few bucks on construction, and waste money because the project is extending for just another day or two days, is kind of foolish.

So I think Jack Lemley pointed that out. So it's a combination. If you look at this elephant one way, you see one thing. But we're trying to look at the whole thing and move the whole project as fast as we can within the funds we've got. So you'll find that our thinking is always considering how can we do that? And I think we've made a lot of progress. The Scenario A has driven us to look at this. So what I present tomorrow, I think, is a--I like it. You may not like it, but I like it, and I can only go with what I feel.

DR. CORDING: I'm interested in hearing it.

The other issue is just how much you have in the issue each year, your cash.

MR. SIMECKA: Absolutely.

DR. CORDING: It seems to me you have enough money, perhaps, to buy part of the system, but not to really fully operate it. I know that's a concurrent concern, and I think it's one of the issues that's extremely important here. That also is delaying things, but it's because of the cash that you have available.

MR. SIMECKA: Um-hum. Now, I should say, before I sit

down, that Dick Bullock's approach allows us to go hard money contract, I believe. That's a natural for doing hard money contract, because we can just go do it, and get down there, because we're going to be driving to the point right below the Ghost Dance where this fast path is, and I think that is an opportunity. So we are considering that very strongly.

DR. CORDING: And I think even with a hard money contract, it still doesn't mean that you--in other words, a positive way of saying it is that you still can have interfaces set up within the contract that allow you to do certain things that you might--

MR. SIMECKA: Of course.

DR. CORDING: --need to do in a testing.

MR. SIMECKA: Of course.

DR. CORDING: Say, "We're going to delay such and such, what's the delay time?"

MR. SIMECKA: That's right.

DR. CORDING: You know, "What's the delay cost?"

MR. SIMECKA: Yeah.

DR. CORDING: And put that in the contract, and you--

MR. SIMECKA: Sort of the unit price.

DR. CORDING: --can handle that, and you know what the value of it is at that point.

MR. SIMECKA: That's right, you can unit price some things. We can do that. And I think getting this thing started is the main thing. Once we get it started, we can start doing these variations. Because we'll have time to do that.

Anyway, after my presentation tomorrow, I hope you'll be even happier.

DR. CORDING: Thank you, Bill. Please.

MR. OLIVER: Ron Oliver with the ESF Test Coordination Office for the DOE. One thing I heard this morning--or this afternoon--from Jean, and to supplement what Bill just said, is that the ESF testing program also carries with it, as the TBM moves ahead, both geologic mapping and consolidated sampling.

Both of those programs, each foot of advance of the TBM, we gather the capability of collecting samples for thermomechanical tests, hydrochemistry tests, all of those types of tests that we plan to do in the ESF. That geologic mapping data will help us sight the particular alcove locations. So our testing program is working very much as construction proceeds, it's carrying down in the ESF whether we continue the loop around or we go over to the North Ramp extension to explore a thermomechanical area. We'll be gathering a basis to make those decisions based on our discoveries and observations as we excavate the facility.

Thank you.

DR. CORDING: Are you looking also at ways you can--for example, you encounter a fault, and you say, "Now, we want to go to that fault with a separate tunnel or drillholes," and how are you going to test across those features? Just how are you looking at that, or are you involved in that part of it?

MR. OLIVER: Absolutely. The characterization of major faults is another test that we're carrying around, and some of the alcoves that we're building that Jean mentioned are in direct support of that. So that portion of the program, when we see a fault, and it's determined that it's a fault, because we're against criteria that the USGS will basically bring to the table, and then there will be a test put in. But it will be based on discovery.

I heard some discussion about, I think, the Sundance Fault this afternoon, and that, again, until we can get to the underground and see it, see how it crosses the ESF, and physically get some properties of it from the exposure, I think that's how we'll determine actually how to put those programs in. But they're absolutely planned, and those are some of the alcoves that--

DR. CORDING: Now, for example, you've got four alcoves. Would that be where you would be sighting some of those alcoves, and do they need to be done before the tunnel-boring machine is finished? What is the sequencing of that? Do you have to get in and do it right away?

MR. OLIVER: It's a mixture--

DR. CORDING: For example, for drilling.

MR. OLIVER: Okay, it's a mixture. We're working with the design team, the reality of procurements, and the DOE to put those alcoves in as soon as possible. With the trailing gear and some of the stuff that Bill will probably talk about with various scenarios, I think that's best discussed tomorrow. But we're very much working on that. Drilling can be done, the TBM design is facilitated drilling off the mapping gantry. We have equipment that if we find anomalies, we can certainly test them. And I think that is in the program right now.

DR. CORDING: One of the items is the drilling, and the progress in drilling is perhaps on the same order as the progress and advance of the tunnel-boring machine. It seems to me, one of the things we were discussing with the 25-foot tunnel was the ability to use some sort of a gantry that you could continue to operate the tunnel-boring machine, but have it set up for the drills. And I think possibly even the double track gives you that option, at least at some point behind the trailing gear, to be able to do drilling

separately and continue operating the machine. So those are some of the interfaces, I would think, that maybe would keep one from having to stop the entire operation to complete drilling. And I guess I'm not fully clear as to when you have to do the drilling, at one point one has to do that, and how much of that is going to stop the progress and how much of it can be done concurrently or later.

That was kind of a long comment and question. I don't know whether you have any response.

MR. OLIVER: I think to do something--because it's invaluable to the testing community each foot of advance that we make. We're trying to understand Yucca Mountain. And actually, to stop the advance for any long period of time without actually getting to see the geological conditions in the underground, we're not advocating that as we work with the design team. We certainly have the capability, design, and the equipment so we can do that, but there's a cost. And those trade-offs will be made once we are underground and can assess with the researchers, because they're the ones that are doing that assessment on the importance. We take that to the DOE's table, and decisions will be made.

DR. CORDING: Okay. Tony Ivan Smith?

MR. IVAN SMITH: A quick question for Ron. Do you expect any delay? Is your testing able to keep up with the normal performance of the tunnel machine?

MR. OLIVER: We don't expect any delay with the testing that we have planned. Consolidated sampling and geologic mapping will both be conducted on a gantry that is part of the tunnel-boring machine equipment. So there should be no delay.

MR. IVAN SMITH: So if the tunnel machine went to a normal 24-hour day or extended six-day week, the testing program would be able to keep up with it?

MR. OLIVER: We believe there's not a problem there. We work very closely with the design team to assure that that's the case.

MR. IVAN SMITH: Thank you.

DR. CORDING: Leon Reiter?

DR. REITER: I have a question for Jean. Jean, I want to apologize. I usually try to warn you about some of these questions beforehand. You mentioned that one of the whole purposes of the PPA, one of the big things, is concentration on site suitability, and I think Dan Dreyfus talked about the idea of focusing in on important studies. Not everything in the SCP is important.

Certainly, in suitability, one of the things that we hope will be important, that if we had to walk away from the site, we want to walk away as soon as possible. And you

said you met with a group of people talking about these things. Could you, perhaps, enlighten us on what kind of things you would find that would raise a severe question in your mind as challenging the site? And within that, do you view any of the thermal characteristics of the site that could render the site unsuitable?

DR. BARNARD: I think she needed a warning, Leon.

UNIDENTIFIED SPEAKER: Did you warn her?

DR. REITER: No, I didn't. I apologize for not warning you.

DR. YOUNKER: Yeah. Let me make it clear, I had no warning that was coming this time from Leon.

Let me see. The first part of it was, what kinds of things would we look for? You know, what kinds of things would give us the biggest concern from a suitability perspective. And, you know, bear in mind that as I tried to make clear when I was saying look at my list of things that matter to us from a suitability perspective, we're talking about a regulatory definition of suitability per 960. So that list that I had on my slide was--that was the list that shows where the major uncertainties were as we tried to do the evaluation of compliance with 960 the last time we did it, which was at the Environmental Assessment, and then again in the contractor generated document, the Early Site Suitability Evaluation.

So, if you ask me where are the major uncertainties and what would I look for to tell me if I had a problem, I'd go back down that list with you--and I could pull it back up. But if I have a high confidence finding that I have a very rapid flow path along the Ghost Dance Fault, and if I also found it was continuous, and if I thought I really had a mechanism in place that could cause a large volume of water to pass through the repository, down that fault, and out, I mean, I think I would then have to look at it from a total system performance perspective and say, "How much transport could I allow and still say I had a suitable site?" You know, what kind of fast flow path? What percentage of my flow path could be along that pathway?

Let me see if I can be clear on this. From a ground water travel time perspective, and on Part 960, that issue is really pretty clear. It's going to be a probabilistic approach to defining what percentage of your flow path really could be less than 1,000 years if you look at 960. And you then broaden it and look at it from a total system perspective, then you get more out of what I was talking about before in that you'd have to look at it from what's the total release and how much of it could go along that short path.

In terms of--something related to thermal. The second question Leon had was something related to thermal.

DR. REITER: Right. The question is, are the thermal properties, the thermal hydrological behavior, in your mind, or minds of other people, is that a suitability issue?

DR. YOUNKER: Well, from the standpoint--as I think Don Langmuir said earlier, that if the flux through the repository is really the natural infiltration plus whatever gets redistributed according to the thermal perturbation, which we have to believe that it is, assuming any kind of areal power density that causes that kind of massive redistribution of flux, then obviously, in order to even bound the case in '98, I'm going to have to have some kind of an estimate that's credible for what my flux at the repository level is under those perturbed conditions.

So, I guess from that standpoint, Leon, I would say it certainly is a suitability issue and that I've got to have a credible at least bounding calculation for '98, and again for 2001.

DR. CORDING: Even if one thought perhaps it isn't going to be a show stopper in any way? It seems that there needs to be good understanding and ability to describe what the mechanism is and what really does happen under various thermal scenarios.

DR. YOUNKER: Yeah, I think that's what I was getting at, was if I don't have some handle on the process, then how will I convince people that my bounding scenario is a good one?

DR. CORDING: Yeah.

DR. YOUNKER: Leon, did that answer your question?

DR. REITER: Partially.

DR. CORDING: Jean, do you see in months ahead this--it just seems to me that there is going to be a lot of work involved in fitting the physical exploration to the proposed plan and the test objectives and things that relate to the suitability issues. I mean, that really needs to continue to be brought together. And can you describe a little bit as to how you see that process working?

DR. YOUNKER: I'm not sure I'm the right person to talk about this aspect of it. I think from the side of the house that I work on, you know, we did the best we could to kind of take the objectives of the new approach and kind of compare it to what the site characterization plan had laid out, to see what aspects of it we would emphasize under this approach, and get kind of the best definition we could, I guess, of the basis for it. The strategies, if you will.

But I think from the standpoint of implementing it, then, and putting it into the actual practical program, it's

other people who are taking that and moving forward with it.

Dennis Williams from DOE, who is a manager in the Scientific Programs area, is here now, and he wasn't when I was talking, when I tried to toss him the ball a couple of times. But Dennis is really involved in that next step of taking it and trying to get the site program, testing program, laid out. So maybe Dennis could comment on the process you have in mind.

MR. WILLIAMS: Dennis Williams, DOE. Part of the reason why I wasn't supporting my Jean Younker team here a little earlier is we're really engaged in that process right now. What we've tried to do is take the information for the--I'll use Scenario A for lack of the preferred plan approach or--these titles change a little bit and confuse me. But anyway, taking the information that she has given us with regard to the major elements that we need for site suitability--and, of course, they've done lot of work on trying to determine where we stand on those programs, where we need to be with regard to the bounded situation, or the substantially complete situation.

But we take that information and then we turn it over to our managers in the scientific program. And then we actually try to flush out a program that will achieve the goals to get where we need to be in '98 for Technical Site Suitability. And they basically go through all the elements of the SCP, all the elements of the program that we've had in place since basically the beginning of time, and then develop those in concert with the participants and roll it up into a '95, '96 and '97 program. Not only a field exploration program, but a great deal of emphasis on the synthesis and modeling that we need to do in order to make this information meaningful. So, we anticipate that we'll have a major effort in '95 in the field, but also a very major effort in the laboratory with regard to the geochemistry program and a large synthesis and modeling effort.

As far as the specific details and what element has how many dollars, I don't have all that information for us here today. But that's what I've got about 24 people back over there in the parking garage working on right now as we speak.

DR. CORDING: How does that tie into the people that are--with the constructor side of it, for example? How do you interface with them on just getting this planned out at the site in terms of schedule? How does that tie to their schedule for excavating a facility, for example?

MR. WILLIAMS: Well, one of the things that we do, we're trying to take a little bit of the product-oriented approach here. Like with the suitability folks, we actually sat down

and said, "Okay, we need to deliver a product to you. Define what you feel to be the specifications for that product, and we'll get an understanding of what we need, and not only from a matter of content, but also a matter of schedule." And then that's what we put in our--basically a criteria statement that we deliver to them at the appropriate time.

With regard to design, of course, we have a couple of interfaces, or a different area of interfaces dealing with those folks. We have to provide them design data for the design of tunnels, that type of thing. In addition, we also have to describe for them what openings we will need, say, at the Ghost Dance Fault or at the heater test areas, whatever, so that they can provide the openings at the appropriate time that we need to feed that into a schedule so we can do our testing so we can build our report to hand off to suitability.

So it's really quite an intricate process of interfaces dealing with design, dealing with the suitability folks, dealing with PA. And one of the things that we like to do is build a little--I'm a maniac for wiring diagrams, block diagrams and wiring connections of all the interfaces that we need to make sure that we keep track of it so we have the information flow coming in to us on what the needs are, and then the information going back out to our customer.

DR. CORDING: Thank you.

MR. BROCOUM: I'd just like to--

DR. CORDING: Steve Brocoum?

MR. BROCOUM: He touched on it, and the reason I got up is I want to say we have a suitability team. The team leader is Jane Summerson. She has a bunch of people that are matrix to her that include people from Science, people from PA, people from Regulatory and Licensing, and that team is helping to define what Dennis called the specifications that we want in each of the key areas. And that team has been meeting over the last several weeks so that we can then say, "These are the kinds of pieces of information we need in Science. You guys go out and get those pieces of information, using what exists and what we think will be in the future." Dennis touched on it. I just want to say there is a formal mechanism for doing that through this Site Suitability Team. Okay, I just wanted to make that point.

DR. CORDING: Okay, thank you. Yes, Garry Brewer.

DR. BREWER: Brewer, on the Board. We have an impressive collection of consultants here in terms of experience, and I think it was Tony Ivan Smith at some point made the comment that this is a mature industry or business. One or all of you, how would you characterize standard practice in a mature industry to what you see here?

MR. IVAN SMITH: It conflicts severely.
DR. BREWER: I'm sorry?
MR. IVAN SMITH: It conflicts severely to commercial practice.
DR. BREWER: I'm not a tunneling expert. I'd like to know what that means. Can you give me some for instances where the conflicts are?
MR. IVAN SMITH: Let Jack answer while I think.
MR. LEMLEY: Jack Lemley. I think that, at least from my perspective, from just the little bit that I've witnessed here today, it would suggest that we have almost a national research program here involving most of the interested universities and various engineering companies in the country feeding at the trough, if I can express it that way. I think there could be a significant amount of clean-up in terms of the administration of the program, where you had very specific responsibilities assigned to the progress of the various elements, that I don't detect now. I detect management by a very large group of committees, not one committee in particular.

I think one of the cleanest presentations I heard today was by Mr. Bullock, recommending a completely independent access into the site. To me, that has an enormous amount of appeal if I were responsible for the program, because it would start to add flexibility. It would start to give you real comparisons in terms of cost and progress and some of the other things that have to go into this program.

In my mind, I don't think this falls in the area of commercial normal operations in any respect. I think it's completely outside of that and is almost a total research program on the face of it to drive several miles of tunnel, which, to me, is, as my colleague indicated earlier, it's a very mature process.

Bob Matyas described in a very articulate way the experience at the SSC where the civil works and the underground work really was not a major issue in terms of cost or progress. It was how the scientific aspect was tied into it. And I would suggest that that's going to be the problem here, how that interface is really developed, because you've got a whole litany of issues that are confusing the construction part of it. That's probably the most simple element of it all.

DR. BREWER: Thank you. Mr. Smith, did you have--
MR. IVAN SMITH: Just to amplify my point is what is happening right now. I don't know the intrinsic details, but typically in this industry, a tunnel machine is delivered to the site, and within three, four or five weeks, the machine

is operational. There is a shakedown period, and work continues. And for reasons of edict or for a new type of learning curve, there is a great delay.

It was about a year and a half ago. I think it was November the 21st, here, I questioned Mr. Gertz on the fact that at that point in time they did not show in their schedule the purchase of the backup equipment. And I commented to him, typically, in a project of this size, the backup could cost more than a typically priced new machine.

Well, right now, it's my understanding the conveying system, which is a fundamental part of the tunnel-boring machine, has not yet been purchased. So there is a potential delay of six months to a year. So this is where I'm saying the project is quite different from a normal commercial practice, but if one followed normal commercial practice, then the project would be much better.

DR. BREWER: Thank you. In your views, do you think that the management problems that you are suggesting would have any impact or implication on the kind of science that could be done here?

MR. IVAN SMITH: I don't think so. I've been associated with the problem. People such as Mr. Bullock have done an extremely dignified and excellent job in terms of estimating. I mean, to actually present 30 different scenarios for tunneling, when typically one would suffice, does not change the quality of the work. I feel that the people that have been involved in this project, from my viewpoint, are absolutely the top you could find. But they've been overburdened in the size of their task.

DR. BREWER: Thank you.

MR. LEMLEY: Just as an observation, and I do know several of the people involved with the program, you've got the best in the industry working in it. It's really a matter of organization. And it would be my conclusion that if the organization was very effective, the science would be better.

DR. BREWER: Thank you very much.

DR. CORDING: Thank you, Garry. Bob Matyas, did you have some comments in this regard also?

MR. MATYAS: I said earlier that the supercollider as a comparative project suffered from mixing a scientific project with a construction project. Back in the beginning, when this project started in 1984, we started at Lawrence Berkeley. Seven of us tried to address how we were going to do it. And we broke up into groups. One person said, "I'll lead the cryogenics." Another said, "I'll lead the superconducting magnets." And we got some money to pursue these activities to come up with what was called a conceptual design to take to the Department of Energy.

After we sorted it all out, it occurred to us that one of the items that was a billion-dollar item was the construction, and nobody was addressing R&D on construction. They took it for granted.

So it fell to me to examine that, and I went to the National Research Council, and I said, "Look, we're going to do at least a billion dollars worth of construction. How can we contribute to the general knowledge?" And I must confess, at that point, I was sufficiently naive as to think that we ought to be worried about advanced rates and grip of tunnel-boring machines and muck removal. The answer was, "Not at all." As Tony said, it's a very sophisticated business. And today, it's even more sophisticated. The answer was, management is where you need to spend R&D dollars, to manage a large construction project.

And it took a while, but I managed to get $130,000 given to the USNCTTT, and they produced a study, which was followed very carefully. Not completely, unfortunately. But I think it was that kind of direction that allowed us to keep separate the construction of a major project versus a major scientific endeavor.

One of the things that I'd like to ask somebody--it's probably not in the context of this panel--but does somebody really have their arms around the science that one wants to do? Or is it just an open situation? Anybody that knocks, can they come in and do this? Is there a Chief Scientist?

MR. WILLIAMS: I didn't stand up because I consider myself to be the Chief Scientist. However, as to who has their arms around the science on this program, it is my boss. Her name is Susan Jones. She is Assistant Manager for Scientific Programs. She is the one that basically makes the decisions on the science here. I am her deputy. We basically--for lack of a better term, we basically are attempting to get our hands around the scientific program.

I guess while I'm up here, one other thing, I take a little bit of an offense at the terminology of "feeding at the trough," because I think that the people that you have here are basically trying to carry out the rules that were developed by others. They did not develop the rules. They're just trying to do this scientific effort to the best of their abilities. It's not a construction job, it is a science job. And again, that's my opinion, and I think the DOE management would probably concur with that opinion.

DR. CORDING: Thank you.

MR. LEMLEY: That doesn't surprise me at all, and I certainly didn't mean to cast dispersions on the individuals involved. As I said, I think you have a group of some of the

most talented people in the world working on this

I drew the conclusion, however, from the very wide attendance that attended the conference here in Las Vegas about two weeks ago on this program. It's a fairly narrowly focused program in terms of the science and in terms of what has to be done in this program. It's sophisticated, it's involved, but it's fairly narrow. But you had something in the neighborhood of 1,000 people attending quite a narrowly focused program, and most of them, in some way or another, were involved with the program. And from my observation, most of the papers were coauthored by DOE people. And it seems to me that this program has taken on a life of itself with no program, no schedule attached to it. That's the part that is distressing to me.

I left Morrison-Knudsen in 1987. I was involved in the BWIPP project. I did have a fair amount of input into their activities in this regard, and it seems to me I've heard all of this in the early '80's talked about with the same degree of fervor as we're hearing it now. And I don't understand what happened to the last ten years.

DR. CORDING: Dennis?

MR. WILLIAMS: Dennis Williams here again. We probably have a lot of things that you and I could discuss outside this forum, but I would like to explain to you sometime my perspective on the High-Level Waste Conference here a couple weeks ago.

A lot of the scientists that work on this project, that's a forum for them to present some of their work. And I would like to emphasize that that is some of their work. I mean, they might have a few weeks of very limited activity that they can roll up into a scientific paper that they can present, but that does not represent all the products that are going into the DOE to satisfy some of the more mundane things of science, of design and, if you will, construction of the facility.

So, I think we could probably have an enjoyable discussion sometime later about this.

MR. LEMLEY: Indeed.

DR. CORDING: Yes, Tony?

MR. IVAN SMITH: Mr. Williams, you made a comment about this is a scientific project, not a construction project, when the major element at this time is the construction project. Could you qualify your remark?

MR. WILLIAMS: I realize that it takes construction in order to capture the science. I'm not new to that kind of a process. I'm quite new to DOE. I come from the Bureau of Reclamation, one of the projects that you cite, the Central Utah Project. We had a lot of construction there, we

collected a lot of science. In that capacity, I was somewhat their Chief Scientist for the Central Utah Project. So I think I have some understanding of how to capture the science at the same time that we have construction. And that's what we're trying to incorporate into our program here.

MR. IVAN SMITH: Well, hopefully, knowing your experience there, that the same efforts can be made here, because they were diligent, and it's an operating system that is--we're very proud to have the Central Utah Project there in Utah.

MR. WILLIAMS: Okay, well, I think that we can do that.

DR. CORDING: Bill Simecka?

MR. SIMECKA: Yes, I'd like to make a couple points. First of all, from my perspective--I'm in charge of engineering and construction--and I know firsthand that from my perspective it is a science program. And I accept that. I don't see any reason why it shouldn't be, because we are trying to determine site suitability, and it takes scientific material, data, etc., to make that decision. So I think you can't do things the way you could, maybe, in supercollider. Even though it's a scientific program, the construction didn't have anything to do with the science.

Secondly, we don't do things very efficiently, and you have detected that--in the construction area, because we don't have adequate funds to buy the stuff that we need when we want it. Now, from a management standpoint, I guess you can say that's a failing that we haven't allocated our funds appropriately to go buy the construction stuff efficiently, but we're trying to balance this scientific program. We've got the scientists working, and you can't just lay them off for a couple years while you buy a conveyor. So if we had adequate funds--and of course that's a universal solution to everything--we could accomplish some of the things that you detect as deficiencies.

So I think that the project--and here I guess I'm on my soapbox, but--we don't tell you the progress we've made. There's a lot of progress that Dennis just mentioned that's in the minds of the scientists, that are in the papers that haven't been published yet, and so forth. We don't tell you about those things. And we're amassing that. All you see is the holes in the ground, the number of boreholes, and things like this. And we've been damnably slow in getting those holes. Obviously we want to get those holes as fast as possible to get underground and see what's there.

So, I think that you're underrating us from progress standpoint if the High-Level Waste Conference and these meetings are all you believe is the progress. Maybe we need to work on how to market what we do a little better.

DR. CORDING: Okay, thank you, Bill. Any comments?

MR. MATYAS: Let me make another comment. I think Bill is right that the difference between the supercollider and this is that you want to collect data on the material you're excavating, and I buy that. But I guess what I'd like to say to you is, the quicker you get in, the more you're going to learn about what you want to do, and it's going to change. And you someday have to bite that bullet and get in there using industrial tunneling techniques, and you'll be constantly reassessing and reevaluating your scientific program.

The tunneling community can work with you. It's a very efficient group of people. They're very sophisticated techniques. I just came from the North American Tunneling Conference in Denver last week, and the work that's been done on micro tunneling is very exciting. I think you might want to harness some of that technology as well.

But you've got to start learning how to react to the mining into the mountain.

DR. CORDING: I think that to me it obviously goes both ways, and the science side has to explain to the construction, "This is what we need." And then I see a lot of the situation with the construction is saying, "These are some opportunities that we might be able to provide." There are certain things that could be done that will enhance the ability to get the science. And I think, for example, of using a tunnel-boring machine, a small diameter tunnel-boring machine, perhaps very small even, to do drifting for the thermal tests. And the resulting surfaces that will be provided will be much more like those that might be actually used in the drift-in-place facility. And by optimizing that, you get better science, I think, out of it if you tie the construction together with the science and keep working back and forth on that interface, which I think is one of the toughest ones, at least in my experience with projects. That's obviously one of the toughest ones to deal with. And it's going to be a constant tension, but I think there are contributions that can be made on each side.

I'm encouraged to see some of the things that are going on in rethinking some of these things and coming up with a better approach, for example, for the core test area--what used to be described as a core test area. And so I think there's a lot here. And even within the last year, Bill was saying, well, you have to get through the repository before you do these other things. But there are some possibilities here that are being described where there can be some other--with some of the more recent developments--some operations that could go on without causing some of the

interferences that we anticipated a year and a half ago.

So I think this is going to be an area or constant tension, but one in which there's a lot to be gained from efficient construction that takes care of the science needs and meets the science needs.

Yes, Clarence Allen?

DR. ALLEN: Clarence Allen. I'm a scientist through and through, but I'm sort of astounded to hear people saying this is a scientific project. To me, this is ultimately an engineering project. Namely, how to get nuclear waste underground.

Now, it's a first-of-a-kind project. There are many unanswered questions, particularly with regard to the length of time we have to worry about for safety. And so an awful lot of science has to be done before we convince ourselves and our regulators that indeed it's safe, if indeed it will be. But nevertheless, ultimately it's an engineering project.

And I share with you some of the concerns in the project. The question hasn't always been asked in doing the science of how that particular project is going to effect site suitability. I think there's some very good science being done. I wish more often the question were asked, how will this particular project possibly effect suitability or eventual licensing?

Having said that, though, I--this is very different from many projects in that we must satisfy the people of the country, we must satisfy our regulators, the EPA and the Nuclear Regulatory Commission. To some degree, they are asked for things that we may not completely agree with and we may think are illogical. Nevertheless, ultimately, if the project's going to be successful, we have to satisfy the regulators, and that's the way the system works. But it's not as though the DOE can make up its own mind completely as to exactly what's the most relevant and what isn't, because the regulators have to be satisfied, and that's the way the system works.

DR. CORDING: Okay. I think we're a bit ahead of schedule, and I would suggest that we end our session today and start tomorrow morning at 8 a.m. Bob Nelson, who's in charge of the Yucca Mountain Site Characterization Office, will be making his presentation. We're going to have time for more discussion, more round-table discussion. I'd like to have that after we've had a chance to hear some more of these things. And Bill Simecka's already described some of the things he's going to say, but we'll hear that tomorrow morning as well as Dean Stucker is going to be describing some of the advanced design for the repository itself. So,

we'll do that tomorrow morning at 8:00.

Thank you very much. Appreciate your participation, consultants, DOE participants and audience.

(Whereupon, the meeting was adjourned, to reconvene Tuesday, June 14, 1994, at 8:00 a.m.)