UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD

FULL BOARD MEETING

July 7, 1992

Stouffer Concourse Hotel
3801 Quebec Street
Denver, Colorado

BOARD MEMBERS PRESENT

Dr. John E. Cantlon, Chairman

Dr. Clarence R. Allen

Dr. Garry D. Brewer

Dr. Edward J. Cording

Dr. Patrick A Domenico

Dr. Donald Langmuir

Dr. John J. McKetta

Dr. D. Warner North

Dr. Dennis L. Price

Dr. Ellis D. Verink

ALSO PRESENT

Dr. William D. Barnard, Executive Director
Nuclear Waste Technical Review Board

Mr. Dennis G. Condie, Deputy Executive Director

Mr. Russell McFarland, Senior Professional Staff

Dr. Sidney J.S. Parry, Senior Professional Staff

Dr. Sherwood C. Chu, Senior Professional Staff

Ms. Karyn D. Severson, Congressional Liaison

Dr. Leon Reiter, Senior Professional Staff

Dr. Carl Di Bella, Senior Professional Staff

Dr. Bob Luce, Senior Professional Staff

I N D E X

P R O C E E D I N G S

8:30 a.m.

DR. CANTLON: Good morning to each of you. This is the Board's summer meeting. My name is John Cantlon and I'm here as the new chairman of the Board, having replaced Don Deere who declined reappointment when his term expired in late April. For those of you who may not know me from my first four year term on the Board, I'm Vice-President Emeritus of Research and Graduate Studies at Michigan State University and my field is environmental biology.

It's also my pleasure to introduce to you our three new Board members. I see we don't have all of them here yet. Dr. John J. McKetta, sitting over here, and Dr. Brewer, I guess hasn't arrived yet. Dr. Edward Cording is here.

Dr. McKetta is the Joe C. Walters Professor of Chemical Engineering at the University of Texas-Austin and brings to the Board some 55 years of experience in practicing and teaching chemical engineering. I know that Dr. McKetta's wealth of experience and expertise will be valuable to the Board in its review of this program.

Our newest member, Dr. Ed Cording, who many of you have met before since he served as a consultant to the Board is a Professor of Civil Engineering at the University of Illinois. Dr. Cording's degrees are in geology and civil engineering. He brings to the Board crucial expertise and

broad experience in civil and geotechnical engineering.

I don't see Dr. Brewer yet. Let me just say that Dr. Brewer--oh, good morning, Garry. Dr. Brewer is a Professor of Resource, Policy, and Management and Dean of the School of Natural Resources at the University of Michigan and holds degrees in mathematical economics, public administration, and in political science. He will provide critical insights on the public policy aspects of DOE's technical and scientific program.

Let me also briefly introduce the other Board members who are here today. Dr. Clarence Allen, a Professor Emeritus of Geology and Geophysics at the California Institute of Technology; Patrick Domenico who is the David B. Harris Professor of Geology at Texas A&M; Donald Langmuir, Professor of Geochemistry, Colorado School of Mines; Warner North, Consulting Professor in Engineering & Economic Systems, Stanford University, and a principle in Decision Focus, a consulting firm; Dennis Price, Professor of Industrial & Systems Engineering and Director of the Safety Projects Office at Virginia Polytechnic Institute and State University; and Dr. Ellis Verink who is Distinguished Service Professor of Metallurgical Engineering at the University of Florida.

Also in attendance is Bill Barnard who is our Executive Director, Bill over on the far corner; Russ McFar-

land, Leon Reiter, Jack Parry, Sherwood Chu, Bob Luce, and Carl Di Bella, all of our technical staff.

As most of you know, the Nuclear Waste Technical Review Board was created by Congress in the 1987 amendment of the Nuclear Waste Policy Act of 1982. In that same legislation, Congress directed the Department of Energy to characterize the site at Yucca Mountain, Nevada for the potential development of a repository for the disposal of spent fuel from civilian nuclear power plants and some defense high-level waste from reprocessing.

The Board is charged with providing an unbiased source of expert advice on technical and scientific validity of the DOE's work in this area. An important part of the Board's review involves hearing from individuals directly involved in this important national challenge. Today's meeting will provide us with valuable information regarding the status of various elements of this program.

Following my remarks, we will be briefed by Dr. John W. Bartlett, Director of the Office of Civilian Radioactive Waste Management, after which we will hear a presentation by Carl Gertz, OCRWM Associate Director for Geologic Disposal, on the progress being made in the surface-based testing program at Yucca Mountain. Following this, Steve Brocoum will discuss the repository site characterization/ program convergence and we're very interested in that dimen-

sion of the work going on there.

I'm sure you all know that last Monday a magnitude 5.6 earthquake occurred near the proposed Yucca Mountain repository site and we're, of course, interested in this event and any insight that it might provide on the local tectonics and seismic risk in the area. Apparently, this is the largest historically recorded earthquake to occur within 100 miles of the Yucca Mountain site. We've asked the DOE to provide us with an update this morning on the earthquake and the subsequent investigations and Carl Gertz has agreed to add this to his update. So, if you'll put a little amendment there, we'll have an extra 15 minutes in the program schedule at that point. We look forward to both his update and the initial assessment of the seismic event.

The program for this afternoon and tomorrow morning will be dedicated to briefings by representatives of the management and operations contractor. This will be the Board's first opportunity to review system-wide studies and other work being conducted by the M&O in it's role as systems manager. We will meet the senior managers and hear an over-view of their activities both in Washington and the Nevada site. I'm especially pleased that we will be reviewing pro-gress made on the study of a systems implication of thermal loading which a major portion of the Board's fifth report covered.

During the presentations, questions of the speakers will be confined to the Board members and staff. However, at the end of the briefings, we will accept questions and comments from the audience. We ask that questioners identify themselves at a microphone so that the formal transcript which we make of our meetings will be accurate. It will expedite progress if the questions are directed to a specific-named individual.

We have a very full agenda. So, without further delay, I'll introduce Dr. John Bartlett who will make some introductory remarks and provide us a status report for the program. Dr. Bartlett, on behalf of the Board, I'd like to thank you for taking time of what must be a very hectic time at this particular juncture to be with us today. Thank you.

DR. BARTLETT: Thank you, Mr. Chairman, and members of he Board. It's very good to have an opportunity to be with you again.

I would like to take this opportunity to briefly update you on recent activities within the program, some of the highlights, one of which, of course, is as Dr. Cantlon mentioned the recent earthquake. You're hear more about that in a technical sense from Carl in a few minutes. What I did want to tell you is that although the occurrence of that earthquake in terms of the location and magnitude was well within the range of expected conditions for the site, it, of

course, aroused significant public concern and seismic hazards are, of course, one of the major issues with regard to site evaluation at Yucca Mountain. As a result of that, I have asked Carl to prepare for the program an integrated, focused, and accelerated plan of action for evaluation of seismic hazards at Yucca Mountain. So that we will address this specific issue just as rapidly and as effectively as we can in order to resolve the questions concerning the potential for seismic hazards and their effect on whether or not the Yucca Mountain site is a suitable location for a repository. So, you will be seeing in the not too distant future, a plan specifically directed at that aspect of site characterization.

The second item I'd like to just mention briefly, pending legislation. The Congress has still before it legislation in terms of the energy bill and appropriation bills, both of which can have significant effect on the program. All I can say at this point is that they are, in fact, both pending. It is very unwise to make any prognostications about what Congress will do and so I won't. We'll simply have to see what happens in terms of any action that Congress might choose to take or what actions they do choose to take.

With regard to the monitored retrievable storage facility siting, I think you're probably all aware of the fact that we received through the efforts of the nuclear

waste negotiator who has the lead responsibility in terms of identifying a potential host for an MRS facility, we received as a result of his efforts, a total of 21 applications for feasibility evaluation studies from potentially interested tribes and counties around the nation. Activities with regard to those 21 are still underway. Most recently, there has been activity very strongly in Fremont County in Wyoming and just recently a citizens' advisory board in Fremont County recommended to the County Commissioners that they proceed with an application for what we call a Phase II grant which would then move them into the second and more intense phase of evaluation of the possibility of Fremont County becoming the location of an MRS and potentially then having them move toward a negotiated agreement with the Department or with the Federal Government. So, that's very promising.

As part of the efforts out there, we did send an actual transport cask out so that the people could see what a cask really is and we've been trundling it around Wyoming so that the folks could see it and I think that was very helpful as an effort available. In addition, if Fremont County does apply for a Phase II grant application, they will become the second party in that phase of activity. The Mescalaro Apache Indians in New Mexico are already working on a Phase II grant and the window of opportunity for application for such grants is open until September 30. There are activities and other

interested parties. We'll just have to see which choose to go forward with their interests.

Back around the turn of the year, we completed a study called the Early Site Suitability Evaluation. We had our contractors take a look at all the data we have to date and make an assessment of those data in terms of opinions with regard to suitability or unsuitability of the site based on what we know, so far. The contractors and an independent peer review panel made an assessment, presented a report to us, and we have issued that report for public comment and review. And, we are now in the final stages of receiving comments on that report. After we do, we will respond and then that report will become part of the basis for our plans of activities at Yucca Mountain in the future. So, you can look forward to ultimately our use of that report as a basis for program action.

In addition to that, we recently have had completed by a contractor our first comprehensive Total System Performance Assessment of a potential repository at the Yucca Mountain site. That report is awaiting printing and will be available for distribution later this month. So, we will have then a combination of two things available as a basis for future action; one is that early site suitability evaluation report and the other is this baseline or preliminary, based on what know to date, performance assessment, radiolog-

ical performance assessment, of the potential repository at Yucca Mountain. Those again, I emphasize, will be a basis for future action in the program.

With regard to interactions with the Nuclear Regulatory Commission, just a couple of weeks ago, I briefed the Commission with considerable staff help on our efforts with regard to preparation of our annotated outline and our issue resolutions initiative. The annotated outline is basically the road map for defining the allocation and utilization of information that would be presented to the NRC for pre-licensing reviews and for a license application should the site be found suitable. So, what we are doing is establishing the protocols and the inventories and distributions of information and modes of interaction with the NRC in the future.

Issue resolution initiatives refers to the fact that we are about to move into making some findings with regard to some of the technical issues associated with the suitability or unsuitability of the Yucca Mountain site. The early site suitability evaluation report found that in a couple of areas in their opinion we are well enough informed in terms of data to make some findings and seek to resolve some of the issues associated with the site. And, so what we are describing to the NRC is how we expect to proceed with regard to issue resolution. Basically, what this will in-

volve is that the Department will prepare topical reports on the subjects, submit them to the NRC for review. I would emphasize that issues cannot be closed prior to the licensing action. In this pre-licensing phase, we can interact with the NRC and come to an agreement on interpretation of data, but we cannot officially close the issues. Issue closure can only occur after the licensing is underway and that, of course, will not occur unless the site is found suitable. But, we are marching our way with respect to the specific technical issues associated with site evaluation down the path toward eventually closing all the issues that are related to site evaluation.

Let me now just briefly give you some background for your meeting today and tomorrow. This meeting addresses principally program management, how we are expecting to proceed in the management of the program in the future. There's a very key word in your agenda and it's the first thing you're going to hear about from Steve Brocoum and that's convergence. What we are trying to do basically is to converge the site evaluation activities, the data interpretation activities, the regulatory compliance activities, management decisions, management decisions based on performance assessment as a tool of interpreting and using the data. All of these activities pointing toward production of defensible, solid, technical, topical reports on the site evaluation

issues and then using those as a basis for the Department's judgment concerning whether the site is suitable or not and then, if it is found suitable, to move into a license application. None of this has ever been done before. What we have underway with site evaluation is a range of activities that are being put together in a way that is absolutely unique and that's why we have started these major initiatives toward what we call convergence. To converge this range of activities rather than having things go on and on and on. But, to converge them to decisions, to findings, to actions that will focus the program, and make the essential judgments regarding whether or not the site is suitable.

A major point of assistance or means of assistance in that process is, of course, the management and operating contractor. The M&O contractor under TRW leadership came on board in February of 1991 and they will be transitioning into their full range of responsibilities over approximately a two year period. So, we're about halfway there at this point and you're going to hear essentially a progress report on some of their activities, their contributions, and you'll hear essentially also where they are going, how their responsibilities are expected to evolve. They have two major responsibilities to the program, for program integration and for program technical management, and it is anticipated that their role in the program will be a value added role in the sense that

they bring consolidation to the program activities and effective interaction of the many disciplines and activities that are involved. So, it's expected that they will fulfill those responsibilities and I might say that they have in my opinion been doing very well at it, so far. And, the program that you're about to hear is going to describe some of those activities and how it is pointing toward our convergence in the future.

With those brief comments, I thank you again for the opportunity to be here. I'd like to turn it over to Carl and he'll talk to you about our recent progress at Yucca Mountain.

MR. GERTZ: Thanks, John. I guess the microphone is working, it sounds fine.

As Dr. Cantlon pointed out, not only am I going to talk about the update of our activities at Yucca Mountain, but also talk about the recent events, the seismic activities. As the project manager, I try to keep things on schedule. So, I'll try to live within the changed conditions which is now 45 minutes for this presentation. I'm going to provide some viewgraphs of the new work, I'm going to provide at the end of that presentation, a videotape of some news coverage that we've had on the new work. I'll then switch subjects to recent earthquake activities and provide you a videotape inside of Skull Mountain; X-Tunnel inside of Skull

Mountain to show you what effects relatively--no effects that earthquake had on X-Tunnel in Skull Mountain.

Let's talk about new work. I'll provide you an overview, talk about what we're doing at UZ-16, our first LM-300 hole, talk about the 12 holes we've completed in Dr. Flint's infiltration studies, talk about what we're doing in Midway Valley, soil and rock properties investigations, getting ready for the portal construction. I'll talk about Borehole NRG-1 which is also getting ready for the portal. I'll talk about a monitoring well that we completed called JF-3 and update you briefly on our volcanic investigations.

I want to point out that major new work is under-way. This is a view down from Exile Hill when we're in the midst of doing soil pits and construction a road to the drill pad. Lots of things are happening on Yucca Mountain. It's kind of fun to be a project manager now that we can have two or three drill rigs working and bulldozers and graders and everything working. This represents some of our focus. The last six months, it's been on the scientific drilling program including some of the infiltration holes at the top of the mountain and other holes on slopes, in valleys, and I'll talk more about that later.

Just to put things in perspective, we've got a lot of holes and trenches and geophysical surveys to do. There's the totals, some of which were completed prior to 1986, prior

to our suspension of work. Once we got permits, we've now restarted that work and we're starting to accomplish some of the new plan activities. As I said, in summary, I'll tell you about UZ-16, I'll tell you about the 12 neutron holes, about our 18 soil pits and trenches, about 33 test pits in our soil and rock properties in Midway Valley, about north ramp geological hole-1--that's what NRG is--and that drilling now is complete to update this slide, talk about our JF-3 hole, and talk about the excavations in our volcanism studies.

Let's move to UZ-16, first. It's just off the repository block. I'll show you a little bit later on a map where it is. It's planned to be 1663 feet deep, about 40 feet below the water table. It's our first deep, new hole. 16 inch diameter surface casing has now been set at 52 feet. We're proceeding to enlarge the hole and take core. We're about 140 feet or so with our coring operations at this time. Drilling was initiated on May 27. It's only a one shift operation at this time. We would hope next year as funds are available, we would make it around the clock. That's probably a more efficient way to run this drill rig. Our estimated completion date is in November. We're using the LM-300, the new drill rig.

Certainly, the use of data is going to provide--it's going to be used by many principal investigators.

Whether it's structural, stratigraphic, hydrologic, mechanical, and geochemical information, lots of investigators want use of the core, want use of instrumentation in the hole. It will provide more information on infiltration rate at depth, in-situ tests of bulk rock mass, borehole-to-borehole correlation data as we get other boreholes in the area, provides certainly an improved understanding of the subsurface structural features.

As we got ready for it, this is our drill rig that some of you may or may not have seen working its way up to the mountain up to this drill pad. We had constructed this drill pad starting, I believe, it was, in February. That's the LM-300 on the pad. As I said, it's working fine. Our articulating arm is working. We don't have to manhandle the pipe around. We have, in effect, state-of-the-art robotics to handle the heavy pipe right now. Here's another view of that pad. Here's a view of how it's set up. Very recently, you might notice there's several trailers set up just on cinderblocks. This will become important a little bit later because in the earthquake nothing happened to those trailers. Another view with the air cleaning equipment. In this perspective, this is one of Dr. Flint's holes, rigs working back here. Just to let you know, lots of things were going on close up at the drill rig site. As I said, we're going to provide some video, but once again, Dr. Cantlon, I'd like to

invite you when you come out in October to spend a full day at the site and take a look at the suite of activities because lots of things are going on right now. Another view, closeup view of some of the equipment. It is a lot bigger than you think when you get up on a rig putting in our core string.

Let me move on to the next element of work that we talk about. This is what we call the neutron access bore-holes. Dr. Flint is the chief investigator. As another opportunity for you all maybe in the fall, you might want to hear from him and what he's learned from these holes and about his understanding of the mountain. I'll try to fill in some of that for you this morning, but certainly everything I'm providing you is very preliminary. But, the purpose of these holes was to investigate the precipitation infiltration process, the near surface infiltration processes. Measure the rates within the surficial material at the site.

These were the 12 holes that have been completed. There, the depths vary from 270 feet and some as shallow as about 60 feet. We tried to core the entire length. Some-times, we didn't get the entire length, but overall we aver-aged about 90% of core for the hole. There's the dates that they were completed. And, by the way, UZ-16, we intend to core the entire length to all 1600 feet. That was dry drilling. These neutron access holes were dry drilling, but

because we weren't going deep, we didn't have to use the big drill rig. We were able to use a smaller rig.

Future activities with these holes, our Phase I, as we call it, is completed. We are now planning to do additional 12 this year, this calendar year, maybe even this fiscal year if we can get it fitted in, but certainly this calendar year we intend to do an additional 12. And, Dr. Flint believes that should provide him enough data to complete his modeling effort and to complete his understanding of this aspect of the mountain. Our Phase II drilling is expected to total about 1200 feet, average 100 feet per hole. It will begin later this month.

This is another drill rig looking another way at the UZ-16 hole and this was one of the later holes that was completed. People working with the core and doing their recording. Yeah, that's mine. Yeah, we got that one already.

The question is what did we learn out there? And, I'd like to once again emphasize this is just very preliminary. I'm just trying to give you a feel of real time. In fact, I talked to Dr. Flint last night about some of these things. Certainly, the purpose was to provide access to a variety of active hydrologic settings; washes, hill slopes, ridge tops because we want to understand what we believe is the most dynamic part of Yucca Mountain in the way of hydrol-

ogy is what happens to the rain water? What happens to the near-surface infiltration? We were able to obtain profiles of saturations. We had much like we think the earthquakes providing us opportunity to gather information, we had probably one of the wettest springs on recent record. While we average only five inches of rain or six inches at Yucca Mountain throughout the year, this spring we had seven inches in the first quarter of rain. So, that provided us an excellent opportunity to look at saturation profiles. And, we also, of course, have taken core out of that to understand the processes.

But, some observations, the top of our nonwelded base of the Tiva Canyon flow is nearly saturated. It supports the expectation from the conceptual model of capillary barriers. In effect, the water comes down and it's kind of sucked up in this barrier. This nearly saturated zone is a zone where fracture flow, in effect, probably terminates below which we think matrix flow dominates and, certainly, there's a qualifier in there. Matrix flow probably dominates. We're going to have to do some more studies. That's what the next hold is about. It also could be a likely barrier to gas flow between Tiva Canyon and Topopah Springs units. So, we think this may provide a barrier to infiltration and maybe there isn't much infiltration in the near-surface units.

DR. CANTLON: Carl?

MR. GERTZ: Yes, John?

DR. CANTLON: I don't think our books have that.

MR. GERTZ: We'll provide you that. I'm sorry, we just put this in and we'll provide you a copy of that. Thanks, John.

This new data set is being used in the international community for modeling unsaturated zone transport in a model validation program. Dr. Flint has been able to get the data out to the international community and they are working with that. Our principle modeling or preliminary modeling indicates that Yucca Mountain has been a long-term drying trend. While it may rain the average of two or three inches the last 10 years or so in what we call the drought, it's been drying out at two and a half to three inches. In effect, Yucca Mountain has been drying out. Maybe, according to these modelings, over the last 1,000 years or so, it's been drying out. We believe in order to produce the current profiles of saturation in the deeper holes, there's been a net water loss at Yucca Mountain. The system is not steady state. It's either going to be drying or getting wetter. So, that's an important understanding, observation that we're coming to. And, future information will help in many ways to characterize Yucca Mountain. Geochemical analysis will help to identify fast pathways. Is there fast pathways for even

small amounts of water? And, these holes, of course, are available to continue, be it probably monthly, metering of the whole neutron logging equipment. And, that will be able to help characterize the changes in water content with depth.

As I said, I suggest, if you'd all like, in October we'd be glad to have Dr. Flint provide a more detailed analysis of what he's doing and we have some people with the USGS here to answer any in-depth questions about this also.

Another area that we started work in and we call it the north ramp geologic borehole. We are eager to design the exploratory studies facility. In fact, we're designing roads and pads right now, and later this month, we'll be conducting our 90% review on that. This is a geotechnical borehole. It's kind of an engineering borehole. It's targeted to be below the tunnel invert. I'll show you that. There's the diameters. There's the drill rig we're using. It is dry drilled, of course. Use of the data help us design the portal high wall, help us understand how we're going to get into the mountain, and design a launch chamber for the TBM.

This is the initial construction of that pad on the side of Exile Hill. That's early construction out in Midway Valley. That's our road to the drill pad. You might comment about the barrier. That's part of our safety aspects. It's not a super highway to the drill pad, but we had to do a tradeoff. Do you make the road twice as wide for safety

purposes or do you put a barrier up. It appeared more cost-effective to put the barrier up for us. Here's the pad completed and I'll talk about it later, but you get a good view of an 1100 foot long trench in this area for the surface facilities. And, soil pits, you can see underway.

There's the drill rig in work on that pad. I think, it took us about a week to complete that hole. Once again, as we talked in January, there's lots of preparation to do work on this program and we had to build a road, make it all safe for maybe a week's drilling, and everything. But, that's what it takes to do business. That's a closeup of that rig on the pad.

Let me just give you a little perspective. If you were looking in cross-section on Exile Hill, here is the pad that you saw and there is the drill hole. There is the proposed invert tunnel elevation. This is what the area looks like right now. Eventually, we will take this rock out and we will build what we call the north pad through here, 665 foot in this direction. This is, in effect, an east/west elevation. But, that's where we drilled and we drilled down 150 feet below the invert to gather information. Our engineers now are analyzing that information. This is the same view in plan looking right into Exile Hill with the drill pad existing here. Eventually, it will look like this. And, there is the drill hole right through the center of the

tunnel right at the portal face. Our engineers were eager to gather that information because that information leads us to preparing the ramp and the launching chamber for the TBM. I think some of you have seen this before, but once again, I want to point out that that's where we're heading is trying to get ready to start this excavation with TBMs as soon as possible and certainly this excavation will provide opportunities for the scientists to understand some of the faults in the area, Bow Ridge Fault and some of the other potential faults, and understand the stratigraphy a little better. Right now, it's about, I think, a 6% grade on the north ramp. Eventually, to be done by a TBM type machine, just to remind you of that. The south ramp we're working on now is still at the 1% or so grade.

Let's talk about some of the other work going on in Midway Valley. I showed you the drill hole, but we're doing what we call test pits, 33 excavations of that site. We want to understand the bedrock in-situ conditions so we can design a pad and so we can understand the potential engineering properties for future repository construction should Yucca Mountain be suitable. Design of ESF facility pad, engineered fill requirements, and design of the portal high wall, all to provide the engineers information. Normal type engineering soil pits with a trench and a square area for some testing including moisture testing, another view of one of these 33

trenches.

Actually, when you go out and look at Midway Valley, it almost looks like a war zone because there's bunkers and holes and barriers all over the place right now including activity going on to understand the geologic or seismic hazards in Midway Valley. Our progress to date is we started mapping in '91. In July of '91, when we started new work on Trench 14, I think you'll recall, in July we thought it essential to get out there once we received the permits and we started deepening Trench 14 to address the calcite silica issue, we started working with Bruce Crowe's volcanic issues, and we started work in seismic issues in Midway Valley. That trench was completed, mapped, and backfilled. In effect, that's checked off and out of the way, We found no evidence of faulting and this is what we were looking for was an extension of the Bow Ridge Fault and we could find no evidence in that area.

In March then, we went into Midway Valley, excavated some more soil pits looking for faults and looking for information on the ages of the geologic deposits which will help us identify any faulting and age of faulting if it occurred. That's, in effect, the soil pits once again in Midway Valley. And, we did our 1100 foot long trench. It was just completed and that trench is another thing we'll show you later, but right after the 5.6 earthquake we went

out and looked at that trench. It was not shored yet. The mappers haven't got in there. And, it withstood the earthquake ground motion in Midway Valley without any sloughing, no caving, no appreciable damage, or no appreciable deterioration of the trench that we saw. The mapping of the trench is in progress. Other trenches in both the Bow Ridge Fault and the Paintbrush Fault are currently being excavated. They're not 1100 feet long. They're smaller trenches across these faults. But, that activity is underway by John Whitney's group with the USGS right now. In effect, there's one view of the trench when it just got started and the longer view of the trench and that's how it looked before last Monday's earthquake and that's how it looked after the earthquake.

Another activity that we completed was our responsibility to put a monitoring well in place in order to meet the state engineer's requirements of a water permit and to meet the Park Service's requirement to withdraw their protest. This well, we call JF-3. It's a south, down-gradient, water-wise from where we're withdrawing water at J-13. This hole was almost 1300 feet deep. It started in November, completed in April. It was not dry drilled because it was a water table hole. It was wet drilled. Diameter of it is 8-5/8 inches and it's part of our monitoring program. This was a new well. We monitor the water level in 22 existing wells,

both private and Government wells in the area, but this was a new well that is strategically located to provide an early warning should we be affecting water table level. It's just part of our overall program. You saw that before. For those of you who hadn't saw it, that was the drill rig used there and we did do some double shift operation there.

Another activity that certainly receives lots of public interest--you know, I'll classify public interest as being concerned about earthquakes and volcanos primarily, a little bit about groundwater, but most of the questions we get from the public are what are you going to do about earthquakes, what are you going to do about volcanos? Certainly, Bruce Crowe has been working very aggressively at the Lathrop Wells Volcanic Center, 32 new trenches out there; five trenches also in the Cima Volcanic Field in California. Our conclusions is Lathrop Wells is a polycyclic volcanic center providing important input to performance assessment. As John talked about the performance assessment that we've just finished with Sandia, that will--as I said, at the printers right now--some of this information was input to that and other studies indicate that volcanism is waning in the area of Yucca Mountain. But, once again, these are somewhat preliminary. We plan to do some more trenching later this year and next year. We want to finish up at Lathrop Wells and continue some work in the Cima Field and begin some

Sleeping Butte work north of the site. That's the kind of activity that Dr. Crowe works with, a backhoe and soil trenches. We don't leave them open very long for safety reasons. We excavate them, map them, make them available to whoever wants to see them, and then we close them up.

In Dr. Crowe's studies, we've involved several people from across the country--in fact, I guess it is just in this country--trying to understand the geochronology issues and lots of people are looking at it and those soil pits. That's the Lathrop Wells Volcanic Center and the blocks are showing you where some of the soil pits are.

With that, John, before I take questions, I'd like to show you a video of the work so you can see it in motion as opposed to just stills and then I can take any questions on this part of it and I can go to the earthquake part, if that's all right.

We're ready for the video.

(Whereupon, a videotape was shown and the following is the audio portion of that video.)

"UNIDENTIFIED SPEAKER: While the Federal Government is still working hard to try and make the nuclear waste issue a friendly one, today the Department of Energy invited the media to the latest tour of the Yucca Mountain site. Environmental reporter, David Rugelman (phonetic) took the offer and says the Feds want to lay their cards on the table.

MR. RUGELMAN: The DOE put on the ultimate media show. News crews were shown work sites with plenty of activity, maps and graphs, displays, and slides. And, of course, scientific types were there to answer the battery of questions. All this to show Yucca Mountain is being studied as a possible nuclear waste repository. The key word there to the DOE is "possible". A bit part of the presentation today is that the site is just being studied.

UNIDENTIFIED SPEAKER: If it's not safe we want to get out of here and go study somewhere else. But, if it is safe, let's get on with solving a national need.

MR. RUGELMAN: I'm standing in front of what could be the main entrance to the nuclear waste repository if Yucca Mountain is selected. Now, this is also the place where the DOE plans to drill a large test tunnel. Imagine an opening here about 28 feet across. Many people wonder since the tunnel will already be here, will the repository have to follow. Scientists say that won't happen, even those who don't work directly for the DOE. Bruce Crowe is billed as one of the top geologists in the world. The Los Alamos laboratory expert assures me if Yucca Mountain isn't suited for a waste site, it won't be selected.

MR. CROWE: Because our reputations depend on this, there's just no way we could conceal information.

MR. RUGELMAN: Would it surprise you, Bruce, if a

lot of people in Las Vegas don't believe that?

MR. CROWE: Oh, absolutely. I mean, for some of the past backgrounds, DOE's reputation is not the best, but we're here as scientists to say that this is a different project, that we're basing our careers on that this will be done right.

MR. RUGELMAN: But, scientists won't make the final decision. Politicians in Congress will. Since the DOE will spend a whopping $6.3 billion just studying Yucca Mountain, critics worry cost may influence the decision more than safety.

At Yucca Mountain, David Rugelman, News 3.

UNIDENTIFIED SPEAKER: And, even if Yucca Mountain is proven to be a safe site, there's the issue of transportation. Nuclear waste will have to travel here from all over the nation. Some opponents worry more about that than Yucca Mountain itself."

(End of first videotape.)

(Whereupon, a videotape was shown and the following is the audio portion of that video.)

"UNIDENTIFIED SPEAKER: A new round of advertising to promote a nuclear waste dump at Yucca Mountain is hitting the airwaves. Over the past few weeks, ads have been run in newspapers and on the radio. Today, they began airing on television stations. The commercials are financed by the

American Nuclear Energy Council which has said it will spend at least $10 million on advertising over the next three years. The new commercial features a geologist and focuses on the question of why the waste cannot stay stored where it is, above ground.

UNIDENTIFIED SPEAKER: Well, as we've discussed before, dry cask storage is a safe interim storage method and many utilities will probably be interested in doing that for the short-term. But, again, leaving it on the surface where it has to be managed by people and monitored fairly carefully is not what we consider a good, long-term solution. We prefer getting it underground where we can--

UNIDENTIFIED SPEAKER: The ad campaign is airing statewide. Different commercial spots will be aired over the course of the next two years. They will focus on the transportation and the storage of nuclear waste.

UNIDENTIFIED SPEAKER: Scientists may know within a year whether water movement poses a big enough threat to disqualify Yucca Mountain as a nuclear waste repository. Scientists plan to study the mountain for the next nine years. But, as Sheila Walker reports, new drilling work underway could shorten the process.

MS. WALKER: Yucca Mountain Project workers are using the LM-300. It's a huge drill capable of digging deep holes and removing samples of the underground rock in Yucca

Mountain. Scientists say these underground core samples provide information about problems that might arise involving what would be nuclear waste canisters buried inside the mountain. If the canisters were to leak, these core samples let scientists know how quickly water might carry the radio-active material into the outside environment.

UNIDENTIFIED SPEAKER: We're not really concerned about what we've seen, so far. What we're looking at is the movement of water in the unsaturated rock. Water movement is the most likely way in which radionuclides would be released to the accessible environment.

MS. WALKER: But, scientists admit they haven't yet studied the most important parts of the underground rock. They say, once they do, they will know whether the threat of groundwater contamination is great enough to scrap the idea of a nuke dump. Yucca Mountain Project managers say the new drilling technology will provide the samples and the answers possibly within a year.

The LM-300 drill rig costs $3.5 million to build. It costs a quarter million dollars a month to operate. Yucca Mountain Project managers hope to eventually have four of these drills operating around the clock.

All of the plans, though, depend on funding and whether anti-dump critics win any more rounds in the war against Yucca Mountain studies.

Sheila Walker, Eyewitness News 8.

UNIDENTIFIED SPEAKER: Scientists conducting tests out at Yucca Mountain called the news media out there today to see their progress. The scientists are trying to determine if the site is suitable for a nuclear waste repository. A big new drill is expected to provide some answers. One of the big questions is whether the site is susceptible to water getting into the canisters of nuclear waste. The scientists told reporters today that they're looking at core samples brought up by the big drill. The samples should help scientists test the likelihood of a waterborne contamination.

(End of videotape.)

MR. GERTZ: That's some excerpts of the media day that we had. It also addressed some of the nuclear industry commercials that were going on and I thought I'd provide you with that opportunity to let you know what's going on at Yucca Mountain and how certain members of the public view it.

DR. CANTLON: Thank you, Carl.

Questions from the Board?

DR. CORDING: Carl, they're talking about--is the discussion about four drill rigs? Is that correct? Is that what you're planning to have?

MR. GERTZ: Yeah, if we're to keep on the 2001 schedule, eventually we have a plan laid out where it will take four drill rigs to complete the drilling in time.

DR. CORDING: And, you would be adding drill rigs at what times?

MR. GERTZ: Depending on the funding, but with good funding in '93 and '94, we'd pick up at least two and maybe the three additional ones.

DR. CORDING: You're figuring about a six month schedule per hole. Is that about right?

MR. GERTZ: Maybe three months when we work around the clock. We're still trying to figure out what the drilling rates are and we'll figure that out at UZ-16. We've been very successful with some of our new bits being tested at the Colorado School of Mines and that we're now using.

DR. CORDING: Thank you.

DR. DOMENICO: Carl, did I detect that it seems to me you sound like you're getting very close to resolution of the volcanic and the seismic issues. Is that a fair statement?

MR. GERTZ: Well, let me talk a little bit about the volcanic issue. As John pointed out, one of our initiatives is what we call issue resolution and Dr. Crowe and his team are scheduled to produce some papers and to interact with the NRC later in this year on the volcanic issue and at least try to narrow the understanding of that issue, particularly on a direct hit, not on the coupled effects. But, more on direct effects of volcanism.

And, on the seismic issue, as John just pointed

out, we're going to try to accelerate that activity. We don't have that scheduled right now for issue resolution. So, that's a little further away.

DR. CORDING: On other question, Carl. Will any of this testing or any of this issue resolution result in change in the SCP tests or ability to reduce the testing that is presently in the SCP?

MR. GERTZ: Certainly, some of it will. The erosion issue that we started to discuss with the NRC right now eliminates, I think, four study plans or parts of four study plans. So, that's our goal. Based on our current understanding, if we can reduce the program, we can focus on things that are less certain. So, that's part of our goal. Once again, we're always battling the question how much is enough? But, there is a mechanism in place to change the SCP. It's baselined, it's under change control, and should we agree some testing to be deleted, we'll take them out. Should we agree, on the other hand, tests need to be added, we'll add those in a controlled process.

DR. CANTLON: Just confirming your comment earlier. The series of overheads that weren't in our books, you'll give us--

MR. GERTZ: Yes, sir.

DR. CANTLON: Okay.

MR. GERTZ: I think we only missed two.

DR. CANTLON: No, there were more than that.
MR. GERTZ: Is there some more?
DR. CANTLON: In my book, yeah.
MR. GERTZ: Okay. We'll get you--
DR. CANTLON: There was a whole set of them missing that--
MR. GERTZ: Pictures and the cross-sections of the--
DR. CANTLON: Right.
MR. GERTZ: You bet.
DR. CANTLON: How would the work in prepping for drill pads and the portal and so on compare with a typical, comparable operation for mining exploration?
MR. GERTZ: Certainly, for a mining exploration, you could do it a lot faster and a lot cheaper.
DR. CANTLON: Cheaper.
MR. GERTZ: That's right. Although, across the world--excuse me, across this country, all industrial activities are having to go through a lot more hoops if that's what you want to call it. The nation has instituted very comprehensive environmental programs both under RCRA, under CIRCLA. They've instituted very comprehensive protection programs for endangered species. So, other people I've talked to in the business--and I think there's a report out by the petroleum industry about maybe half their drilling--not cost-effective based on meeting today's current standards. But, on the

other hand, we still even live in more of a fishbowl. We're in a regulated environment. We're in a very controversial project and I want to assure that we are dotting every I and crossing every T. We can't afford not to meet an OSHA requirement, a RCRA requirement, or anything along those lines. And then, we're in the detailed record keeping that goes with the license, too.

DR. CANTLON: It's the problem of tradeoff of escalating costs and concerns on paying and the question is if you have to cut, are there perhaps ways that some of that operation could be thought more in keeping with what normal Nevada operations would be?

MR. GERTZ: But, once again, normal Nevada is not licensed by an NRC.

DR. CANTLON: I understand.

MR. GERTZ: My colleagues doing the Bond Bullfrog Gold Mine do things a lot different than we do at Yucca Mountain.

DR. CANTLON: Okay.

MR. GERTZ: Including, as a simple thing, John, when we put water on it to keep the dust down, we had to have a documented analysis that that water wasn't going to affect waste isolation and a performance assessment that it wasn't going to affect testing either in the future.

DR. CANTLON: Yeah. And, that part of it, I would understand. I think that's quite straightforward.

What kind of work is underway--you were commenting about refilling the holes over at the crater analyses and eventually you're obligated to do site mitigation and so on. Is there a research program on mitigation underway there?

MR. GERTZ: Oh, yes, sir. If you come out in October, we'll show you our plots right along the road we call H-3 where some of Dr. Flint's holes have already been revegetated. He's just completed 12 and I think some of them have already been replanted by our environmental program and we're testing different flora and fauna species to see what works best in the desert.

DR. CANTLON: Other Board questions?

DR. DOMENICO: I have one more. I'm looking at the surface-based testing summary status and it seems that you have 267 shallow boreholes drilled and you've completed 164 and you've planned for 64 deep holes and you've completed 44. For that remaining part of the program, do you really need four rigs operating 24 hours a day?

MR. GERTZ: We believe we do to get the holes done by 1997/1998. It depends how much--when you need the data, but we need them in that time frame to assemble a license application. So, that's what our current chart looks like and we've laid it all out with the time frames and we have each hole and each depth laid out and we can provide you certainly that schedule.

DR. DOMENICO: It seems like you're a third of the way there, now. Something approximating a third.

MR. GERTZ: Yes. Yeah, certainly, many of those--

DR. DOMENICO: With one rig, is that--or is there another one?

MR. GERTZ: No.

DR. DOMENICO: No.

MR. GERTZ: Many of those holes--put that chart back up.

DR. DOMENICO: Those are old days?

MR. GERTZ: Old days' holes done wet, done differently than today's way of doing business.

DR. DOMENICO: Okay. Okay.

MR. GERTZ: Completely different way of doing business.

DR. DOMENICO: Okay.

MR. GERTZ: Some of it may be very good corroborating data, though.

DR. CANTLON: Ed?

DR. CORDING: With 64 deep holes, that's where your time problem is?

MR. GERTZ: Yes, sir.

DR. CORDING: 64 deep holes?

MR. GERTZ: The deep holes are the problem. That's exactly right.

DR. CORDING: And, they're at least three to six months apiece.

MR. GERTZ: In that range, that's correct.

DR. CORDING: Or, at least, right now they're six months, but you're estimating perhaps you'll get up to around three?

MR. GERTZ: I think our schedule shows about three.

DR. CORDING: Could I ask one other question, Carl? In regard to the schedule on the tunneling, FY-93 has some funds for purchase of or start of a contract and then, as I understood it--these are questions, really. As I understood it, October '95 was the start of tunneling. Is that the current schedule?

MR. GERTZ: That's the current schedule based upon a funding profile of 240 million or so for the project next year and we can accelerate that by a year with an additional 75 million that we had for in a hoped for budget amendment, but that budget amendment did not go forward. So, it depends upon how Congress treats us in the appropriation process. On the other hand, the House only has a total of 275 for John's entire program in the latest markup which would mean Yucca Mountain would be, you know, a little bit more than half of that which doesn't get us much done, at all, next year.

DR. CORDING: With 240 million, does that--what does that involve in terms of startup of tunneling, say, in fiscal '93?

MR. GERTZ: Just starting the portal. In essence,

starting the portal. Your schedule for the TBM that you gave me matches that 240 million. TBM operations in '95.

DR. CORDING: So, the contract for the TBM and contractor purchasing TBM or whatever would not be in fiscal '93, is that right?

MR. GERTZ: No, the contract will be in '93 to bring them on board. We'd start writing the specs. About mid-year, we'd say go get the equipment and he'd start the equipment about mid-year and deliver it in mid-'94 to operate in '95. Sixty to 90 days to set it up. We expect July '94, if I recall our current schedule.

DR. CORDING: For equipment setup?

MR. GERTZ: One or two TBM--yeah, July '94 to receive one or two TBMs and set them up.

DR. CORDING: But then, you'd have the TBM a year and three months prior to the time the TBM moves into the ground?

MR. GERTZ: In fall of '95, we'd put it in. FY-95, I believe.

DR. CORDING: FY-95?

MR. GERTZ: Early '95, fall of '94.

DR. CORDING: Okay, I see. So, that would be four months later, five months later?

MR. GERTZ: Yeah.

DR. CORDING: The one concern I have is that even with an October '95 date, you're six years away from time of

submitting the licensing application and there seems to be a tremendous amount of work to be done--for example, heater tests and things like that, time to do those things, time to evaluate results. It would seem to me that it's a very tight schedule even, you know, with the present schedule of October '95 for startup of actual tunneling.

MR. GERTZ: Yes, sir. We agree with you. You'll hear more about it later today in what we call the Mission 2001 and how we're trying to validate that schedule, but preliminary, your observation is absolutely correct. It's a tight schedule. And, that's based upon successful funding in '93. If that does not materialize, that schedule becomes impossible to meet.

DR. CANTLON: Question, Dennis?

DR. PRICE: The costs on the ESF have risen from an early estimate of 64 million to $900 million and I think your response at one point indicated it was due to the NRC--part of these costs and this escalation due to adjustments in the program related to requirements by NRC and some comments made by the NWTRB. Could you give us some kind of an idea about how that $900 million figure breaks out and maybe enlighten us a little bit about that?

MR. GERTZ: Yeah, I need to give you just a little history. If you're talking about $64 million, it might have been just one shaft and a couple hundred feet of excavation

below ground and then we went to one shaft in 12 foot diameter and a six foot diameter and then we went to two shafts and then we went to five miles below ground. So, the 64 began to grow as we went forward and our SCP configuration was maybe in the $300 million to $400 million range. At that time, based on conversations with you all, based upon reading the NRC, it appeared to us after extensive studies that a ramp configuration would be better suited for the scientific investigation and the overall project approach. So, now, we went to what we call 14 miles of underground tunnels. So, we went from less than a mile of tunnels to 14 miles of drifting and ramps to provide access. So, we've significantly expanded the scope of that particular facility and I think it's appropriate, the scientists think it's appropriate, and provides us a great opportunity to intersect faults at various levels. So, we just changed the scope a little bit of our ESF.

If you want to break it down, you know, it's mostly in the tunneling, mostly in getting 14 miles of tunnels in. The surface facilities, in effect, are about the same. They've increased some, but they're now supporting 14 miles of tunnels, as opposed to four miles.

DR. PRICE: To what extent is that figure sensitive to the size of the tunnels?

MR. GERTZ: Not very sensitive, at all, to the size of

the tunnels. People we've been discussing it with indicate that once you get a TBM in place and going, whether it's a 18 or a 25 foot, is not that much different. Some difference, but we can provide you some more data on that. We're doing some studies on that right now.

DR. CANTLON: Ed?

DR. CORDING: At the time that this 900 million was estimated, that was part of the 32 different options study? Was that the one we're referring to now?

MR. GERTZ: Yeah, that's correct. In fact, now, we have a Title I design of that, a much more detailed design, that was independently reviewed by a Department of Energy team called the Independent Cost Estimating Team led by Gilbert Commonwealth and they, in effect, validated that cost estimate based upon their knowledge of the industry, work, and practices, including nuclear history.

DR. CORDING: At that time, all of the 32 options were ranging between 600 and 900 million. So, even the--

MR. GERTZ: Yeah, except the base case, yes.

DR. CORDING: Wasn't the base case around 590 or something?

MR. GERTZ: Ed, I don't recall. It was a modified base case, I think, but you're right, yeah, including the Calico Hills which wasn't in our original base case.

DR. CORDING: I see.

DR. CANTLON: Staff, questions? Leon? Leon Reiter?

DR. REITER: Carl, a year or so ago, we had a meeting on volcanism. The Board had a meeting and there was a lot of controversy associated with positions that were taken, people like Gene Smith from the University of Nevada-Las Vegas and some people in the USGS. You said you're doing these volcanism, these investigations, but you're closing up the holes. Before you close up the holes, are you asking the people who have expressed differences of opinion if they're interested in looking at it?

MR. GERTZ: Yes, sir, we sure are.

DR. REITER: Including people from the USGS who--

MR. GERTZ: Turrin & Champion haven't been specifically asked if that's who you're talking about.

MR. JOHNSON: Excuse me, let me respond to what you just asked, Leon. The State of Nevada has never been asked to take a look at those excavations that Bruce Crowe has been doing out at Lathrop Wells. Gene Smith has gone out there once, but only on his initiative to see what was going on. He's never been asked back again. We have never been asked formally to participate in review of those particular excavations.

MR. GERTZ: Carl, I'll sure take an action to make sure both you and Gene are notified specifically in the future. Certainly, we provide your office a weekly report of what's

going on and perhaps it's not specific enough for you. So, we'll do that more specifically.

MR. JOHNSON: Carl, let me remind you what you provide to us on a weekly basis and what you don't provide to us on a weekly basis. What you provide to us on a weekly basis is a report of your drilling activities and your drilling activities, alone. That's the same report that I understand your contractors provide to us. You provide us no information on the progress of any of your trenching activities.

MR. GERTZ: I won't debate it with you right now, but we provide you two reports, the drilling activity and the weekly highlights report which generically talks about some of the other things. But, we'll be specific with you. That's a good point. I appreciate it.

DR. CANTLON: Okay. Other questions from the staff?

(No response.)

DR. CANTLON: All right. Thank you, Carl. Let's hear about seismic.

MR. GERTZ: Seismic, okay. By the way, before I start the seismic, I need to tell you I have Dr. Jim Brune from the University of Nevada here who may provide some added information at your request. We can decide on your time frame after I go through this.

Let's talk about what we call the Little Skull Earthquake and, first of all, in my haste to put this

together, the earthquake happened on June 29, not 19. It happened at 3:14 a.m., and to let you know how media interest is in things like that, I got a call at 4:00 o'clock in the morning from the tv stations wondering what happened and could I come down and talk to them about it. There is the location. It's depth was approximately five and a half miles, magnitude of 5.6, approximately 12-1/2 miles from the proposed repository perimeter drift.

To put it in perspective, those of you who have been to the mountain through Lathrop Wells up to our field operations center, here is Little Skull Mountain. Our epi-center right now, we think, was about right there, and from there, to there is about 12-1/2 miles, about four miles from the field operations center. And, an item of note, during a Department of Defense activity, there is a couple of tunnels right in Little Skull Mountain called X & Y Tunnel and that was of interest to us because we wondered how the 5.6 earth-quake would affect underground structures. Intuitively, of course, people have studied underground structures and under-stand they withstand pretty well including the major--experi-ence. But, we wanted--that was an item of interest. By the way, you'll see Wells H-5 and H-6 up there and that's where we have some continuous reading water level depth and we'll provide you some preliminary information on that. Once again, what I'm providing you is very preliminary.

DR. CANTLON: Carl, before you take that off, could you --roughly, what's the distance between X & Y Tunnel and the epicenter, about two miles?

MR. GERTZ: Well, I don't have the scale on that, but we think it's about two miles, a mile and a half to two miles. They go in here about 600 feet. It's hard to show that at that--

DR. CANTLON: Um-hum. And, how are they oriented relative to the fault that you think is under there?

MR. GERTZ: I don't know. I don't have an answer for that. I don't--maybe Jim knows.

DR. CANTLON: Okay. Thank you.

DR. ALLEN: Are you going to tell us what did happen in the tunnels?

MR. GERTZ: Yeah, I'm going to show you a video of the tunnels, as a matter of fact, later on in the presentation. This is the overall view of Las Vegas and where we think the epicenter was right here in Little Skull Mountain, approximate location right there. That's in the book for you.

We have a Southern Great Basin Seismic Network that was initially instituted to provide small motion detectors. And, all these, in effect, went off scale on the 5.6 earthquake. But, that shows you where they are located. I think there is 52 of them. They're currently being run by the USGS. They will eventually be run by the University of

Nevada system, Jim Brune's activities. We're in the process of transition. Not on one of the small motion detectors on the Southern Great Basin Network, but on one of the regional networks, on Shoshone Peak, this station had just been put in there about a week beforehand and it was operating. It's not been calibrated yet, but we believe at Shoshone Peak which is about the same distance from the epicenter as Yucca Mountain, it was less than 1/10g ground acceleration caused by this Little Skull Mountain Earthquake. That happens to be the reading for those of you who wanted to see the raw data.

Let's put this in historical perspective. Quakes of 5.6 or greater are infrequent in southern Nevada, very infrequent. Only two others are documented in historical record; Tonopah of 6.3 and Caliente of 6 in 1966. Tonopah, I don't know how far that is from Yucca Mountain, maybe 100 miles. Caliente may be 70 miles. I'm not sure. I didn't chart that out. While this is the first significant earthquake recorded near Little Skull, our Southern Great Basin Seismic Network which looks at micro-earthquakes has seen lots of movement in this area in the past.

We had several aftershocks. If you want to talk about aftershocks, there's been over 1,000 recorded, so far. The largest magnitude has to even be updated right now. Last Sunday, Jim Brune told me that we had up to a 4.4 aftershock. We've located 15 of them using our Great Basin

Network and some temporary equipment. On Monday, the earthquake--on Monday afternoon, we started moving in temporary equipment and moving scientists from the USGS and University of Nevada system out to look at portable instruments and now are deployed in the area. We're trying to get some in X & Y Tunnel, as a matter of fact, to compare the underground motion with the aboveground motion. The main shock, as I said, was about 5.6. Here was a Little Skull Mountain detector. There's some other information.

Type of faulting, we think it was normal faulting of northeasterly striking plane. Aftershocks, some normal on a north to northeast plane; some show some strike-slip. That's some of our early information for you.

Geologic effects, well, we've looked both on the ground and from helicopters, both ourselves and Jim Brune's people and they revealed no evidence of any surface rupture. We couldn't find any surface rupture. Some boulders about two feet in diameter on Little Skull Mountain were dislodged with the ground motion. We couldn't find any evidence of boulders moving at the Yucca Mountain crest, but some boulders on the west side of Yucca Mountain on the Solotario Canyon side south of the proposed repository block had moved. Jim even has some slides of that if you'd like further discussion.

Here's our damage perspective. At the field opera-

tions center, we think we may have had .1 to .15g based on the size and the distance, but that's just kind of guessing. To put things in perspective, in our conceptual design of repository facilities that went along with the SCP, we had designed our facilities in that design for .4g. Our potential repository design in the SCP, depending on where you look, varies from .5 to .6 and even in some areas we're looking at .7g. So, what we saw, of course, was well below what we intend to design ground acceleration for. Further perspective, Las Vegas code is .2g right now. Such accelerations, we expect in this part of the country. Where the damage occurred in our office building was the building that was designed in 1962. It was designed to the 1961 Uniform Building Code. No one was able to find what kind of ground acceleration that required, but at the time it was Seismic Zone 2 and wind at 25. Modern design would use an updated building code which has updated that area to Seismic Zone 3 which is about .3g and 80 miles per hour. Some of the facilities in the building were upgraded to that and we put a fire sprinkler system in and other things as we upgraded this 1962 building. And, the utilities in the building, it didn't lose power, it didn't lose water, they all withstood it. But, we did have quite a bit of surficial damage.

I'm going to switch a little bit to the water levels because that's always a concern in earthquakes, par-

ticularly at Yucca Mountain, and for the Little Skull Mountain, I'm going to compare that with the Landers, California mainshock. But, in Well H-5--you saw that on the map--in the upper interval of this well which is water level, we also measured fore-pressure below that with the--but in the upper interval, we had peak to valley of a little over a foot and they returned to near background--in other words, to where the water level was before--in about a half hour. And, for Landers, California mainshock, the upper level, in effect, went off scale, above 1.73 feet. Oscillations returned to background within about two hours. Even though this was much further away, almost 200 miles away, it created much more water level activity than the one that was close. No permanent change in the water level. This happens to be the H-5 well for the Skull Mountain Earthquake and you can--this is the upper level and that, in effect, is peak-to-peak and this is the fore-pressure and, of course, the fore-pressure was much greater below that at 3:15 a.m. on 6-29, and you saw it start to come back down.

This is the Landers, California one and keep that in mind. This was the first quake off scale in the fore-pressure, off scale in the water level. This was the first aftershock. I think it was about four hours later. You can see the activity in this well due to Landers compared to the activity on the closeby earthquake. Certainly, magnitude

appears to have a greater influence on water level than distance in that empirical observation.

Here's some of the data from both H-5 and H-6, another well that we had instrumented and you can pull that off and look at it. But, we have the double amplitude and maximum rise/maximum fall and apparent offset after 120 minutes, after two hours. That's, once again, preliminary information. I'd like to caution you on that, but we thought it's important to provide that to you.

Let's talk about the effects on site structure. We had minor architectural damage to several buildings. For example, management facility and the hydrologic research lab were metal buildings. They seemed to withstand it pretty well. One overhead door went off the track and that was about all in those buildings. Some beakers were tipped over. Some file cabinets opened, things like that. One of the substations had an insulator broken in the area and the field operations center, we did have lots of architectural damage, many broken windows and ceiling tiles that have been dropped. No loss of structural capacity. We were back in the building working, but certainly some cosmetic damage including the caulking cracked all around the building and so we have a preliminary estimate of about $900,000 to $1 million to repair this building.

At the drill sites, we went and looked at the UZ-25

and UZ-16 drill sites. No apparent damage. The drill rig was still sitting, the trailers were still on their cinder-blocks. So, the drill sites were not affected. And, the trenches in Midway Valley, as I talked about, had no damage in the trenches or soil pits.

That's the field operations center, the building where the damage did occur. We'll show you some of those damaged things. Just to point out, I showed you that before. Those trailers, everything stood that pretty well. The high racks in our sample management facility with the samples on it had no problem. No samples fell off the shelves. This trench had no problem that we could identify. Everything was stable in Midway Valley both before and after the earthquake. It looked the same to us. This is the field office center. You can see broken glass. The windows certainly just, in effect, failed. Another view of those windows. The cracks in the wall, the cinderblock wall, as you can see. Ceiling tiles damaged. Upper story windows. As you would suspect, there was more damage on the third floor. It's a two and a half story building. More damage on the third floor than there was on the second, less damage on the first floor.

In summary, the earthquake and its aftershocks is going to provide us some valuable information. We had crews in the fields almost instantaneously. The ground motion provides us, once again, an opportunity to understand and

assess the seismic hazard. As John pointed out, he's directed me to concentrate and focus on this activity in the near-term. Facilities and equipment are being studied to determine what actions--we want to insure our workers are safe in the buildings. So, we've had them inspected by earthquake qualified people. Earthquakes of this magnitude are infrequent, but not unexpected. Our SCP, if you recall, looked at a design condition of a 6.5 earthquake on the Paintbrush Canyon Fault which was about a quarter of a mile from the portal or surface facilities. So, while this was a significant event, it was well within the envelope that we're studying and certainly the ground accelerations were about .1g and it's significantly below accelerations that were being considered for preliminary design. And, as I pointed out, the major observation for us was in X & Y Tunnel and I'll show you the video on that because, here, we had tunnels inside a mountain that had an earthquake and the tunnels seemed--were not lined. A few rockbolts seemed to withstand those forces without any significant damage.

Okay. Are we ready to show the video?

DR. CANTLON: Sure, um-hum.

MR. GERTZ: Do you want to try the second one? I think it's about four minutes and it's not much--

(Whereupon, a videotape was shown and the following is the audio portion of that video.)

"UNIDENTIFIED SPEAKER: We are standing in the entrance, X tunnel on Little Skull Mountain, looking up the back, panning down to the invert, looking to the work point.

(Pause.)

UNIDENTIFIED SPEAKER: From this camera angle, it's 350 feet in from the work point--in from the portal, excuse me. In from the portal looking to the work point. Now, looking at the back and panning down to the invert.

(Pause.)

UNIDENTIFIED SPEAKER: Looking from the portal to the face of the work point, just looking at the entrance of the cavity at the work point.

(Pause.)

UNIDENTIFIED SPEAKER: We're at approximately 600 foot in from the portal looking up at the back at the work point, panning down to the invert."

(End of videotape.)

DR. CANTLON: Is that a shotcreted surface--

MR. GERTZ: I don't know. I wasn't in there and I don't have the answer to that myself. It looked like it was shot-creted, but other people said it was painted. Maybe a little of each. Maybe someone in the audience knows, but I don't know.

Yeah, would you like to hear from Jim if you have time?

DR. CANTLON: Carl Johnson wanted five minutes to comment on what they had seen there and I think that's appropriate.

MR. GERTZ: Sure.

DR. ALLEN: Can I ask one question?

DR. CANTLON: Sure.

DR. ALLEN: A geologic question and maybe Jim or someone else knows the answer to it. Of course, on both sides immediately adjacent to the repository block and perhaps even through it, we've identified faults that have displacement for the past 10,000 years, presumably associated with earthquakes significantly larger than this 5.6. In Little Skull Mountain itself, there are also northeast trending faults. Do any of those also show evidence of quaternary or holes being displayed?

DR. BRUNE: I don't know the answer to that question. John Whitney was out there looking at them. My understanding is that they're probably Pleistocene motion, but I wouldn't say. I don't know about any more recent than that.

MR. GERTZ: And, certainly, even Ghost Dance, I don't know if we've identified as quaternary or not.

DR. ALLEN: No, no, that's true. There's not much evidence. So, possibly it does have that kind of--

MR. GERTZ: Yeah, true.

DR. BROCOUM: I think the Rock--Fault has shown either

quaternary--but not necessarily or, as you said, going through Little Skull Mountain.

DR. BRUNE: What turns out to be a very unusual feature of Yucca Mountain is that there's a lot of precariously balanced rocks there and I'll show you some slides showing what precariously balanced rocks are. For the sake of calibration, I've had fun in the last nine months going around the U.S., everywhere I could find earthquakes, and looking for precarious rocks in earthquake areas. And, I've looked in the aftershock regions of all these earthquakes and you do not find these precarious rocks in any of these aftershock zones. The only other place I found them a lot is down in southern California, crossing the peninsula range--in an area that is predicted to have very low accelerations with very long return times and so it's a very low area as far as acceptability to ground shaking is concerned. So, I think the method, although it's developing, is showing a lot of promise in certain areas for indicating ground motion expected over long periods of time.

This is what I define as a precarious rock. So, here, we have the defining example of precarious rock. This is a broken rock and there's actually three pieces of it here. This broken piece sitting on top, it's ready to fall down a steep cliff here. This is John Whitney, my colleague, who provides the other part of the story; namely, that this

rock varnish that covers all these faces is very old, 5,000 to 10,000 years old. And, if that's true that it's been sitting exposed to the air that long, it certainly gives a control of some sort on the peak ground accelerations that have been occurring there.

So, I'll go through and show you a lot of these quickly so you'll get an idea of what we're talking about. This is another one. You see it has a broken piece on the bottom and it's ready to fall down that cliff on that side. This is one looking downhill that's perched precariously on the edge of a slide here and it's ready to fall down into this--I feel like I could go over there and kick it and knock it off. But, we don't want to destroy any evidence because this is a developing technique and we need to have a good study of these rocks before we dislodge them and see how much acceleration. Here's another one that's perched, ready to go down. Another example of perched rocks and they occur all along the face of Yucca Mountain.

This is at the crest of Yucca Mountain. So, it's quite interesting because we know that the crest of the mountain will accelerate more than halfway down the slope. This, in fact, is near one of the strong motion sites that went in right after the earthquake. So, we'll get a good calibration to calculate how much ground shaking occurred during the earthquake at the site. And, this is downhill here. So, if

that shakes loose, it will fall down the hill.

And, here's a precarious rock up on the crest of Yucca Mountain to the north edge of the site and this is probably the most spectacular set of rocks there. As you can see, a number of rocks balanced there at the cliff face, all covered with dark rock varnish and the faces on the inside of the rock are covered with dark rock varnish, too, indicating thousands of years this has been sitting here like this. This is looking down at that same rock column from the top and you see the topmost block is bigger than the other ones. So, it's balanced up here on top and it's a very precarious situation. It looks to me like easily 1/10g would knock that off.

So, I have two more slides. And, this is a new one that I just put in. The reason for that is I got my slides that I had taken earlier of these things just last night and I was looking at that and I realized that there's a chance that on the side of Yucca Mountain that rock was knocked off. I did not actually walk up to look at this site, but I looked with binoculars--not with binoculars, but the best I could without binoculars from a distance and I don't remember seeing that, but I have to go back and check whether that rock is still there. But, the last one, which is probably the most important--this may be a $10,000 or a $100,000 rock because this one was knocked off by the earthquake. I went

back afterwards and found it had been knocked down the hill. It's at the south-most end of rocks I looked at, about a mile south of the mouth of the Solotario Canyon and John Whitney is going to go out there and look at it, but based on the darkness of the rock varnish and what he's told me before, it looks like this has been sitting there like this for thousands of years and this earthquake knocked it off, it split. You can see obvious evidence where it bounced against other rocks and scratched and so forth. So, for somebody who is trying to develop a technique, this is almost unbelievable luck to have an earthquake where we have a pretty good idea of what the ground acceleration was to calibrate the method. If the rock was sitting there several thousand years, to finally get one that calibrates your methods in such a short time, less than a year of looking at these rocks is pretty incredible.

So, I believe that these rocks indicate that as long as they've been standing there, and that's going to depend on the rock varnish dating people to determine how long these faces have been exposed to the atmosphere, there have not been large accelerations. Large accelerations, I guess, in this case means about 1/10g and there's two lines of evidence which I cite to calibrate this method. One is a study by David Keefer of the USGS who has looked at something like 50 earthquakes and looked at the distance out to which

you get rockfalls from these earthquakes and his conclusion is that on steep slopes like we have here at Yucca Mountain, rockfalls occur between intensity 5 and 6 which translates to a peak ground acceleration of about .07g; near 1/10g, but something like .07g. So, intensity 6 would have knocked down a lot of these rocks on Yucca Mountain. So, I think we have a control on the acceleration there, if his study is right and I have no reason to doubt it. The other thing that's interesting is what we got just now and that is this earthquake, if you use standard regression curves, predicts that the acceleration of the ground at the site that knocked over that lowermost rock was about 1/10g. So, there's a calibration of the method, two independent things that seem to indicate that rocks that are this precarious will be knocked over by 1/10g.

And, the last couple of things I'll just mention here just to show you the perspective on what I'm talking about, this is where the earthquake faulting occurred. We went up afterwards and Chris Menges of the USGS took a series of pictures with me of knocked down rocks along the base of Little Skull Mountain. There are literally hundreds of large boulders that have been dislodged. But, I think more exciting from a scientific point of view is it seems pretty clear to me that we can see previous generations of rockfalls because of the gradation in the rock varnish. The ones that

have just been knocked down have faces on them which have absolutely no rock varnish on them. Obviously, they split off the cliff. But, looking back, it looks like a few thousand years ago there was another earthquake there that knocked off a series of rocks which have intermediate stages of rock varnish on it. This is the site over here on Yucca Mountain which the rock was knocked down. This is the general area of Yucca Mountain where there were no rockfalls where the precarious rocks I showed you were knocked down. So, the closest site to the earthquake just by serendipity happened to be knocked down to calibrate my method.

Let me just make one brief statement about the aftershock activity. There's a high continuing rate of micro-earthquakes which is a little bit abnormal. We're still getting on our micro-earthquake network there--we're still getting like 40 to 50 micro-earthquakes per hour recording and, of course, we had a magnitude 4 on Sunday. The second point is there's going to be a bonanza of data here from an engineering, side effects, geologic response point of view. We've put strong motion sensors out in Midway Valley. We've captured some of the larger aftershocks. We have sites on rock in the Valley. We have one out in the middle of Jackass Flats to get the response of the deep sedimentary valley. We have sites up on Little Skull Mountain and, as Carl said, we're going to get sites in the

mountain which will provide--it's going to be--it's great luck from understanding a ground motion point of view to have a bonanza of data like this available to do these engineering type side effects.

I checked roughly to see if our micro-earthquake gear which is very sensitive to the repository site--we have a series of kilometer micro-earthquake instruments right around this site. So, I asked one of our technicians--I was out in the field all this week so I did not have a chance to look at records myself--to see if there was any triggered micro-earthquake activity down to magnitude 0 or less and the answer is no, as far as this person could tell. But, I want to go back and look at the records myself.

MR. GERTZ: Jim, I just want to clarify, all those precariously balanced rocks that you showed pictures of, only the one had evidence of any movement?

DR. BRUNE: Yeah, that's the only one that moved except there's that question about that one that I want to go back and look at. I just saw that in the slides last night for the first time and I realize I don't remember seeing it up there, but I'll have to go take a look.

DR. CANTLON: Jim, I seem to recall, oh, gosh, 15 or 20 years ago going up into the Nevada Test Site and seeing precariously balanced rocks that had fallen off following a couple of the big shocks.

DR. BRUNE: Yeah, I've looked at the ones very close to the Ranier Mesa and, of course, they're all knocked off there.

DR. CANTLON: Right.

DR. BRUNE: The faces of all the cliffs are knocked out. We need to do a study to see how far--as you go away from the shocks toward Yucca Mountain, we start getting precarious rocks and John Whitney and I are planning to do that.

DR. CANTLON: Questions from the Board?

MR. GERTZ: John, I have just one other observation. We also during the earthquake had people working underground in other Nevada Test Site tunnels, actually underground at the time of the earthquake. They have been interviewed. Most of them felt nothing. Some said, well, maybe they were on a platform and they felt the platform--certainly, a much greater distance from Little Skull Mountain, but once again, they were in tunnels in the vicinity and working.

DR. CANTLON: All right. Questions?

DR. PRICE: Just a quick one. On these pictures of these precariously perched piles of--what was the range of the vertical piles? You couldn't tell from the picture. In the one case, it was a person. How high?

MR. BRUNE: The one that had all the columns on was about 12 feet high total, the one that had the stacked up--

DR. CANTLON: All right. Well, let's bring Carl Johnson

up. Carl?

MR. JOHNSON: Thank you, Mr. Chairman, for the opportunity here to inject into the meeting and to present some additional information.

I might respond to Jim Brune's remark. I don't think it was blind luck or good luck that we had the foresight to identify and document prior to the earthquake the location of some of these precariously balanced rocks. It's been part of something that the state has been discussing with Dr. Brune for a long time and participated in documenting some of those original locations.

I'm going to take just a few minutes to add just a little bit more to what you've heard this morning to hopefully round out the information base for the Board relative to this particular event. We have had individuals in the field since Monday afternoon and a full team by Tuesday morning from Nevada Bureau of Mines & Geology and also from the UNR Seismological Laboratory. Many of those people are still in the field today. As you probably know, but just to refresh a little bit for the Board, the last week in June, that last weekend, it was quite eventful. We had started out on Sunday with the two large earthquakes in southern California which Dr. Clarence Allen is probably extremely familiar with; the Yucca Valley event and then the Big Bear event. Yucca Valley event was 7.4, the Big Bear event was a

6.6 magnitude event. But, some other events occurred in the general region which is I think interesting to note and certainly is food for future thinking on plate tectonics and how movement on one particular fault relates to movement on other faults.

On that same Sunday as the two southern California events, we had a 4 magnitude event at Mina. Then, on Monday at 3:00 a.m., we had the 5.6 magnitude event at Yucca Mountain and that was followed on Tuesday by a 4.6 magnitude event in Death Valley. So, we don't know yet, I think it's still out as to whether there's any relationship between all of these, but it certainly is fortuitous that they all were occurring about the same weekend.

This particular one, it's--we've talked that over already with Carl's remarks and with Jim Brune's remarks. The epicenter of the earthquake was Little Skull Mountain. It was originally identified as being Rock Valley, but now it's been moved northward a little bit to Little Skull Mountain. The epicenter could be on either those north/south normal faults that are in Little Skull Mountain or the strike-slip faults in an east/westerly direction that are in Rock Valley. I don't think we know enough yet to determine which.

This generally is a listing up to this last Sunday of the earthquakes that were recorded at Yucca Mountain by

the UNR Seismological Laboratory. The UNR Seismological Laboratory has three seismograph stations in and around the general Yucca Mountain area. As you can see from the initial event at 3:00 o'clock in the morning on the 29th, you had a steady decrease in activity through the 30th of June which was a Tuesday. Then, after that, the events dropped below magnitude 3 and there was a series of magnitude 2 events on through. Then, all of a sudden, on the 4th of July which was Saturday at approximately midnight, we picked up a 4.4 magnitude earthquake. This event here on July 5 was a followup to that one, a 3.1. This was the end of the analysis of the data as of yesterday at noon. And, so we may--the analysis that's taken place yesterday afternoon and last night and today may yield some additional magnitude 3s beyond this one on Sunday. We don't know at this point. But, that is as current as we have at this point.

This here is a plot that UNR people put together up through this last Sunday morning of the locations of the earthquakes and you just barely can't see on the bottom of the scale, but this is magnitude 2s and above. The locations are slightly off of what has been presented in other maps and what was given in the other maps. That's partly due to the fact that the seismological laboratory only has three recording stations down there. So, I think the denser network of the U.S. Geological Survey will provide us additional more

refined locations than what is on this plot. But, the important thing is to look at kind of the pattern of the events, although I would caution that I think this northwesterly trend, so to speak, of the epicenter is an artificial remnant of the location of our recording stations.

Another point here, just to bring this into perspective as to the size of this particular earthquake is we look at the larger historic earthquakes in southern Nevada and our database is very limited here. Essentially, prior to 1910, there just wasn't much of a population in southern Nevada. So, we just don't have a whole lot of information. But, as you can see from the listing of these five earthquakes, that the event that occurred at Yucca Mountain just a week ago is the third largest event recorded in southern Nevada in historic times.

At this point, I don't have much else to present, just to add some additional information for your use. What the earthquake and the effects of that earthquake have to do with the repository, I think I want to reserve that discussion until tomorrow when we make a presentation about some comments we have on the Board's fifth report.

DR. CANTLON: Thank you. Questions, comments?

(No response.)

DR. CANTLON: All right. We're well behind schedule as the result of putting the earthquake in there. Let's take a

short break. Let's take about 10 minutes and then we'll hope we get back on track.

(Whereupon, a brief recess was taken.)

DR. CANTLON: As we indicated earlier, we're going to now begin to look at repository program convergence. So, Steve Brocoum, would you take the rostrum?

DR. BROCOUM: Okay. We've heard a lot this morning about all kinds of new data coming into the program. So, the question is how do we pull it all together to be able to meet the program goals? And, so this activity is trying to start to think of how we pull it all together.

For the last several years, John Bartlett has been talking about the term "engine of evolution" in which, you know, he thinks of data cycles and using PA to analyze the data and then using these analyses to guide the program. John asked us to have a workshop and this activity sort of started last February when we had a workshop at Yucca Mountain with the senior managers from headquarters and the senior managers from the Yucca Mountain Project Office. And, at that meeting, we defined engine of evolution as overall process of integrating, focusing, prioritizing data collection and analysis and design activities, using iterative performance assessments and appropriate management and oversight, all leading to resolution of issues that we had--we have lots of issues--and decision making related to site

suitability and licensing.

In other words, this process should provide an appropriate and clear basis for management decisions related to program direction, schedule development, allocation of resources, compliance with regulatory requirements, and so on.

The term "engine of evolution" is a metaphor for a process that we are now calling convergence. The convergences is all the things that have to happen to reach the program goals. After this meeting in February, nothing much happened until May 1 when, under John's direction, Frank Peters issued a letter establishing the repository program convergence task force and we have two major goals; to produce a defensible site evaluation document and, if the site is suitable, to produce a defensible license application. And, in a sense, convergence will bring together all the major components of the repository program under an integrated management approach in order to minimize constraints and barriers to progress and to achieve the stated objectives.

In the letter that Frank issued which was issued on May 1, he asked us to develop strategy and action plans to focus the work on meeting those goals keeping in mind the following and this first bullet is really incorrect. It should be two bullets, protection of public and worker health and safety and maintaining scientific and engineering integ-

rity. Originally, it was two bullets. Someone took the liberty to combine them. The implementation of appropriate QA, prioritization and integration of all the relevant program activities, the ability to accommodate change and uncertainty. This program has a lot of uncertainty. We don't even know what our fiscal year '93 budget is going to be and it's kind of hard to plan fiscal year '93 which is just around the corner without knowing your budget. And, finally, to be able to present this in a logical and clear approach so that the stakeholders will have increased trust and confidence.

For those of you who were at the Director's Forum, several people made comments. I'd just like to paraphrase them. John Linehan from the NRC said has it all fit together? How do progress reports, study plans, annotated outlines, SCPs all fit together? Now, if John Linehan doesn't understand it, how can we expect the stakeholders because he's been following it for over three years. Steve Kraft said something along the lines of you cannot understand this program unless you've been following it for many years. It's our goal to try to present how this program is moving in a logical, clear, and concise approach. All of this was to be done within the context of meeting the goals as early as possible at the lowest cost.

So, this is kind of a summation of Frank Peters' letter. Now, I've added one viewgraph here that was supposed to be in the package, but was inadvertently left out. I think this diagram has been shown before. This is the concept of convergence where we take site characterization, information data, we use performance assessment, we iterate everything, we use the regulatory process and a design to reach a decision on suitability, and if a site is suitable, have a successful license application.

The organization that we set up looks like this. This is not a long-term task. This task started May 1 and will end August--is scheduled to end August 31. The task is led by Frank Peters and I'm his executive director worrying about it day-to-day. For this particular task, I report to Frank. Normally, I report to Carl for all of the activities. The actual convergence plan will be written by this group led by Mike Cline of the M&O. The M&O is uniquely suited to pull us all together, being that they're located both at Yucca Mountain and at headquarters and all the other parts of the program.

We have represented here also external relations; Alan Benson representing Jerry Saltzman. We have QA represented; Bob Clark from DOE. And, we also have program strategy, the strategic vision of the program, represented by Tom Isaacs and his people.

At the February meeting, several issues came up: PA, the role of PA; data cycles is something that John Bartlett has talked on for several years; evolution of regulations--you know, 191, rulemaking, changes in 10 CFR 60--what's our overall licensing strategy; and how do we close or resolve issues with the NRC? So, in Frank Peters' letter, he mentioned most of these groups and we decided to group them into three logical, topical areas. The first being site characterization which consists of PA and data. We're using data cycles here in the broader sense, not in the sense of just data management, but everything from collection and prioritization of data to analysis. Design evolution which we include the interface between the repository program, MRS, and transportation and repository and EFS design. And then, under regulatory compliance which we include regulatory evolution, license strategy, and task issue resolution. Each of these three topical tasks was asked given guidance to write a topical proposal which was due yesterday and which I understand we have in. And then, this group was going to take these three proposals and merge them into one overall repository program convergence plan.

The repository program convergence plan will be an overall implementation plan telling you how we intend to do business. The SCP, for example, is a plan. That tells you what we're going to do, not how we're going to do it. And,

the goal, as I said, is to present it in a logical and clear way for convergence. We will integrate the three topical group proposals and they will be consistent with the overall program strategy.

Specific things that we're going to attempt to identify are the critical actions needed to achieve convergence. We may not be able to resolve all of these things, but we're going to bring them to management's attention, things that management has to decide. If they don't decide, they are in a sense delaying the program. We need to have a process for evaluating alternative actions. There are many suggestions in our program of how to do something differently or better and they tend to be ad hoc and, to some degree, random. We need to have a systematic way of looking at all of these things.

We need to identify all the necessary documents that our program will use to communicate with, if you like, all the stakeholders or the interested parties. We're not talking here about the lower level documents way down in the organization. We're talking about the documents used among the DOE officers with OCRWM and between OCRWM and the rest of DOE and between DOE and the outside world. For example, in issue resolution, we have annotated outlines, we have issue resolution reports, we have topical reports, we have scientific papers. We want to screen through all of this and try

to lay out in some logical way which other types of reports we need to kind of reach our goals.

We want to make sure that line managers are identified for each major decision or a process put in place to do so. In a sense, we want to provide integrated management overlay at the program level. This is really a high level activity.

We want to clarify the role of systems integration in achieving convergence. You know, we've been debating systems as long as I've been on the program. I think we have made a lot of progress and you'll hear a lot more about that today. And, it's in my mind not a big issue as it would have been a year ago. At least, today, we have agreed on a document hierarchy that all parties have signed off on.

We need to make sure at the management level of all the proper interfaces that are present. We had an internal meeting where we discussed draft--proposed and it became pretty clear at that meeting that not all interfaces were present. We had detailed discussions on data and we had detailed discussions on PA, but they were not--at least, for that draft adequately integrated.

We need to develop a plan for external pre-decision involvement. DOE has made a commitment to pre-decisional involvement. How do we implement that commitment in a meaningful way? That's what we're struggling with. And, Alan

Benson representing Jerry Saltzman is on a convergence work group and is working on that.

We need to have a way of identifying realistic schedules for critical-path milestones. Usually, our schedules are in a sense out of date or are baselined. Many times or by the time they're baselined, they're almost out of date.

And, finally, when resources are scarce, we need to have a systematic way of allocating our resources. It's not every office within OCRWM trying to get the largest slice of the pie.

These are the major milestones for this activity. We had the meeting in February, but this activity really was kicked off on May 1 with Frank Peters' letter. The task groups were formulated on May 15. A presentation was made to the TPOs and to the stakeholders on June 12. The topical proposals were due yesterday. I understand they're here. We're having our meeting today. And, the last major thing I want to talk about are the workshops that occur August 11 and 12, and finally, a final draft plan on August 31.

On August 11, we're going to have a workshop with the task force that writes the overall plan, with the topical task group members, and with the management review team. This will be the first time that this review team which consists of all the ADs and ODs, the senior managers from the

M&O, and a senior manager from Weston will hear the plan. At that meeting, which we are going to run like a normal internal DOE meeting, we are inviting all the stakeholders, so that the stakeholders or affected parties will hear this plan at the same time that the management review team hears it for the first time. That will happen on August 11.

On August 12, we will have an executive session to take all the comments that were generated on August 11 to decide how we're going to finalize this plan. So, in a sense, it's our attempt to implement the pre-decisional involvement of the stakeholders. We'll have them in the meeting and then we'll make our final decisions after that meeting.

The last two viewgraphs I just had here were a backup just to tell you the kind of information we ask for in the detailed task plan. So, I wasn't going to talk about those.

DR. CANTLON: Okay.

DR. BROCOUM: Thank you.

DR. CANTLON: Questions from the Board?

(No response.)

DR. CANTLON: Let me ask this kind of a question. As you get this process of convergence underway and you have this myriad of study plans, many of which are now fairly old, many of which are being updated, but as we view some of the

updated ones, they're not truly updated; for instance, there's one of the updated ones that's still talking about a drill and blast shaft. What process do you have to make sure that the process of convergence doesn't freeze you on what is an obsolete based plan? There are many changes that have already--you've already accepted in the original base plan that was--

DR. BROCOUM: Oh, yeah.

DR. CANTLON: And, that process, hopefully, is going to continue to mature. What about what you're doing will prevent freezing on that?

DR. BROCOUM: We're not trying to freeze the program in some past mode. I mean, the program is always evolving. What we're trying to do is clarify for ourselves and for the outside world the kind of steps we're going to go through, for example, to decide if the site is suitable. How do we make that decision, who makes the decision, what are the documents we're going to produce to make that decision? I don't think that is clear in our minds at this moment. Okay? So, that's the kind of thing we're talking about, the how, not the why. Okay? It's the process. We're trying to make that distinction here. The SCP says the studies we're going to do. That could change. We're trying to tell you the process for implementing this change.

DR. CANTLON: Warner?

DR. NORTH: Could you be a little bit more specific as to how you are going to unfreeze the situation from the present? Now, Dr. Cantlon described the situation. There's a study plan that was signed off in April of this year with some revisions in it, but left completely untouched was a long discussion about mapping in the tunnels and how one would distinguish fractures that were caused by the blasting from fractures naturally present. Now, it strikes me that that's an oversight that you have a study plan revised and nobody notices that the experimental shaft facility has become the experimental studies facility and makes the appropriate changes.

DR. BROCOUM: That is an issue of accountability and we have to make sure people are accountable. I mean, I can't speak for that specific example, but I think it tells you that you need to have a DOE manager or surrogate accountable and you will hold that person accountable. That's what we were trying to say politely in some of these viewgraphs.

MR. GERTZ: Steve, let me address that process and I don't know the details of that particular study plan. But, the theory is we revise study plans continually. I know there's about 10 after the original revision that have been revised in a controlled manner. Many are revised for a specific purpose in that time frame. I don't know, I'm sure that revision was not meant to up update shafts to ramps. It

might have been meant to update another part of the study plan and rather delay that study plan while we updated shafts to ramps. We revised what we needed to get on with our near-term activities. There will be another revision, I'm sure, that will revise mapping, fractures, and address that discussion. Perhaps, maybe we should have took it out and said TBD. You know, I don't know the details. But, the process is in place. It's a control process that we know what this revision is. It still is probably not the current revision for the way we're going to do business and that will follow as we figure out what we're going to do. But, we're responsible for updated study plans before we implement them in those areas.

DR. BROCOUM: But, you're hearing a more fundamental issue. Our baselines are usually out of date. That's the issue you're really addressing--

DR. NORTH: Yeah, I think that's the issue and how do you get back in control?

DR. BROCOUM: --at this level here.

MR. GERTZ: We are in a change control process where a study plan has change control and, as it gets changed, we change the SCP. We have costs, schedule, and technical impact analysis done, and then we determine whether to implement the change or not.

DR. NORTH: But, see, the cost schedule impacts would be

critical because, in fact, your costs and your schedule are based on material that's several years out of date. That gives you some rather misleading information as the basis for planning your program.

MR. GERTZ: Yeah, certainly.

DR. BROCOUM: Well, the other major issue is, you know, as long as I've been on the program, we've always assumed two years hence or one year hence, we'll get our big budgets. And, so we've always planned on those assumptions. Okay? Is that realistic planning? Okay? That's one of the issues.

DR. CANTLON: The initial list of study plans were actually designed to get information based on early agreements between NRC and DOE. And, it may well be that as you go into a highly prioritized approach to coming to closure, many of those pieces could be set aside, possibly permanently, but at least to a much later date. How do you visualize that process working, of coming down to the absolute bare boned set of what do you need, when? How is that process moving?

MR. BROCOUM: That is one thing that we really have to attack vigorously. I don't have a vision in my mind how that should happen, but we have done four or five priorities since I have done the program. But, it hasn't always affected the field work because there's no much other procedural and long lead times. We have to get that under control. But, it's

basically within DOE's power to do that. Okay? So, we are going to make some suggestions to management. It will be up to management to implement them. I want to make one more thing. All this kind of work won't help much unless there's strong management oversight. It's really--it's got to be top-down for management to make this work. It's not a bot-toms-up issue, it's a tops-down issue in my book.

MR. GERTZ: John, let me add one thing. The vehicle we see to change the existing program is called our semi-annual site characterization progress reports. And, when we deter-mine that there's a change in the program, we document that by reference or specifically in the semi-annual SCP progress reports. Once we make that determination, that's our formal way. There has to be a lot of things happen before we do that including interactions with our regulator and things like that.

DR. CANTLON: You know, this may be a perspective. We're obviously on the outside looking in and so bear with me. You have a process which has been emerging now for a long time. You started with a base plan, as I say, many elements of which you've already decided to change and, from what I understand, you're contemplating still other major changes in that. When you have a change in this semi-annual meeting, you have a lot of inertia that you're packing along because you've got a lot of people dedicated to process and

data process that's underway. What internal management tool do you have to begin jettisoning pieces of this material which clearly, if you're going into tougher fiscal constraints, you're going to have to jettison something. But, is there an internal process that you're thinking about to get that done?

DR. BARTLETT: Yes, there is. The core to that entire issue of managing to resolution, which is really what we're talking about--and, I might mention, if you'll notice, there's a really interesting thing going on here. We have a program that's evolving at the same time as pointing toward convergence. The basis for the actions comes from estimates or specific definition of requirements to close the issues. And, this has to do fundamentally with requirements for regulatory compliance, a good many of which are not defined at this stage of the game. What we have are regulations in the broadest sense which are in themselves still in a state of transition, and operationally, those regulations get implemented through rulemakings of "here's the means and requirements for demonstration of compliance" with the regulatory requirements. Those are not in place. They are needed for us to make these decisions. We have in my mind an obligation and a responsibility to, in fact, take the initiative to define what those are. So, in parallel with the pro- gram activities having to do with site work and everything else,

we have on the regulatory side of the house initiatives going toward what are the requirements for demonstrating compliance or, in essence, closing the specific issues. It's a parallel effort and it's an initiative which, I say, we have to take because we can't sit around and ask the NRC to tell us what to do. They won't. So, we're going to tell them what we intend to do and here is our basis and that gives them then a baseline from which to make their judgments and for us to interact with them to come to closure on these things. So, all of these things, the decisions what to shed, what to retain, what to change as we evolve, really depend critically on the criteria for closure which translates in, more or less, reg speak as the rules for demonstrating compliance. Some of that will be formalized. We will be asking for specific rulemakings on some of the major issues and some of it will be essentially through agreement in this implementation of the dialogue of the annotated outline and the issue resolutions issue. That's where it comes from. So, we have to develop those criteria at the same time we're making the decisions. They are the basis for the decisions and that's the parallel part of the program.

DR. CANTLON: To pursue that, some of the internal DOE language really evolved at a time when you were trying to choose among site candidates. And, you've now--Congress made that decision for you on kind of a temporary basis. Yet, the

language from which you're departing still is tied to that old site selection language. Is anything going to happen to sharpen it up, to get it to site assessment, as opposed to site selection?

DR. BARTLETT: This is part of that process. The siting guidelines, 10 CFR, Part 960, where DOE rules basically for selecting preferred sites. They contain a range of factors to be considered. Within that range--and, there's 40 some depending on how you count--there is about half of them which are virtually identical to the NRC's requirements and the safety standards for disposal which they list as favorable and unfavorable conditions with regard to licensing and safety performance assessment. So, they form the common core of the two and what it amounts to is that the siting guidelines expanded beyond that so you could have a basis for differentiating between candidate sites. What needs to be done in all those cases is to translate what is really pretty qualitative language into some kind of a metric for a decision and our effort basically comes down to that; to translating that into some of the specifics. For example, in other areas where the NRC promulgates rulemakings or rules for compliance, something simple like doing a chemical analysis, they'll specify specific techniques that then become the basis of you use those techniques and use them under a quality assured program, then you are in compliance. Well,

we have to invent those. This program has none of those yet. We will be taking the initiative to invent those metrics to translate those requirements and focus on the specific issues that we deal with.

MR. BROCOUM: Just to give an example, remember when the ESSE presentation, I think the Board--Jean Younker, I think --that the contractor said that it was enough information to make findings on half the qualifying conditions and almost all of the--conditions. Okay? At a recent ACNW meeting, maybe two or three weeks ago, the NRC staff said in our opinion DOE should--there's not enough information to make any findings at this time. So, we have like a gap that we have to resolve. But, basically, that's a DOE decision. Those findings are a DOE decision. I think John is right. We have to be able to have a basis--

DR. BARTLETT: So, we can go ahead and make findings, take them to the NRC, and then it becomes the baseline for interaction.

DR. CANTLON: Board questions?

(No response.)

DR. CANTLON: Staff? Dr. Chu?

DR. CHU: Yeah, I have one, another one from the outside looking in, Steve. How is this related to the management systems improvement strategy--

DR. BROCOUM: The management systems improvement

strategy is being--the results of that are being used in improving our systems documents, right now. The output of that, if you like, is going into development of our systems requirements right now which I believe will be talked about by Bill and the M&O a little later. Okay? We are talking here high level management interactions, not requirements. Okay? We're talking about managing the program from my perspective, not specific requirements. Okay? How the ADs relate to each other, how the offices relate, and how DOE relates internally and externally. Okay?

DR. CANTLON: All right. Let's proceed since we're running behind schedule.

Robby Robertson on TRW for the M&O?

MR. ROBERTSON: Thank you, John.

We gave you a fairly substantial briefing some time ago about the role of the M&O on this program and the kind of activities that were assigned to it and kind of how we were gearing ourselves and organizing ourselves to take on those and a little bit of a snapshot of what was going on with the transition. I'm going to talk to you today in kind of a summary fashion about what's--just to reacquaint some of the new Board members what the M&O organization looks like, where some of the players are distributed, and give you a little bit of the highlights of the activities to date and our focus for the future and kind of a little bit of a summary picture

of where I think we are on the program for the M&O.

Our organization is set up, I'm the general manager and we have two assistant general managers. Art Greenberg, over here, his deputy John Cowles in the back. Ray Godman is here. Dale Foust is somewhere in the wilderness. We can't find him and Jean Younker is standing in for him for today. And, I have my typical set of staff functions. Many of you recognize Tom Cotton who has been with the program a long time. My finance and administration functions, contracts with DOE. There's a lot of that activity. And, our human relations and our training activities and Ed Taylor is doing a lot of the strategic plans and international programs in concert with Tom and Dale in managing the site activities out here for Carl. You'll be hearing some about the organizations of all three of these organizations a little later, but I just wanted to point that out as to the way we're structured.

To remind some of the old members and perhaps acquaint some of the new members with our team, the--oops, a little bit out of skew here in terms of getting things on the board here. TRW is the prime contractor. We hold the contract with DOE and these other teammates of ours are subcontractors in a technical sense to us, but they are teammates. And, you will find these individuals from these different companies who are integrated completely into a

badgeless organization. In some cases, they're seconded into management roles as a part of the M&O construct. We, as the prime contractor, are concentrating on integrating the whole program and doing the system engineering and so forth. Fluor Daniel is concentrating on surface facilities. Morrison Knudsen, underground, the ESF as well as the repository. Babcock-Wilcox Fuel Company with the engineered barrier system. Woodward Clyde, site characterization, technical direction and integration. Duke, licensing, outreach, MRS design, and of course, lead for QA since they have a strong nuclear industry background. INTERA, a smaller company who concentrates on performance assessment, played a significant role with Sandia on the WIPP program. E.R. Johnson in storage and transportation. J.K. Associates, public policy and socioeconomics. And, RDA Logicon in some system engineering and modeling. That gives you a little bit of a feel for what the focus of the individual partners are on this.

We'll talk a little bit about the manpower by program area. A snapshot as it is today and how we see it at the close of--now, let me caution you, these are figures as of June numbers, head counts. These are figures as of the end of fiscal '93, September '93 head count numbers coming out of our proposal to DOE as to how the M&O would recommend be staffed based on the administrative budget request approval. This will clearly change as a function of whatever

the budget comes out.

So, I want to point out briefly to you what the growth is that you're going to see during this period of time as to where we are now. The area here is one area that will grow significantly. The bulk of this growth in the system engineering and integration activities are a buildup with the MRS and the transportation arena. And, the Las Vegas transition of the change control, the site characterization technical direction, plans and procedures, and a configuration of management. That's the big bulk of things. And, you might ask, well, my goodness, you know, your management is growing here. Well, proportionately, it's not growing that much. It's going from 18% in this case to 14% over here, but the bulk of the head count growth here is in program control. We assumed control of the PAC system in September of this year and we will also be doing the program control functions for the MRS program as it evolves. We're adding some training people in this category, as well. So, that gives you a little bit of a picture as to where the M&O is focusing, where by location, because this question keeps coming up.

Currently, 63% of the head count is in Washington with 10% here in Charlotte doing MRS design and Carl's program represents 27%. You might recall that this transition activity here was delayed somewhat and won't be complete for another year. We're about halfway through that process.

You'll notice that as we move into this, there is a concomitant growth here in Charlotte as we move into the Title I--design for the MRS. There's a modest growth at Washington here which represents about 250 heads. About 37 to 40% of that is growth of the MRS and the storage and transportation activities. About 21% of it is records management and information management and about 20% of it program control and quality assurance. There's some modest growth also in the areas of regulatory compliance, international and strategic plans, studies, and modeling. But, the bulk of the growth is occurring out in Las Vegas where we go from 27% here to 41% out here, as you might expect with a sizeable number of heads out there. The bulk of that growth being in the design--advanced conceptual design work for the repository, the engineered barrier system, and the Title II design work for the exploratory studies facility.

One other question might be how is this distributed among the various skill mixes of what we've got. One thing to point out to you is in this TRW, now with the way we're structured, all the secretarial support, all the records management, all the information and ADP and support work is carried in TRW's numbers. So, when you get over here, these are all hard engineering numbers on this side. So, again, you see considerable growth in the design functions out there and in growth here with the design work building up on the

MRS design and your surface facility and a buildup also with B&W to do the waste package work.

Let me just touch on the highlights. There are a number of things in here and I'm not going to try to cover them all. But, I think it's significant that we pass--the M&O has passed three QA readiness reviews and we're in the process of anticipating a letter this week from DOE saying the M&O is ready to proceed with quality affecting work with the exception of the hole points that have been established. Most of those hole points are for work that it not yet scheduled to be done. So, I think we've done a remarkable job, been strongly supported by DOE in getting our QA program in place.

Someone asked a question about the MSIS program. The main product out of that is the document hierarchy set of documents which gives you your program management documents and your baseline technical documents. Those have all been agreed to and drafts of most of those key documents are now evolving in this process and we feel by the end of this year we'll have most of those documents in place both at the program level and at the project level.

We have established with Carl a new management and integration system at Yucca Mountain along with his TPOs, regular reviews of the ongoing participants' work, both cost and schedule, as well as technical content.

You're going to hear more about these systems studies. These drafts of these license annotated outlines have been prepared and are being iterated and they are the principal vehicle now that's been agreed to by DOE and the NRC for assuring that we're getting closure of agreement and the content that is needed for that long-term license application should the site be suitable. We've begun a number of these site suitability resolution issues with NRC. The first one being erosion which we just started. We did complete the MRS conceptual design. That document is now complete and is awaiting final DOE signoff. It will go to the DOE headquarters ASAP in, I believe, it's October. Isn't it, John? In October for approval to move into the Title I design. A lot of support from our organization, the DOE, and the negotiator in the siting and we have assumed the technical direction and integration of site characterization, albeit it at a modest staffing level at the moment because of funding.

We have restructured the form of assessment activities in conjunction with DOE and have assumed the management and integration role for that. We will assume this fall in October the ESF Title II work and we have already assumed the construction management there on that program. We've assumed responsibility of consolidation of all the program records management and in that process saved about 25% head count in that consolidation. We are develop-

ing the InfoSTREAMS which is the software system that will acquire some 40 million pages of data that will eventually interface with the license support system. So, we're developing that. Some of you may know we had a significant role in assisting DOE in developing their position in this recent rulemaking. I guess this never did get changed because this is supposed to be rulemaking on the 191.

Let's see, what are we going to do in '93? We're clearly going to drive to make sure that we get fully audited on all the rest of the hole points in our QA program that allows us to do quality affecting procurement and all the software V&V work that will be done.

You're going to hear a little bit later in the day from Rickertsen who is standing in for Frank Ridolphi, who is ill and couldn't make it, about this systems studies road map, the thing that we've talked a lot with you about, Dennis, and Dr. Price, and we hope that this will show you we're not finished with it, but we have a framework in which that's going to come into being. I think we've got these documents I've mentioned. I hope by the end of this year, we'll have those finished and in place so that we have a program management baseline and a technical baseline against which to manage. Obviously, we've got the Title I and II designs to focus on and a lot of siting selection and evaluation work to do.

You perhaps are aware of the Phase I casks procurement which are buying essentially current technology casks to make sure that we can meet the '98 date. That procurement acquisition is going on under the M&O and we will be getting that underway. Full integration of the site characterization is our goal early on in the beginning of this fall. I mentioned the Title II design, getting into the repository and EBS conceptual designs, to give these areas the emphasis that are needed so that we don't have problems with the interface between the ESF and the repository, and that we look at some options in terms of the engineered barrier system as defense in depth. And, obviously, there's a significant transition of work and a ramp-up of people with the M&O in Las Vegas that we must manage properly.

But, see, in summary, I believe the transition of the M&O into its management and integration role is going well. That does not mean that there aren't some warts, bumps, and a little bit of difficulties along the way and we had some delays in getting that to where we want it, but I believe it's going well. I also believe that our program, that the M&O program and project, QA systems, design controls, management systems, and technical baselines will be in place to support a major program ramp-up in the near future. In other words, we will be in place by the end of this year with what's needed to assure that you can manage a program

effectively with this size. It's going to take time against these baselines to pare out some of the redundancy or to find those test plans that need to be eliminated or to find those duplications and things where there are other ways to go about doing it. But, I believe those systems are in place. And, this may sound like a commercial, but as a senior program manager, it is absolutely essential that one has some adequate and predictable annual funding so that you can meet these goals, but more importantly control the program costs because any time you slip things, you're never going to-- you've got this big historesis loop that's associated with it and this is really causing us a lot of grief. Replanning exercises are time consuming.

That's all I had on the charts. If there are any questions, I'd be happy to try to answer them.

DR. CANTLON: Okay. Questions from the group?

DR. DOMENICO: I have one. Your first slide, your first pie diagram, could we take a look at that?

MR. ROBERTSON: Yes, sir.

DR. DOMENICO: No, the pie diagram.

MR. ROBERTSON: Oh, pie diagram, okay. Which one?

DR. DOMENICO: The first one, yeah.

MR. ROBERTSON: Do you want the program areas?

DR. DOMENICO: Manpower by program areas, sure.

MR. ROBERTSON: Okay, this one.

DR. DOMENICO: That will work.

MR. ROBERTSON: All right.

DR. DOMENICO: Does that also--that does not represent the allocation of the total budget, does it?

MR. ROBERTSON: Oh, no, not by any means.

DR. DOMENICO: Okay. But, if we're dealing with a budget of, let's say, $275 million, what percentage would that represent?

MR. ROBERTSON: This number right here represents an end point of a buildup from about--I want to say on the order of 200 or 300 people to here and that represents approximately $70 million. Now, you're got to be careful about some of that because a lot of that there was $15 million that were monies that had to be carried forward for lease terminations and things that were kind of a one time startup in them. So, if you take those numbers out, you're somewhere in the range of $50 million for this as an average number. This number represents a ramp from there to here that would probably be in the range of, oh, $125 million or so.

DR. DOMENICO: I see. So, the first diagram, the current diagram, represents less you say, by $50 million out of a total. That's the M&O--

MR. ROBERTSON: That's correct. And, what it represents also in this case is a good bit of work having transitioned over from other contractors that were previously on the

project.

DR. DOMENICO: Yeah. In your ramp-up, are there any-- does any of that include any field work of sorts?

MR. ROBERTSON: Field work?

DR. DOMENICO: Yes?

MR. ROBERTSON: Well, let's see, yes, there are people in here who are doing technical direction of the site characterization program. This means people out there understanding what's going on and dealing with that on a day-to-day basis. If you want to call it construction management of the surface based testing is in here, construction management of the ESF--I mean that may not necessarily be field work. And then, over here, there's a lot of design work that is actually design work for people in Las Vegas that are doing the design work for either the ESF Title II or the engineered barrier system or the repository components. So, those are, if you will, field--I guess you could call them field work.

DR. DOMENICO: And, the laboratories and the USGS and all these other components of the--they're paid out of other parts of the budget. Is the M&O managing their activities, as well, or--

MR. ROBERTSON: Let's see, we will transition in fully into that now. There are only a couple of places where we're really fully managing that at the moment. The performance assessment is one which we're doing that in conjunction with

Carl. But, that will move into full tilt this fall. In here, yes, that has full management of those activities, technical direction of those activities, under the guidance of Carl and his people.

DR. DOMENICO: So, you will have considerable input into the priorities, the allocation of the monies, that are going to the field people and laboratories and the experimental work and things of that sort?

MR. ROBERTSON: That's correct and, as you'll see from our 2001 exercise, we're laying the ground work to try to get that framework in place where we can examine those things, you know, as a kind of a critical outside look at it. Obviously, we have to depend on them for the fundamentals of what they think they have to accomplish, but in conjunction with Carl's management and headquarters' management, I think it's part of our role to challenge those and say, hey, look, should these be done? I believe the one thing that Carl perhaps didn't hit on as much is that there have been an enormous number of cost reviews of this program and these by outside people, including this last one which I thought was pretty thorough by the guys from the ICE Committee, Gilbert Commonwealth. And, for the program, as its defined, people keep coming up with the same number and they're right within the margin of error with where Carl's program is. The real question is, is all of that needed or is there duplication?

And, I submit that we, in conjunction with DOE, are on a path to try to understand that and make sure that we provide them with the muscle to make those decisions.

DR. DOMENICO: This ramp-up from 50 to 125, do you visualize that will be ramped up even further in '94 or '95?

MR. ROBERTSON: Let's see, it really depends on the rate of things. I would see this flattening out a little bit until you reach the point where you started into Title I/ Title II design for the repository itself and the waste package itself. And, that would perhaps provide an overlay on this thing. I'd see that coming, you know, some--it depends on again the timing of a lot of these things. This is about where you're going to ramp to though, however, on the MRS and transportation program.

DR. DOMENICO: And, I gather, as manager, you are in agreement with what Carl has told us about getting under-ground, perhaps '95, '96, as opposed to more small allocation to that activity in the near future?

MR. ROBERTSON: Those are being reviewed now in the 2001 exercise that we're going through now that you'll hear a little bit about. You're not going to hear much result, but you're going to hear a little bit about the methodology and what's going on. That's being looked at. I'm sure that Carl has mentioned to look at Busted Butte for some of the things that perhaps you could do in parallel with it. All those

things have to be traded in terms of the overall costs in the envelopes. Clearly, you could save some time if you could get at ordering those tunnel boring machines early which is, of course, hoped for.

DR. DOMENICO: Then, I guess if some of us want to get underground a little earlier, you have no objection to us lobbying you on that?

MR. ROBERTSON: Certainly not. I mean, you lobby Carl, you might as well lobby me, too.

DR. DOMENICO: Oh, thank you. Thank you.

MR. GERTZ: I want to get underground earlier, too, Pat. I don't think that's a debate. Pat, let me add one thing, too. Maybe Robby didn't emphasize it, but, Robby, your allocation is based on the President's budget of $392 million.

MR. ROBERTSON: Oh, absolutely. This is 392. This is not at 275.

MR. GERTZ: Not on 275. You talked about 275 and I wanted to eliminate that as an element of confusion. Robby's presentation on the right hand side is based upon a program allocation of 392 million.

DR. DOMENICO: But, if the allocation is 275, that allocation does not change? The monies are the same?

MR. GERTZ: The whole program has to change, yes.

DR. DOMENICO: That is reduced accordingly?

MR. GERTZ: Yeah. Who knows how--

DR. DOMENICO: That's not fixed?

MR. ROBERTSON: This is not fixed, no. Absolutely not.

DR. DOMENICO: Okay.

MR. GERTZ: And, I need to respond a little bit, Robby, to what John asked earlier. Is when we get our money for the year, we then sit down with our top management team, including the labs, and figure out what we're going to do, allocate that work out, see what are our priorities based upon our money, and that's when we establish next year's priorities. It's not fixed now.

DR. DOMENICO: Then, if there's no change in budget, the 1993 pie will look like the '92, probably, right? If there's no increase?

MR. ROBERTSON: No. No, it will not because there are a significant number of activities that are currently being performed by other contractors that are not in this wheel. They are in this wheel, some very large ones. So, there will be a substantial growth, you know, even if the budget is flat for the program because of that transition--

DR. DOMENICO: So, it will exceed 50 million then. You won't stay within the 50 million?

MR. ROBERTSON: That would be my guess.

DR. DOMENICO: Yeah. Okay.

MR. GERTZ: But, we have to do tradeoffs. That is, do

we do ESF design, do we even buy TBMs or do we continue surface-based testing if we have reduced budgets. What's the best thing for the program?

MR. ROBERTSON: Big swingers in this are ESF Title II design and MRS Title I design and the transportation cask acquisition.

DR. CORDING: On this--you're talking about the re-base-lining on the SCP. Are you looking at a potential for a significant change from surface-based experiments to under-ground? I mean, we have an expanded underground platform from which to perform tests and it seems to me that there's an opportunity there to do more underground and to actually reduce the surface-based program.

MR. ROBERTSON: I think that's a possibility. It's being looked at as a part of the 2001 exercise where we're trying to take a fresh look, bottoms-up at it, and then once we've got those alternatives together, we'll look at them in conjunction with Carl and see if there are some trades that can be made on the assumption of what goes forward. I'm sure that one of the reasons that we'll probably continue to drive on the surface-based testing is the uncertainty about the budget to really get down to depth again. But, that's being looked at. I don't have an answer to you, yet, but you would think it's a logical process. That might be.

DR. CORDING: I understand the uncertainty about getting

down underground, but it seems to me tunneling--the whole program is somewhat like what a single tunnel project typically is. Typically, in a tunnel project, if you aren't advancing the heading, you're spending money and not making any results. You've got to have a certain amount underground taken care of, opened up. You've got to perform tests underground. And, if you don't do it for six more years, you're going to have overhead going into things that is less productive than it would be if you are actually carrying out the work.

MR. ROBERTSON: Right. Let me also point--

DR. CORDING: There's a typical approach to sort of a linear system. You've got to advance the heading in order to make progress.

MR. ROBERTSON: I agree, but let's all be honest with ourselves. If this budget is 275 next year, there are some tough programmatic decisions, not Yucca Mountain Project, programmatic decisions because we've got a big thing going with the MRS, MRS sitings, and all that sort of thing to make the '98 date. You just can't ignore those off to one side. They have to be played into this which--and, John will have some tough calls to make which we hope to help him with some completed staff work.

DR. CORDING: Well, my focus has been Yucca Mountain, itself.

MR. ROBERTSON: I understand.

DR. CORDING: But, I understand your other concerns, as well.

MR. ROBERTSON: Right.

DR. CANTLON: Robby, you mentioned the fact that in the records area, you were able to get a 25% personnel reduction. Are there other targets that you see within the operation as you now go through the phasing that are reasonable opportunities so that you're not a total add-on of all that many personnel, but there's going to be replacements?

MR. ROBERTSON: Let's see, hopefully, in those areas in which there is transition, we're hoping that there's going to be a 20 to 25% reduction, a lot of it from consolidation. The records management is a good example. I mean, it's not because we walk on water necessarily. It's the fact that the records were consolidated. Unfortunately, this balloon is moving all the time. So, it's very difficult to say, you know, what's happening because there was very little work being done, as an example, in the design areas which we were involved in here with this very modest number, but a little of that transition from the labs and so forth. And, so again when you look over here, all of a sudden, you've got a growth of almost 200 people in the design area over here. That's new work that wasn't being done before, although some of it was being transitioned from RSN, as an example. But, we are

attempting to do an analysis of the transition. And, in those cases where we can isolate though and show with some certainty, we're trying to do that to try to show whether or not there's some saving. One of the things to remember, you know, this right here and even this absorption, most of which takes place in the early part of the year next year, again I believe that there are lots of opportunities to question the value added and the need for some of them. We've not digested that well enough yet to get into that mode yet. There's the efficiency of combining them, getting them in place, but we haven't yet had an opportunity with DOE's management to go in and say, look, do we really need this much paper? These are fairly cheap people. Let's see, inexpensive people--let me phrase that differently--here in that sense.

DR. CANTLON: Yeah. Questions, Board, staff? Russ?

MR. MCFARLAND: Robby, the REECo solicitation that closed last week had in Phase I, a major technical support activity to the REECo organization. How did that technical support activity relate to the Morrison-Knudsen technical support activity that's a part of your team?

MR. ROBERTSON: I would have--let's see, I would assume and again I'm not familiar with the details. Carl can probably amplify on it, but I would assume that most of that technical support is associated with putting the specs

together for the tunnel boring machine, you know, and they're assisting them in their portion of defining the requirements for the details of the construction, you know, the physical construction. Carl, do you want to--

MR. GERTZ: Yes. Russ, let me clarify that a little bit with you because we just went through it at headquarters the other day. But, under Bill Simecka, we're going to have an office called construction management. In essence, that's going to be responsible for carrying out the ESF construc-tion. REECo will be the constructor, but the arms and legs, the DOE person may just be one or two in that construction management office. The MK team will be the construction manager supporting that team. Doing the work will be REECo. The current solicitation will have a world's best subcontractor for TBMs or for underground excavation on the REECo team and they'll provide expertise under the guidance of the M&O team to carry off the entire program. So, the hierarchy would be the DOE construction manager, the M&O people assisting us in that day-to-day management and then designers and constructors, one of the constructors being REECo, with a subcontract being the world's best tunneling people.

MR. MCFARLAND: All right. Thank you, Carl. I think if you asked MK, they would challenge that title as the world's best underground constructors.

MR. GERTZ: Oh, yeah, to put MK through a conflict of interest couldn't be part of that competition in the--

MR. ROBERTSON: The fact that they hold 24 world records in tunnel boring probably would support what he's saying.

MR. GERTZ: I think between the MK team and whoever we'll choose out of the REECo competition that was eligible due to non-conflict, we should have the world's best team put together.

DR. DOMENICO: My last question, Robby. I didn't see SAIC mentioned anywhere on your charts. Have they left the program?

MR. ROBERTSON: No, no, they still will remain on the program in some substantial roles. One, they'll run the sample management facility, they'll continue the near-field environmental monitoring and work that's going on out there. They're continuing in some roles in training and in outreach and the public outreach facilities and so forth and some other support work that goes. But, a big block of their work is transitioning over to us.

DR. DOMENICO: But, they are not included in your pies? I mean, this is--

MR. ROBERTSON: No, no, they're just like a participant, just like the USGS and the others. They're not in the pie except for those pieces of work which have transitioned from them to us.

MR. GERTZ: There are many other program participants. REECo is not included, RSN work--one other thing, Pat, while I have the microphone. When you ask about lobbying Robby for underground or myself, we welcome you lobbying us for that and I want to get that--but I think your lobbying has to be done with the people who provide us the funds because it's more funds than priority that's preventing us from getting underground.

DR. CANTLON: All right. Well, let's proceed. William Lemeshewsky will introduce this next area.

MR. LEMESHEWSKY: I just came up here for a minute to not only show the introductions for the people that you'll hear from today in response to your requested topics, but to cover how some of RW-30's activities, i.e. Office of Systems & Compliance, track in here. One thing I wanted to note on the speakers here, the first two are Virginia based and the last three are Nevada based. So, you'll hear some different perspectives today.

You've seen this before. This is our organization chart for the program. RW-30, Systems & Compliance is down here on the bottom left. The other offices are across there. There's nothing new. I wanted to show and just highlight some of the activities that Systems & Compliance is involved in.

Basically, it's comprised of two divisions and five branches of about 40 individuals. I'm just going to summarize or tie it in at least in the systems division with requirements, documents, databases, change control boards, procedures, control document distributions, configuration management, computer modeling for systems work, as well as the studies that you'll hear about tomorrow in a lot more detail.

The other division, RW-33, is two branches and basically I'm not going to repeat it. You've heard all their activities today in terms of the licensing, the EPA, issues resolution, regulatory compliance, both working for the program, as well as with the DOE organization, for all the other types of NEPA activities, EPA, et cetera, the recent order on NEPA compliance activities for DOE that came out and the Secretary's initiative on self-assessments. So, at some point, you'll hear, if you have not already heard, from those activities.

I'd like to go back--just as in your agenda, you'll hear from Arthur Greenberg in terms of the systems role. I believe that's all. Yeah.

DR. GREENBERG: Good morning. My task is to introduce the members of the Board to the systems organization within the M&O. I'll try to go as swiftly through this as possible. A lot of the topics that I was going to discuss have already

been mentioned by Robby, by Dr. Bartlett, and by others. But, what I do want to talk to you about is what the role of the systems organization is, what the functions are that we contemplated for it, how we organized to do the work, and then at the end of that organizational material, give you an overview of the activities of the past year. The overview will be a top level overview, and tomorrow morning, you will note from your agenda that we will be presenting in detail the status of the systems studies program. And, that will give you more insight into how the systems organization goes about its business.

We wrote down the role of the systems organization some years ago and it hasn't changed very much since then. There isn't a single role for the organization, but rather a series of specific roles depending on what phase of the program we're in. For example, at the beginning of the program, we are expected to establish the management system improvements that have been referred to a couple of times. Program management methods, engineering procedures and standards, and to define and maintain the program requirements and the technical baselines and the interfaces. Then, as the program is executed, we are supposed to identify the change requirements within the program because of external events; new regulatory actions by the NRC, statutory actions by the Congress, and so on. And, we're supposed to import those

changes, interpret them, and communicate them to the performers of the program. And, during the execution of the program, we're also expected to stand at the side, participate in the necessary review activities to insure that the program activities are in compliance with regulatory requirements. Then, towards the end of the program, assuming that all the pre-requisite actions have been satisfied, the systems organization is postured to manage the development of license applications.

Finally, throughout the program, there's a need to maintain communications with other Government agencies and with the public at large and support DOE's communication with the outside world. We have an outreach function to perform. To do that, we've established an organization with four arms to it. I will talk about the functions on subsequent charts, but there's requirements of the licensing organization, systems engineering, performance assessment, and models which is really models and technical databases and software control and outreach support.

The numbers that you'll find in your charts that are in parenthesis are the current head counts. There's 124 individuals in the systems organization at this time. Two-thirds of the individuals are in systems engineering or requirements and licensing which is appropriate as a front end sort of loading of setting the stage with the systems

requirements and the management documents and the regulatory requirements to put a good foundation under the system engineering activities.

The next four charts talk about each one of these organizations. It gives you a little more insight into them. The requirements and licensing organization has three thrusts to it: requirements analysis, that's really regulatory and statutory analysis and translation of those requirements in terms of engineering activities you can understand; environmental and socioeconomic studies; and, licensing and regulatory issues.

The functions of these three organizations are described down here. Requirements analysis worries about identifying and interpreting regulatory requirements and-- I'll go on. The licensing and regulatory organization is concerned with ultimately getting ready for the preparation of license applications and managing issue resolution activities. And then, finally, the environment and socio-economic staff is there to provide support when requested from the projects on related issues.

Systems engineering organization is broken down into two parts. System integration which worries about the definition of a baseline, the definition of the reference system, it's optimization, the integration of the component parts of the overall system, and the tradeoffs that need to

be made to support program level decision making. The systems analysis organization does the system studies that you'll hear about tomorrow.

Functions, this is a further decomposition of what was on my first chart. The functions of the systems integration organization is to develop the management systems' improvements and implement them and this consists primarily of putting this supporting structure of management documents, engineering documents, procedures and standards in place, establishing systems engineering QA procedures, and defining the system requirements, baseline interfaces, and supporting DOE in the management of the baseline.

The systems analysis program is simply what the title implies. It defines systems requirements, evaluates alternative concepts, and supports trade studies and the decision processes of DOE managers.

The organization that we originally called performance assessment and models has three parts to it. The primary thrust is in the model development area where its functions are to acquire and develop models necessary to support both the systems engineering and the design activities of the M&O. This includes the function of supporting the development and maintainence of related data bases. The necessity to apply controls to models and databases, however, and that's the function of the technical database and soft-

ware control organization. And, finally, the performance assessment organization was put in place to evaluate and monitor and ultimately manage the development of performance assessment models. That was done in Virginia at the outset of the program. Those activities, of course, are funded and managed from the Yucca Mountain Project Office and, as a result of our early involvement in reviewing those models, making recommendations for redirection and focusing of performance assessment development activities, the M&O was given the management support responsibility to stand at the side of Yucca Mountain Project Office in managing those programs. And, we've transferred that function out to the M&O staff out in Las Vegas for that purpose to be at the side of DOE. Jean Younker will be talking more about that this afternoon.

Finally, we have outreach support, two main thrusts there. One is the creation of the informational materials. The other one is to support the projects when requested. The project has primarily been asking for support this year of the storage and transportation and you'll see some of the activities in later charts. Functions, as I said, identify communication needs to support the projects, develop public information programs, materials, and help DOE with the communications with interested or affected parties.

Now, what I was trying to do is buy some time for

this more interesting stuff which is what were the accomplishments of the past year? All I can do is give you a snapshot and some representative examples of what has been going on in each of these organizations and then you can project and extrapolate from there and get an understanding of the scope of work underway. I've chosen five topics that the requirements and licensing shop has been involved with. These are both significant activities and they're also representative.

Both Robby and Dr. Bartlett have talked about these first two bullets, the annotated outlines of license applications and the issue resolution initiatives which in cooperation with Bill's office the initiatives of the M&O has formulated and caused to be implemented. What's particularly interesting is that we've reached the first cycle in each of these activities which is intended to bring resolution to the regulatory compliance and the regulatory requirements side of the program. We have developed now an annotated outline of a license application for a repository and another such document for the MRS. These outlines reflect the outlines that the NRC has proposed for such licensing documents. And, the exercise then provides us with the opportunity of collecting information that we have in hand, organizing and writing an abbreviated license application to the NRC defined outlines, and seeing how much we know that has to go into a license

application and finding out what we don't know and using that as a basis for interaction with the NRC staff in order to focus our ongoing activities with respect to site characterization studies and ultimately the preparation of a license, if appropriate. As I mentioned two documents have been prepared. They've been reviewed by DOE. They've been transmitted to NRC and that represents first of a kind documents, the first time those kinds of documents have gone to NRC from DOE.

The issue resolution process has already gone through one cycle of sponsoring a technical exchange with the NRC on the subject of erosion for the purpose of determining whether or not DOE has in hand adequate information to meet the regulatory requirements reflected in 10 CFR 60 on that subject.

Other representative activities, Robby has mentioned that we supported OCRWM in their interacting with EPA on revisions to 40 CFR 191 which they wish to re-promulgate this year. We've collected and assembled a huge quantity, as the Board are all aware, of regulatory requirements for the repository program. We've organized it in a form that can be put into an information management system which is being developed elsewhere in the M&O. You'll hear more about that this afternoon. But, the Board has viewed how a program can be organized that satisfies approximately 6,000 separate

requirements and our approach to it is collect those requirements and put them into an information management system to assure ready traceability of program activities back to the requirement.

And then, finally, because of the tight schedule on MRS, we have done all the preparatory non-site specific work necessary for us to write environmental assessment for the MRS program when a site has been identified.

Looking ahead to next year in the requirements and licensing area, it's important to note that the license application annotated outline process is not considered to be a one time shot, but rather an iterative process in which the completeness of this annotated outline improves with time and the understanding between NRC and DOE of what ultimately must be in a license application also improves. We are planning to do that on a semi-annual cycle and we've already started the second cycle on both MRS and repository annotated outlines. We do intend to put a significant effort behind maintaining the momentum on the issue resolution initiative. There are some eight topics that we would like to put in a queue to move towards NRC over the next couple of years. Erosion is the first one. We intend to implement a safeguard and security policy and guidance document which can introduce these considerations into the project activities. We hope to do an environmental assessment, at least one next year, for

the MRS. And, all the while, continue to insure that the project activities are in compliance with regulatory requirements.

Moving to systems engineering, this has been a particularly active part of the systems organization and primarily because we've been trying to complete and implement the management system improvement strategy. That action has taken the form of putting into place a new document hierarchy, new QA procedures, a new technical baseline, a new systems engineering management plan, baseline management plan, implementing a configuration system on hardware which is now installed and operating, and prepare all the management and regulatory documents that are needed in the document hierarchy. That's a mouthful and it has kept a lot of people busy all year long and the task is not yet done.

The last bullet, I should point out, is more of an editorial observation than a significant accomplishment. I have to tell you that the creation of this kind of structure requires the coordination and integration of a lot of competing views for how the program is to be executed at the project level and screen the projects and to be satisfying the interfaces established at the program level. What we have found is because the M&O operates across all elements of this program that we have been able to facilitate the creation of these documents that are mutually compatible and

coherent with each other by bringing together representatives from the M&O that support each of the program elements within the overall program. And, in this way, insure that this coordination and this compatibility between documents is created during the process of developing the documents rather than after the fact of having to reconcile disconnects.

It will help you visualize this process by the next chart which Robby showed when he talked to you, I believe, back in January. I acknowledge that you can't read this chart, but it is legible in the hard copy. This is the document hierarchy which we have helped OCRWM define and put into place. This represents an improved hierarchy because it involves 45 documents for management of the program which is a considerable number of documents, but just about half of the 83 documents that the program was being managed to in the past. Furthermore, all of these are being put in place at one time. So, as I said before, they're mutually compatible whereas these documents accumulated over a period of time which made it difficult to insure traceability of require-ments from the documents down to the architecture of the program.

So, the document hierarchy shows the usual manage-ment half of the hierarchy and the technical half with the technical baseline reflected in all of these requirements documents. It doesn't show well on the chart, but on your

hard copy you'll note that many of these documents now are shaded in and they represent documents that have either been completed or are well along in their draft process. We expect that all of these documents will be shaded by the end of the calendar year. That's a sizeable undertaking.

What I said before about being able to produce these documents in a coordinated sort of way can also be illustrated from this. We have M&O people who are supporting the Office of Systems & Compliance who is responsible for these documents working with M&O staff who are supporting Carl in the repository project to write these documents and these documents. And, consequently, interface between program responsibilities and project responsibilities is embedded in the documents as they are being created.

DR. CANTLON: You said it was going to be finished by the end of the year. Fiscal or calendar?

DR. GREENBERG: Calendar.

DR. CANTLON: Calendar.

DR. GREENBERG: The other half of the systems engineering office has been doing the system level studies. And, just briefly, because you are somewhat familiar with these and you'll see more of it tomorrow, the system level studies was started in FY-91 and continued to the present time. They were started based on the existing studies list that was extant at the time the M&O contract was put into place. The

study program scope has evolved over the past year to reflect the changing set of management decisions and systems issues which have emerged in that period of time. And, I believe most of you are aware that we are now concentrating on system implications and through-put and examination of alternative casks and canisters, looking at waste handling as a function of different operating strategies, and thermal management scenarios. What we want to do is get ahead of this requirement for systems studies. Rather than be reactive, to anticipate what the study program must be. And, consequently, we've organized a task force, we've told them to go look at program milestones and decision points, and lay out a studies road map which defines what we have to accomplish in the way of a studies program over the next few years. And, we also said, by the way, while you're at it, give us a reference system description so we have a baseline reference system that we can be comparing against suggested alternatives and also, by the way, do it in the next couple of months. So, we expect to have that by October. That will all be discussed in more detail by Larry Rickertson tomorrow.

In terms of the work of next year, the entire systems engineering organization, we are expected to finish up the system element requirements documents as we just discussed, establish the interface control documents, and implement a configuration management program consistent with

the new baseline management plan. We also intend to introduce three supporting engineering elements to the program; systems safety, human factors, risk management. I know the Board has been interested in that in the past and it's time for them to be incorporated into the requirements documents and put into effect. We expect to complete the reference system description and continue the studies program.

I apologize for the speed, but I'm trying to get us back on a clock.

The performance assessment and models area has devoted most of its attention this year to the survey and evaluation of existing models and databases. I mentioned before that we're looking for models and databases needed to support systems engineering and design work, but we also are looking at the models associated with performance assessment. I talked about that a little earlier. To date, we've surveyed 30 models and databases. We've imported 12 models to the M&O and installed them on M&O machines and they are running now and we're still evaluating the question of which of these models are adaptable to the M&O requirements, which can be adopted as is and serve M&O needs, and which ones may need to be replaced. The one model that we did not find, unfortunately, that would satisfy our requirements is a total system model and we are in the process now of putting such a model together from bits and pieces extracted from some of

these existing models and some pieces that we're creating by ourselves. That model is supposed to be available in October or November time period.

MR. GERTZ: Art, would you clarify total system as transportation, repository--

DR. GREENBERG: Yes.

MR. GERTZ: --as opposed to total system performance--

DR. GREENBERG: We're looking for a model that can do the top level tradeoffs between transportation, storage, waste acceptance, repository, and so on, and it will essentially subsume those kinds of studies that we're doing now. Be able to evaluate the impacts of through-put, evaluate the different canister and cask strategies, and so on, all in one integrated model.

DR. CANTLON: It starts at the reactor fence and takes it to the repository?

DR. GREENBERG: Yes. Starts with the waste analysis.

DR. NORTH: Could you clarify the redirections recommended DOE on this slide?

DR. GREENBERG: I can't give you some of the details of it, but what we were--

DR. NORTH: Is there a document we might have?

DR. GREENBERG: I know that there are briefings. I'm not sure that it has been documented. There was a management plan created.

MR. ROBERTSON: There is a management plan that's been created. There is a management plan that was created we can get you. It basically consists of consolidating some 38 contractors that were on the program. Many of them want to become subcontractors to the M&O itself. Restructured to define more clearly the scientific underpinning work, the V&V work, and the performance assessment system level activities among the participants. That's basically what it did.

DR. GREENBERG: The projected work for the performance assessment and models organization is to support direction of the performance assessment program, but as I said, that has not been transferred out to the Las Vegas office and Jean Younker will address that in her talk.

Complete development of the total system model, develop a simulation tool to support the design team on MRS as they move into SAR design and develop and implement an architecture for integrated technical database.

Speaking of databases, I did mention earlier that we've imported 12 computer models. We also have identified with DOE one data base which should be transferred, transitioned to the M&O. That's the characteristics database and the transition has been planned and is now scheduled for the 1st of October.

DR. CANTLON: For those of us whose acronyms are obsolete, what's SAR, SAR design?

DR. GREENBERG: Safety Analysis Report.

DR. CANTLON: Thanks.

DR. GREENBERG: Or Safety Analysis Design.

The last organization I will talk about is outreach. You'll recall that I mentioned that they produce the informational materials and support those projects that have a need for their help. That has largely been associated with MRS and transportation this past year, particularly as candidate hosts have come forward and their local populations have become curious about what an MRS would mean to them.

The project office has come to our outreach organization. They've asked for a variety of public information materials to support the public hearings--not hearings, but public information meetings, but in addition the organization has compiled information about the attributes of candidate sites so that the outreach activity could be focused on a material which is of interest to a particular site and not extraneous material.

Outreach organization has also sponsored tours and exhibits of materials that local populations might find interesting. Dr. Bartlett mentioned the fact that the transportation cask is being shipped around Wyoming as we speak. That was arranged by the outreach organization. They are also carrying with them a cold fuel assembly so that the general public can see what a nuclear reactor fuel assembly

looks like.

They've also organized a whole series of tours for interested and responsible individuals in the MRS siting process, taken them to a Duke Nuclear Power station and their spent fuel storage facility, in order to get the feeling for what these facilities are like, what they look like, how active or benign they are in their current forms.

One of the interesting innovations that the outreach organization did this past year was in response to the emergence of a number of Indian tribes as potential candidate hosts. Because there was a concern about the ability to communicate with Indian tribes on a cultural level which is consistent with their view of the world. And, to understand what the laws and regulations are affecting Indian tribes, we sponsored a Native American outreach program in which responsible people in DOE and the M&O and other organizations who were concerned about dealing with Indian tribes have had full day lectures or more seminars on the history of the Indian tribes and the laws and regulations as they pertain to them in different parts of the country. And, the outreach organization has supported the transportation project with exhibits and various publications.

To look ahead to next year, we expect the outreach organization or we hope the outreach organization will be actively involved in MRS public hearings or at least public

information programs at candidate sites. The outreach organization is also developing plans for EIS outreach activity and for MRS licensing activities and we expect to continue to develop communications materials for the MRS, as well as for the transportation project.

And, that concludes the material I've prepared. I'd be happy to take questions.

DR. CANTLON: What I would like to propose is that we take the first 10 minutes after lunch for your discussion. This is not to your advantage because they'll think up all of the stinker questions between now--

DR. GREENBERG: That's occurred to me.

DR. CANTLON: But, if you're willing to accept that little hiatus, we'll start with the discussion of your presentation after lunch.

DR. GREENBERG: I'd rather have the Board comfortable--

DR. CANTLON: Happy and asleep.

DR GREENBERG: --and content.

DR. CANTLON: Yeah. All right. We'll take a recess then for lunch.

(Whereupon, at 12:05 p.m., luncheon recess was taken.)

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

(1:00 p.m.)

DR. CANTLON: Let's reconvene, please.

For those of you who may have been out at the time we had our lunch break, it is our intent to use the first 10 minutes after our recess to have the discussion following Dr. Greenberg's presentation.

DR. CANTLON: Board questions. Warner North?

DR. NORTH: I would like to ask you some questions about the MSIS or the document hierarchy. I would like to go back to this study plan that I alluded to in an earlier question.

I gather that study plans are part of the system. I would imagine they come in under test requirements or something like that. Is that correct?

DR. GREENBERG: Study plans are certainly part of the site characterization program in which they elaborate the tests and study activities that will be done to meet the requirements of the SCP.

Carl, do you want to make any comments?

MR. GERTZ: They are not one of those 45 documents that he has on there.

DR. NORTH: Well, basically, what I want to have you enlighten me on, is how do you find things that are out of

date or problemmatic and get them fixed?

When I asked the earlier question you were saying it is basically a management attention issue. And there is a process that you go through and you revise these documents and sooner or later hopefully these problems get caught.

But, I would like to find out how this works in this document hierarchy, and whose responsibility it is and how the system really works in practice in terms of giving you an update where you find a situation where basically you have an out of date document that is, ESF has changed character, this particular set of testing requirements hasn't changed, and it ought to have. I mean, how do you find it? Who is responsible?

DR. GREENBERG: Well, each document in the hierarchy has an owner. One of the things that was established in creating the new document hierarchy was to identify who was responsible for the creation of it and the maintenance of it, which is essentially ownership.

Now, those individuals who own documents are expected to deal with problems of the sort that you have described when they materialize.

One of the difficulties I have observed over the last year and a half is that the program itself can change faster than you can make the changes to the documents. And in fact, especially with the old document hierarchy, where

there were very intricate pointing mechanisms from one document to another, so that if you were going to change one document, you had to make sure you made the corresponding changes in the other documents that either derived from it or flowed into it. That was a very complex and cumbersome process. And as a result, the document hierarchy that the program has been working to has essentially been kept in workable order, but not necessarily impeccable order.

Now the process of generating the new document hierarchy includes--it is easy to say we are not going to do it that way anymore. But, it does include the opportunity at one time to make all these documents mutually compatible with all the correct pointers to each other, and the configuration management process that we have put in place, which as you recall is related to the baseline management plan, provides a mechanism whereby DOE controls all of the documents and ensures that when a change is made to one document the process is in place in this baseline management plan, the process is in place to fix the other documents at the same time.

So, I think what we are trying to do is to not retrofit and pick up problems that we have inherited from the past, but rather to put in place a clean new slate of documents and then maintain them from there.

Incidently, along that line of maintaining them, I

went past it very quickly. But, when I talked about our having written a baseline management plant, I also said we defined a configuration management system; we acquired the hardware and the software for it; we have installed it; we have trained people for it; it is operational. That is part of the baseline control process, or the baseline management process. So, when I glibly say that the new document hierarchy is going to have all the necessary pointers, so when you change one, you know what else you have to fix, or if something is discovered that is out of date, you know how to fix all the other things as well as it to bring it all current. That is going to be greatly facilitated by the fact that the entire baseline is going to be computerized. All of the pointers are going to be in place. All the traceability paths will be in there, so that the process is facilitated.

DR. NORTH: What about the issue of ownership? Essentially are you relying on the owner to do this, or is there also a pointer at the owner's manager that it is clear an assignment has been given, there is an action list and the owner has to act in a certain period of time or alarms go off?

DR. GREENBERG: Well, some people from DOE may want to jump in on this one.

However, as we discussed ownership at the time that the document hierarchy was being defined, we also put into

the documentation the process, whereby the owner of a subordinate document has to reveal that document and show that document to the owner of the higher level document, who in turn will verify that the subordinate document meets the requirements established in the higher document.

Now, I don't remember putting a time limit on this sort of thing, but, typically what happens is, if some part of a management document or a requirements document gets out of date and gets picked up in the QA process, when you attempt to do something that has to be pointed to that document and you suddenly discover that the basis for taking that action is no longer valid, at that point, you are faced with two things. You either immediately fix or you stop this work, because you don't have a basis for controlling it, and then you immediately go back and fix that document so that you can then continue doing the work that is required.

MR. GERTZ: Warner, let me even bring it down to a lower level about doing work in the field. Before we start an activity, be it a trench in Midway Valley, or a new drillhole, we go through what we call a job package which includes many prerequisites, environmental QA and everything, and a test planning package, which says, do we have an updated SC study plan? Does everybody agree this is current? And only after we check off all that list in accordance with one of our implementing procedures, do I then authorize that activi-

ty to start in the field, no matter who is doing it. Everybody has to get that job authorization work package through.

And then once we start, if we need to make changes and some of PIs do, they need to widen a trench or narrow a trench, we have an on-site field change control board that acts on that change with certain thresholds, many thresholds, or many activities. I think we have had 36 out there lately, and are acted on right at the field level with the designer, and the principal investigator. It is taken care of right there and the change is made and we go on with the work. If it impacts higher level requirements we have a hierarchy of change control. But we have--our control of it is what we call job package which includes a test planning package before we start work.

DR. GREENBERG: Incidently, even if a change does not exceed a threshold that requires that it be referred to a higher level board, the action of the lower level board is communicated to the higher level board so that they can review and make an independent determination as to whether or not they have to call that action up and reopen it and close it on their own basis.

Now that could be between the field change control board and the project change control board in which case it is all done and it is not known to the program level, because

it is all subordinate to the project office, and totally within their authorized control and ownership.

But, it is possible at any time for something that starts at the lowest level to bubble on up and reach the highest level board of the program office, which is chaired by John Bartlett. Or, his board can call up any action that is taken at a lower level board.

So, there are checks and balances in the process to trigger reviews and assure consistency in compliance, or invoke some sort of whole process so that work doesn't go past the point that it can be traced to requirements documents.

DR. NORTH: Well, I like the theory of it. And I like the theory of it, and I like the theory of the convergence process and the engine of evolution. What I am concerned about though, is the practical implementation of it given the great size and complexity of the program. And, I would love to see, shall we say, some very positive examples. The study plan I think is a rather negative one, that the process is really working in terms of finding problems with the study plans and cleaning them up well before, and shall we say the threshold dirt moving and you go through one last check and make sure everything is okay and if it isn't, well, then you fix it. But then you are really in a emergency response mode, as opposed to an opportunity to have very careful

interactions with everybody.

DR. GREENBERG: Let me give you an existence theorem which might help you feel a little more comfortable.

This is a very complex program, but it is not the only complex program that has been worked to these principles. The Apollo Program; very large and complex. Many of the space programs that are extremely complex with many interacting elements and different time phases.

DR. NORTH: Yes.

DR. GREENBERG: And, these principles have been used repeatedly by organizations such as TRW and others and other government agencies to manage and control these programs, I think you have to say with success. How much actual discomfort occurred during the course of the program, while I tried to make sure that everything still meshed, is something you would have to talk to people who were involved in those programs about. I can't speak for them.

DR. NORTH: Well, I was involved in the space program in the '70s and I would certainly bear out the experience that yes, some very complicated programs were managed very well using these principles. The Board has advocated these principles starting with its first report. I'll speak for myself. I am delighted to see the progress that is being made implementing them, but I want to stress the importance of the implementation as opposed to having just a good theoretical

framework.

Now, my experience with the space program is that there was a very highly flexible management system, whereby things could come up either from the bottom, or could come down from the top. They were acted upon very quickly. There was a relative minimum of bureaucracy and problems with the paper work. If we found there was an issue having to do with the change in priority, it got dealt with very quickly by a series of meetings and then the paper work caught up with them.

I am hoping that I will see evidence of a similar system operating here. You have given me the theoretical design, but I would like to see some examples.

DR. GREENBERG: Well, I am hopeful, also.

The theoretical design, incidently, took a lot from the experience of TRW. And of course we have TRW managers in this program, starting at the top with Robby Robertson, who have been exposed to this process and have been workers of this process in many of these large projects.

DR. NORTH: Well, let me go a little bit further and here I am being speculative. But, I look at this issue of the characterization of structural features and I look at the plan to have photographs taken with every two meters, which maybe makes sense if you are using drill and blast on a shaft. But, it would seem that with a tunnel boring machine,

if you have to stop every two meters and take photographs in front of the head, that is going to be awfully expensive and slow the process down greatly.

Now is that going to be reflected in the schedule and cost implications? Is that somehow in there? And then, what about the priority of this information? How important is it to have a map of all the fractures including the little ones? Is that something that is really a second order of importance now that we have 14 miles of drifts, instead of a much smaller amount? Maybe we would decide that the perfor-mance assessments suggests that information is less important and we could come in and take photographs of the drift after it has been excavated by the tunnel boring machine all at once and do it very inexpensively and cheaply and get the information that we need for the performance assessment.

I mean, what I am not reassured by is I didn't see that when I read this particularly, supposedly, up-to-date study plan. And I would like to find out how this issue is being meshed into the needs for the performance assessment, and how the priorities are being set and how that impacts on the cost and schedule.

DR. GREENBERG: Let me see if I can separate this.

MR. GERTZ: They are all questions that we are dealing with.

DR. NORTH: Yeah.

DR. GREENBERG: Some of the questions that you raised

with respect to the approach of the site characterization process, I believe should be addressed in either a different form or by a different group of people. That is, I can't speak to the specific requirements of mapping the head of the tunnel as the tunnel boring machine goes through it.

I can talk about how that process is going to be subjected to the QA controls of the Yucca Mountain Project Office to assure traceability of those photographs, and the integrity of the face or the knowledge of the lack of integrity of the mine phase at the time the pictures are taken. That is a different matter than how does this theoretical process of systems engineering work?

Somebody in the course of talking about the Mission 2001 or in describing some of the site characterization activities that they want to address some of the points that you have made in respect to the subsurface investigation process--

MR. GERTZ: Art, just to take you off the hook a little bit, that is the questions we are asking the Mission 2001 study of our scientists. Can we have continuous TBM operation? I believe the initial answer was, yes, we can. But, I am speaking well out of turn, because I hear that just as a result to meetings. We need to talk to the people who are

working that at the working level right now.

But, those questions I know are being asked, because I hear about them all the time.

DR. NORTH: Well, it seems to me that you have got a basic generic problem, in that you have to have very detailed record keeping and tracking, which is what this system is supposed to do. But, on the other hand, you need to be able to set priorities and have flexibility in the program, so that you can adjust as you learn what you really need in the engine of evolution concept, that you can change the program and you can save money where you have opportunities to do this, especially in a major way.

MR. GERTZ: Even taking another example. Maybe if there is a need, we take photographs the first 100 feet and all of a sudden we say we don't need them every two feet, the next 14 miles minus 100 feet, we don't take them or something like that. You have to have that flexibility.

DR. CANTLON: Perhaps one or two more questions.

DR. PRICE: I've got two or three I need to ask.

DR. CANTLON: All right.

DR. PRICE: First of all with respect to convergence, which seems to be one of the keystone things in the engine of evolution. In the diagrams that we have seen, that conver-gence leads towards licensability--first suitability and then licensability as I recognize the diagrams. It appears to me

that that notion lops off part of what you have been presenting. That is, it doesn't converge toward licensability and operability of the total system. It is not a total system convergence that I see in that diagram and picking fault that way only for the purpose of getting your feedback, because, I don't believe that is the intent of that. I think though that when you get wrapped up into it, if you are going to get the convergence, you need to get the convergence, you need to get the convergence of the total system working together into this operable repository thing. And, I don't see that coming through strongly in that presentation.

DR. GREENBERG: I think maybe we'll see that and be satisfied with that when you see the convergence report.

Let me explain why I say that. We have had one internal review of the activities that are going on to date. And I was pleased to note two things happening. First, the individuals who were concerned with design convergence and site characterization convergence and regulatory convergence, are indeed focusing on what they must do and what they don't have to do in order to bring their activity to some level of maturation that is required for a site suitability and a license ability.

I also observed, which pleased me a great deal, was I saw people who were concerned with site characterization convergence looking over the shoulders of the people dealing

with regulatory convergence and trying to match what they were planning to do with what was going to be done with regulatory convergence. The notion being, that people are beginning to understand--as you said, all three must converge simultaneously. Are these close enough to one another that they represent a common set of convergence activities.

DR. PRICE: Well, when you are looking at the requirements and the documentation and everything, it should not be limited, in my view anyway, to licensability and suitability, or suitability and licensability to put them in the proper order.

But you are talking about a whole system working together and that gets into the complete system from the beginning of the generation, to the ways forward. And, it has a lot to do with the kinds of documentations that you come up with. Due to the shortness of time, maybe we can talk later.

And, also you mentioned a reference system description that is going to come up in October. I was hoping for just a little clarification. When you say a reference system description, how does that relate to the baseline system configuration in the SCP? I think there is some confusion about that.

DR. GREENBERG: Well, I deliberately didn't use the term

baseline. We have avoided using it in describing what we are attempting to do in the next couple of months.

Right now, there is a SCP baseline and there are component parts, or the system elements of storage, transportation, waste acceptance, repository.

We want to revisit those individual pieces and satisfy ourselves that the descriptions that we are working from for each of these elements are mutually compatible, even if it may not be optimum. But, each one of them has been going down its conceptual path now for some times and there may be disconnects that we are unaware of.

When we take a look at different cask and canister concepts, for example, different throughput rates, we are developing some quantitative, semi-quantitative feeling for how changing one of those independent variables affects the various components of the system. We are not sure we are evaluating the impacts against a complete system as opposed to independent parts. We want to have that.

DR. PRICE: Okay.

Two more questions. One rather--both of them may be a little more specific.

In the--you indicated that you are going to implement in the next year or so a human factors program. That has been one that we have kind of used to try to see what really is going on, because, a lot of the words may sound

right, but what specifically is happening? Could you tell me specifically, for example in the area of documentation what you were doing with respect to human factors and that might help us to understand what you are doing in other areas.

DR. GREENBERG: The Board asked us once before what we were doing with respect to human factors and safety. And we came back and said, well, we are organizing a plan to do that work and to incorporate that in the overall program activities.

What we need to do, just as I talked about security and safeguards, is that we need to incorporate in the document hierarchy provisions for these additional specialty engineering activities, for example. I am trying to remember where we called for this.

DR. PRICE: But the question is, what specifically are you doing in the area of documentation?

DR. GREENBERG: Well, at the moment we are not doing anything specifically. What I was saying on the chart was, we wanted to move in the direction of creating those elements of the program plan and incorporate them in the appropriate places in the document hierarchy, so that they become requirements that flow down through the property engineering process. They are not there now.

DR. PRICE: Okay. But it has been almost three years

since we first made this input, and as yet nothing specific is happening. Let me ask you how you are interacting with the existing human factors engineering documentation that is going on inside DOE.

MR. GREENBERG: Perhaps somebody from the projects wants to address that.

MR. ROBERTSON: We are complying with all of those requirements for DOE as they are specified at the DOE, you know, top level. Also, in each of these documents, the design documents and the performance documents at both the project level and at the program level, there are sections in each one of those documents that deal with human factors, safety and risk assessment. Those are built into those. What doesn't exist is a single integrated plan that is the policy level document that is going to be generated, that he is talking about, for each of those three to fit into the hierarchy. But each of those documents contain those sections and they are being fully developed.

DR. PRICE: But presently right now inside DOE, my understanding is, that there are those that are working on what DOE's position should be on a human factors engineering plan and also specifically on design in their standards area. I think it is NE 70 Area, that they are actually working on such documents right now. And I was trying to see if you had reached them or they have reached you, because, they are

going on with this effort.

MR. ROBERTSON: There has been dialogue among our people at the working level on that. Do we have a specific plan of how we are converging that yet in the top level document, the answer is no.

DR. PRICE: Well, to be real specific, I did call their office and ask them. They didn't know--hardly knew of the existence of civilian radioactive waste management. They didn't even know who was there or what it was or anything. So, I would say there is a disconnect right now in DOE between their standards generation, which has directly to bear on your documentation. Because, you are not going to get a plan in without design requirements or a program planned kind of a document. You have to have it. But there is some work going on, but evidently there is a disconnect between what you are doing and reaching to DOE.

MR. ROBERTSON: You are talking about at the policy level at DOE?

DR. PRICE: Evidently through the system. Through the system, there is a disconnect.

MR. ROBERTSON: Well, we will certainly take an action to actively look at that to make sure that we are taking advantage of that and participate with it.

DR. PRICE: Because, I think it might be easy for you to come up with some of these documents if they are already

being developed.

DR. CANTLON: Other questions?

Don.

DR. LANGMUIR: This morning, we heard from Robby Robertson that whenever the M&O got involved and took up other contracting organizations within their envelope, it looked as if they were saving or cutting 20 to 25 percent of the staffing and were able to do that by combining activities and reducing redundance and so on.

The implication to me is they were saving 20 to 25 percent of the budget of DOE in that process. You are shaking your head. Well, the implication to someone looking into the program from the outside is that if this kind of an approach that you are taking were applied to the whole program, we could save that much of the baseline budget. Now that is what someone from the outside might think. I guess I would like some reaction to that.

MR. ROBERTSON: Let me respond to that, if I can.

Obviously, only some of the work will transition over to M&O. Much of the work will remain with the participants that are doing it. There is very little work that is being done by USGS that is going to transition over to the M&O, as an example. But, there have been across the program, a multiplicity of support contracts doing things such as records management or information systems development or

things of that nature. And I think there is where at the margin you can make some savings in some of those cases where it is fairly clear.

I think it is a more difficult thing to do to say, the fact that you are transitioning the design work of A&E design work, from let's say RSN over to the M&O that there has been an equivalent saving. I can't attest to that, because, for one thing the thing is moving and so you are measuring against something different. But, I don't think you can expect that kind of a saving.

DR. CANTLON: All right.

Dr. Domenico.

DR. DOMENICO: I have a comment to make that will be formulated into a question that maybe Carl or John can address.

A year or a year and a half ago, we learned about a certain change in the emphasis of the program where it was going from ideas of licensability to suitability. The test plans were prioritized in a fashion to go after these ideas.

Now I look at these 45 documents, many of which are done, most of which address licensability issues. For example: Engineered barrier design requirements; site design and test requirements; repository design; MRS. These are, and according to--if you assign priorities to these, you are initially going after licensability issues. My question from

all of this is, has DOE decided that the site is basically suitable and we are back on the track of a program that is going to try to determine licensability?

John? I love you John, but I had to ask you that.

DR. BARTLETT: Of course we have not, Pat.

There is obviously a very, very close relationship between suitability and licensability. And in fact, no where does that come more into evidence than in the matter of the design and implementation of the ESF. It is an excellent example because ESF, although it is simply--I call it the holster for testing at depth, it has potential if the site is found suitable to become part of the repository. Therefore, it has a key role in the safety and waste isolation performance of the repository, therefore, just that site characterization activity is intimately involved with potential licensability issues. And that is why for every day we spend doing work, we spend a day telling the NRC what we are doing on that issue, because it so intimately tied to it. We have to get through the site suitability gate first. But, in the process, we are ever watchful and ever mindful of our flanks and the concerns for, if we do get through the gate and the site is suitable. Then, by virtue of schedule and constructed documentation and records and everything else, it is inherently and very closely related to licensability. So, we are constantly looking ahead to the

implications for licensability. We can't separate them too far.

DR. DOMENICO: You have not made a decision yet on suitability?

MR. GERTZ: Oh, heavens no.

DR. DOMENICO: The follow up--

MR. GERTZ: Pat, excuse me, let me just follow up a little bit. Certainly suitability also includes total systems performance which requires considering the elements of the EBS and the repository.

DR. DOMENICO: You are throwing our words back at us, Carl. That is very good.

Also the document on engineered barriers, which is presumably done or in the state of completion, it is kind of hard to understand how you can construct such a document when it depends on thermal loading strategy which has not yet been decided on, and also depends upon whether you are looking at 300 year canisters or a universal cask or something in between. So, maybe some of these studies are kind of--these documents, maybe they are a little premature. That's a question.

MR. GERTZ: There is a presentation later today about EBS and maybe if you will hold it until then?

DR. DOMENICO: On the EBS, on the engineered barrier?

MR. GERTZ: There is a presentation later today on EBS, and so--

DR. DOMENICO: That's your answer?

MR. GERTZ: Yeah. We'll answer it then, I hope. If we don't then ask it again.

DR. DOMENICO: Sure.

DR. GREENBERG: Well, it is also clear that in developing the requirements documents there are some places where it is not critical to leave the requirement blank. That is, you don't have to know today in order to be able to make some headway but you eventually have that requirement flushed out in order to finish the task.

Now that depends on what the subject matter is. But the requirements documents can be developed now, and you can identify where they may be downstream decisions that will--that could affect some of the requirements documents. All of the more reason why it is important to have good configuration management control, so that when you make a change as a result of a decision, later in time, you can propagate that change down to all the effective documents.

I did want to just respond to you a moment about your opening statement, which got converted to a question. And that is, an appearance that there is an orientation towards licensability may be cosmetic. That is, the top level requirements, it is true, reflect licensing require-

ments. They come out of 10 CFR 60. But, they also come out of other sources like NWPAA which says what the repository is supposed to be capable of doing and what its limits of operation are. It also comes from DOT regulations on transportation processes. They come from EPA in the form of 40 CFR 191.

So, while the program is generally driven by a lot of regulatory considerations, it also has a lot of engineering considerations, and it also--you could look at that and you could say, gee it looks like licensing is the primary thrust. And that is simply one set of requirements that are being attended to in a course of the engineering activity.

DR. CANTLON: Let's bring this discussion to a close so that we can stay somewhere within lines and we'll pick up at the end if there are burning questions from the staff that want to come in.

Dr. Godman, overview for storage and transportation.

DR. GODMAN: The title is slightly inaccurate. What I am going to do on the assistant for operations which in our lexicon means the guy that sort of looks over getting things done. So, my title is operations and I am going to talk overview, what I do which includes storage and transportation and includes other things as well.

I'll go back--this is not in the packet, this is

one of Robby's charts, and talk just a little bit about the two assistant general managers since it sort of reflects a little more on my side of the chart.

In addition to the line responsibilities that I'll talk to, both Art and I have executive oversight responsibility for activities that are not directly under our line management in Nevada, and in particular I have oversight responsibilities for the operations oriented things out there, like design and the site characterization and integration and that kind of thing. So, I just wanted to clarify that point.

Now the things that I do have direct line management responsibility over are shown on this chart, and it is the full scope of activities with respect to the storage and transportation and I guess reflected with the greatest, at least, level of effort in the MRS design area.

In addition, I have responsibility for tracking program status for the M&O that is keeping track of cost and schedules and our progress against our plans, and managing the information. This is basically records management and the computer aspects of records management information.

Using the same format that Art used or at least a similar format showing this part of my organization, storage and transportation, there are about--there are 96 people in

that part of the organization divided up here. And you can see that the majority of the effort is in the MRS design area where we have just completed the conceptual design report for the MRS.

These indications down here show the mix of team-mates and how the work is allocated among our various team-mates. These don't add up--for example this adds up to 8, so there are six TRW people, so where there is not a number shown that is an indication that it is a TRW person. So, that is how you can untangle that chart.

The responsibilities across here, of course, are design. This is where we work with the portion of the pro-gram that has to do with interfacing with the utilities and the contracts with the utilities. We have been interacting with the negotiator for some time. What I think is a reason-ably important experiment in the U.S., and that is to find out whether you can actually voluntarily site one of these facilities which is perceived so negatively by the public. That is going, as John mentioned earlier, quite well. There are 21 Phase I applicants at this time.

Transportation is the job to acquire the transpor-tation facilities necessary to move the waste to the places where we are really going to store it or dispose it on a schedule that is commiserate with our contracts with the utilities. And then we have an integration function which

deals with the interface with the to level requirements that flow down to be implemented by these design activities, and also is responsible for creating and maintaining a specific design requirements document that these organizations are responsible for.

Some of the highlights of what has happened during this year are these. I mentioned earlier that we completed and delivered the conceptual design report for the MRS. That lays out our current concept of what an MRS would be like, including eight different storage technologies which we are presently under contract with vendors to do fixed price bids for providing that storage technology to the program at such time as it might be needed giving us what we believe will be a very good in depth understanding of the technologies, their costs, their complexities and how you would compare them one to the other.

We developed a probabilistic based fee adequacy assessment methodology this year. In the past that calculation has been a deterministic calculation: either it's adequate or inadequate. Generally, there is uncertainty associated with that kind of a calculation, so we try to reflect that uncertainty in the estimates.

DR. CANTLON: You are talking about the attempt--

DR. GODMAN: Right. The ability of the fund to pay for the program.

Earlier in the year, we began, in fact for some time we have been concerned about the ability of our transportation cask initiative to produce casks in time to support our need to pick up fuel in 1998. As we have gone through reviews of those in further detail, it is fairly clear that there is a high risk of getting through the licensing process and having those things available. And so, we have started a program to provide us with a hedge against that using the existing--now, basically what we would like to do is use existing casks. That is not quite possible. First of all there aren't enough of them and secondly that is too much of a compromise with efficiency, but we are going forward with a plan--a program to procure new designs against existing technology which is a much more lower risk program and much more likely to be able to meet our 1998 schedule.

One of my responsibilities had been to get the M&O ready to do work. That is mostly associated with quality assurance, making sure we have a quality assurance program in place that is acceptable to the NRC and to the--well, first of all to the DOE and then to the NRC. During the course of the year, I have conducted a number of reviews across the M&O and we have completed all of that. This refers to the part of that that has to do with transportation and an MRS design.

The Initiative 1 Cask here are those casks which was the ongoing program, not the Phase 1. The Phase 1 Casks

are the ones that we are trying to use existing technology. The Initiative 1 Cask is the name that has been applied to the more advanced designs, the higher capacity of designs.

One of the things we have done early in the year is we looked through the quality assurance requirements of that program to make some assessment of the risk of licensing those casks, and I think that among other things led to our conclusion that we really needed to start a parallel activity.

Art talked about this, the longest pole in the tent for us to get an MRS on line in '98 to support the receipt of waste in '98 is the environmental assessment. So, we have done as much advance planning of that as we can including a fairly detailed description of how we go about doing environmental assessment on a site and progressing through that process, and that is what that is about. Of course, we have to converge on what site to do the environmental assessment on, but we are trying to do as much advance work as we can.

Looking ahead into the rest of the year and on into next year, we need to complete the preparation of management--what I call management documents, those documents on that document hierarchy that pertain to the storage and transportation area. As we continue through a process of working with the utilities, we are trying to get as much of an understanding of what we are going to be getting in the way of

spent fuel as we can. The contracts don't--aren't specific in that regard. They say, always fuel first, but that only has to do with the rights, it doesn't have to do with what we are going to receive. And so we continue try and refine that.

I mentioned earlier that we had contracts with eight vendors to do fix price bids on the storage technologies. We want to complete those contracts and integrate that information into the MRS design process. This refers to the Energy Secretary Acquisition Review Board process of reviewing programs. And it is a major decision point that allows you to go forward into the safety analysis report design and the preparation for a license application. That review we hope to have this fall. There is some uncertainty about that, of course, since we don't have a site, but we would like to go ahead with that review even in the absence of a site to get validation of the costing methodology that we use in our conceptual design process, and the estimates that we have done there and get endorsement of that process so we are--we will be prepared to go forward and do further design work. And of course, continue to support the negotiator in his search for an MRS site and place the contracts for the Phase 1 Transportation Casks.

Next I'll talk about the records management. We

call it the secretariat function. That is one of those fairly uninteresting but important functions that we have to do. You notice the large share of that pie that Robby showed that went in the records management, well this is where it is, or this is where part of it. This is not counting those people that are physically located in Nevada doing this same function. We have oversight of all of that activity for the M&O, however, there is another group--there is a group in Nevada that is under the direct daily line supervision of the people in Nevada. This may be out of order with what is in your packages.

A couple of things that we have done that are worth talking about. One is assuming responsibilities for the records management function for the program both here and both at headquarters and in Nevada and the consolidation of that. Robby has already talked about some of the efficiencies of that process.

Secondly, we are developing a computer automated process which we hope--we know, I guess, will ultimately contain the records for the program in long line computer based system as opposed to what is essentially paper today. There has been a program called the licensing support system, which I am sure most of you have heard of perhaps or familiar with. That is a joint NRC/DOE program to provide the documentation associated with discovery in the licensing process.

This will provide the DOE portion of that set of records. We are right now in the process of deploying Increment 1 of that system, which is fairly, in fact I have another chart that talks about the different increments, so, I will wait until that time.

Art has already talked about the ARMS software. It is my job to build the things and his job to use them. So, it is on both of our charts.

We had at the high level waste conference in Las Vegas, a prototype of the InfoSTREAMS Increment 1 on display there. A lot of people came by and had a chance to sit down with it and use it. We took advantage of that feedback. We are very much proponents of the prototyping demonstration feedback process in software development. So, we took a lot of advantage of that feedback that we got from the people who used the system and commented on it.

Just looking ahead at a few of the things that we plan to do the rest of the year. We have a lot of paper, as I mentioned. We want to store our documents in both ASCII characters and images, pixel map images. This is will be an early generation of something that will be part of InfoSTREAMS ultimately, to allow us to begin to capture some of that paper now before the rest of the system comes on line. I want to continue deploying the increments of InfoSTREAMS and of course complete the ARMS software development.

I have a couple of charts that talk in a little more detail about what InfoSTREAMS is and what is contained in their four increments through its development that stretch out over several years. The first increment is just basic office automation package. The more interesting of that is on-line document review and concurrence. And so that documents can be transmitted between reviewers and the comments captured electronically and permanently made a part of that document repository. And first deliveries are ongoing right now. You notice June.

The second is to improve the operator interface with what is basically COTS or Commercial Off The Shelf Software in Increment 1. And then the third increment is to begin the formal document registration and retrieval capabilities. The initial systems we are building, will only have rudimentary search and retrieval capabilities. And then finally we will get into the ASCII test and image capture and retrieval which will be in the last increment.

The third piece of my organization is called management systems, and has to do with cost and schedule monitoring and creating the--sort of the management side of the document hierarchy. Those documents talk about our management systems and who is responsible for what and those kinds of things. We have 29 people in that organization at pres-

ent. They are all TRW.

Things that we have done; management plan which is a document that describes how the M&O manages itself is now signed and available to anybody that doesn't know how we manage, it is a good place to read.

We have been putting together the Integrated Network Schedules. There has always been a kind of a top level schedule, but as you get further down into the details it is less consistent across the program. Carl has had a lot of detail scheduling in Nevada. Other places haven't been quite the same level of detail. So, we have been putting those schedules together and aiming towards more detail integrated set of schedules across the program. And this is to do with our own performance and not that of the program. How well is the M&O doing against its goals and activities.

DR. PRICE: Are these numbers RW 40, are they your document numbers?

DR. GODMAN: No. Those are organization's. This is the OCRWM Systems and Compliance Organization, that is John Roberts and this is Ron Milner. So, those are organizational designators.

And then finally, looking on into next year, completing the integrated network schedules for the program and moving towards the ability to do performance measurement across the whole OCRWM program. So, that is my formal pre-

sentation. I will be happy to answer any questions.

DR. CANTON: Questions?

Dennis Price.

DR. PRICE: In your presentation of things that you were about to do or going to do, I didn't see anything in there about a minimizing handling workshop.

DR. GODMAN: A minimizing handling workshop. A minimizing fuel handling I assume you are referring to?

DR. PRICE: Yes. It's been one of the recommendations of the board, to which I believe the DOE has indicated that they will be working toward that, but I don't see anything in what you have presented.

DR. GODMAN: Let's see--no, that's true. You don't.

There has been a number of system level studies that have looked at handling the fuel handling operations across the program for various concepts that you might have for multi-purpose transportation casks, and so on.

We would be a participant in those kind of workshops as the designers, but we would look to the Systems Organization to be the facilitator to put those kind of things together.

Much of the things that Art has talked about, and I didn't, our technical people are very much involved in participating and supporting those things. But, I would look to the guys--in fact tomorrow there will be some discussion of

some of those things.

DR. PRICE: But, obviously in your purview, that isn't something that has a very strong neon flashing light to your attention?

DR. GODMAN: How do I answer that? Yes, it does. We are always, of course, concerned about radiation exposure, and your designs are aimed at minimizing radiation exposure within any facilities that we design. And to the extent that fuel handling adds to the exposure, of course it is important.

DR. PRICE: I would like to ask a somewhat leading question. The ARMS that you spoke of, with respect to Westinghouse we have received quite a pile of documents with requirements documents and other things, and I take it those are being massaged and worked into your ARMS software.

DR. GODMAN: Right. We are quite acquainted with the Westinghouse work and software that they built along with doing that, looked at--there is a number of other software packages that also exist around the program to go requirements tracing and I am taking advantage of that work.

DR. CANTLON: Other questions for the Board?

(No audible response.)

From the staff?

(No audible response.)

We thank you.

DR. GODMAN: Okay.

DR. CANTLON: We will proceed with an overview of the Nevada Site activities. Jean Younker.

DR. YOUNKER: Thank you very much. Good afternoon.

I am standing in for Dale Foust, who, as Robby explained earlier, is somewhere in the National Parks of the West, we hope having a wonderful time.

I'll try to give you an understanding, I think of what Dale would like you to understand about what we are doing in the support of the Yucca Mountain Project Site Characterization Project Office.

We do have a dual role that we will try to help you understand this afternoon. And that is, in Carl's organization chart that he shows that shows all of the project participants, he shows us here in a direct line beneath him with the description being Project Management and Integration. He also shows us over here as one of the participants in the project with design and other support service roles, which I will go through following the same kind of an approach that Ray and Art just followed, talking through each of the areas of our organization for you.

Just to review for you, I think most of you are familiar with the rest of the participants in the program, but we have the three national laboratories down here at the U. S. Geological Survey who have primary responsibilities in

the case of USGS and Los Alamos for the site characterization testing programs that will be conducted in the exploratory studies facility and also the surface testing program, and laboratory studies to support that.

In Sandia we have for performance assessment, continuing goal there. They also have some rock mechanics testing responsibilities in the continuing program. Lawrence Livermore, of course is in the waste package materials and near-field environment characterization program. We have Raytheon and REECo. REECo in the drilling and in the ESF design area--not design, excuse me, but the development. Raytheon also in the engineering the pads surface facilities. And, Science Applications, I think, we already mentioned they have a continuing role in the public outreach programs, sample management facility and in environmental programs.

So, what is our role in all of that? Well, as I said, it is a dual role. So, the M&O is kind of--we wear two hats and sometimes even within the same functional area, you will see me describing two different roles that we play. So, it is a little bit complicated, I think, to walk through this with me.

Basically, obviously our primary role is to support the mission of the Yucca Mountain Project Office and activi-ties to evaluate site suitability and if the suitability is established, to help develop the license application for the

MGDS that would be placed at Yucca Mountain.

We do have this management's integration support function that we will go into in a couple of viewgraphs. We also have a number of critical areas of expertise that we provided to the project office. I think the primary one you have already hear discussed to a quite a large extent in the systems engineering area which is an area that has really been strengthened by the addition of the M&O contractor. We have the specific responsibility now, beginning in October of '92 for the Title II ESF design. And, the beginning of '92, as well developing and starting the advance conceptual design phases for repository and waste package.

We have a diagram that has been evolving to try to help us think about and talk with Carl's managers and with Carl about our role in the management and support areas for the project office. This is a version of it that basically says, as you well know, that the policy and project direc-tion, program direction in the case of the entire program comes from DOE. The M&O is kind of a slice in a pyramid the way we are visualizing it in this case. And, we have a project management support role and the word integration which we all have a lot of fun talking about and trying to explain exactly what it is. And I think all of us will express to you some frustration in not being able to clearly

communicate exactly what it is and how to do it. I think. You'll see in a couple of cases. I'll give you some examples of what we think integration is. We think we are doing it in some areas, so we are kind of going to describe to you what it is by giving you some examples. And then of course, we have all the participants that were on the previous organization chart that are responsible for the performance of the activities during the site characterization phase of the program.

Okay. Let's look at the middle slice and dissect it a bit. What we have, the way we have come to think about it is, in terms of the--the roles, the areas of responsibility being repository, EBS design, ESF design and construction, site characterization, kind of captured in the front of the pyramid, and all of the areas where there are controls and support functions necessary that must cut across these primary areas or functional areas of responsibility. Now, in some of these areas, the M&O has responsibilities long this side, as well as along this side. So, as we talk about them, I will point out some of those.

We look at, say for example, the regulatory licensing area or the performance assessment areas as being areas that do cut across all of this, because clearly they have to capture information from the design, from the site program, roll it together both in the regulatory framework and in

assessing total system performance for the MGDS. So, if you can stay with this concept with me, I think--and, the idea is that we have an integration function to make sure that the interfaces at each of these contacts are working; to make sure that the controls and support functions are in place and working. In some cases we actually have the responsibility for the support function or the control area. In other cases, we at least have to do it for our own work, maybe not for the whole project set of participants.

Move to the bottom of the pyramid now, and here you see laid out the participants that we had on the original organization chart with, if you look at the small print here, you can see that we tried to specifically state what their primary roles are. I think most of these are fairly complete. As I mentioned for example, Livermore and the waste package, near-field, geochemistry and hydrology of the near-field environment, Raytheon and the site support and the designs for roads and pads. And here over here still these support and control areas.

And as I said, in some areas such as outreach, for example, the M&O doesn't have a program like responsibility in that area, but we do have a small outreach program of our own, wherein is something like NRC and NWTRB interaction support, we do work that across the whole project for the Yucca Mountain Project Office.

Now, I am going to move into a couple of areas where I try to describe what we do, what we are attempting to get in place to do to show you what we think integration is. In the site characterization area, I think one of the things that in the letter that Dr. Cantlon wrote to Dr. Bartlett, about this meeting talking about some specific areas that he would like to hear about, site characterization integration was one of them.

So, we put together a chart that would kind of help us talk with you about how we are viewing that right now. It has some other interesting pieces of information on it that I will mention to you before I describe the overall integration and the way we view it.

What you see up here is simply a rack out of the tunnel program cost in the 2001 type of planning that we have done that shows the component, you know it is schematic, don't hold me to these figures. But, surface base testing and ESF testing coming in--surface base testing now and ESF coming in as we get the facility in place under the current schedule. And it shows the total cost in those numbers that total to the $6.3 billion. The number that has been through a number of reviews that Robby mentioned earlier.

The $764 million that you see here is tallied down across here and that is the total cost of the testing portion out of that $6.3 billion. Now, this doesn't include building

the exploratory studies facility. It includes, once I have one, how much do the actual tests cost in that facility? So, it is not quite a legitimate way to look at it on one sense. In the other sense, if you just looked at the testing cost estimates that we have, this is how it totals out.

Now, conceptually, what we wanted to communicate here is that we believe in the site integration part of our role in supporting Carl's work, what we have to do is to really have people who are on top of and understanding all the various pieces that are going on, including performance assessment, the design program where we have the actual responsibility. In some of the areas the production of interim data and I just showed a few schematic topics coming in here where data reports and technical reports will be developed as we go along and new data is captured. We need to have people who are almost on a day-to-day basis becoming familiar with the new information as it is being developed, working to make sure that it gets fed into this ongoing annotated outline process, topical report development process that we feel is so critical for moving the program toward a convergence on some answers to the questions of site suitability and potential site license ability.

So, we have to have people who are constantly on top of this information as it comes through. We showed just some interim site suitability evaluations in here, assuming

that some sort of iterative repetition of the early site suitability evaluation will be conducted.

Performance assessments, you know the program is now permitted to let--I think based on the recommendations from you all as well as the recognition of our own, that we need to do interim performance assessments, total system assessments as well as exercise the sub-system models to help us get a handle on what specific site parameters are very important and sensitive to drive it back into the site program, make sure that the information coming out of here is the right information.

So, the way we view our role, we have to have a team of people who basically not only in the case of PA, we have a role to actually conduct performance assessment and designs, but who also understand how this whole picture is fitting together.

Now, to have those kind of people, clearly, you are going to have some discipline experts in many of the areas in the site program which we are beginning to establish. You also are going to have some people who are able to talk across to the modelers, the people who are doing the actual calculations and to the design people who are attempting to fit an engineering system to this advancing understanding of the site--the natural variance of the site. I hope that helps conceptually. We have tried a lot of different ways to

explain where it is we think we are heading.

The other one you mentioned an interest in, and this has already been covered quite a bit, so I will go through it quickly, unless you have a question. We together with Art Greenberg's people have a team that I think is working very effectively to work this whole issue resolution, annotative outline development process. And I have been told by our people in the project office, Susan Jones who manages this area, that whenever she talks about issue resolution, she always starts out with this definition. If she doesn't she somehow gets herself confused and in trouble.

This is the definition that our project office people use. "Issue resolution which is the process of interaction or negotiation between DOE and NRC regarding technical or programmatic concerns to allow the licensing process to move forward..."

The next two charts are simply outlines of the way we see that process working. As I mentioned this is a joint effort. It is a joint effort shown between John Roberts' organization in Washington and Carl Gertz's organization in Nevada. We also have a joint team of M&O leads for the various components of the annotated issue resolution process. So, that in some cases depending on the specific discipline area, we might have an M&O lead from our office or it might be an M&O lead from the Washington office, the Virginia

office.

We always have, of course, in the case where we are moving this ahead, we have teams that include the experts from the participants. Say for example we have one team now that is beginning to work on ground water travel time. So, we would be bringing in the experts from Sandia, from USGS. We will work those specific areas to be members of this team that moves this particular area forward.

The way the process works is that John Roberts' office is the contact with the Nuclear Regulatory Commission, so although there is a joint responsibility for developing the information, it does flow back through a one point, single point contact to the NRC. And then hopefully we get some feedback and comments and something that we can use to help us refine the process, come back through and work this until we get to some point where the department can feel comfortable that they have something that is pretty well resolved, as resolved as it can be in a pre-licensing phase.

This one really says about the same thing, but it tries to put the issue resolution annotated outline process into the overall picture and say that clearly between--if we start down in the lower right-hand corner, the regulatory requirements go to this funny acronym which I didn't get written out, which is the format and content regulatory guide the NRC issued to help us with the content of the license

application as they saw it.

One of our goals in preparing an annotated outline is to test how this is working, to give the NRC a chance to look at what their format and content guide looks like when we start filling it in with a potential license application type of structure. We hope--as I said, we get the comments and feedback. It helps them to understand what it is they are asking us for. It helps us to understand where we have to go in order to eventually develop the basic information that would go into a license application.

Clearly the input here--this is the important input, we the M&O in Nevada have a very important role in making sure that this information, the site design and PA activity information is feeding into this process in a clear and concise way. And I think our overall goal is to make this work as well as we can.

One other point let me make on this. The issue resolution process clearly is intimately tied to the annotated outline, in that as we work along if we have an issue we are pretty confident that we have the technical information, the DOE is ready to stand firm and say, we think this is adequate information, then that is an area where in the annotated outline we might begin to write the information in the way that we believe it would take to convince the regulator that this is a solid basis for a potential closure in

that area. So, there is a very important feedback group and a linkage here.

Okay. Now, we have another kind of change--a shift in the presentation. From on now, go back to the format we had with Ray's and Art's where we will go through the organization with you and give you a feeling for how we are set up, how we are attempting to do the basic job that I have just laid out for you.

Dale Foust, of course, is the general manager for the site office. And we have the QA off-line as it is supposed to be. And we have a number of the support offices, like training outreach and human resources that you would expect to see. Our primary line management areas are shown here. We are going to go through each one of these, talk a little bit about the responsibilities and I will also tell you what we have done this year and what are hopes are for next year, in the same manner that you have heard from Art and Ray.

You can skip the next one. All it did was just take out a few pieces to make a simpler organization chart.

All right. In the systems area, I am the responsible manager in this area, so I obviously am very comfortable talking about this area compared to the other ones. We had the regulatory licensing on for the project office where we coordinate interactions with the NRC with them as well as

with the groups that we are talking with today. We work on the annotated outline as we have already talked about, support the issue resolution initiative, and we have responsibility within this office to prepare the semi-annual site characterization progress reports that go out on a semi-annual basis. As Carl mentioned that is the way we would communicate. When we make changes in the baseline program, we would communicate through those semi-annual progress reports that the changes are being made.

Performance assessment is also in the area of my responsibility and here we have a responsibility for working with the project office in supporting their management of the performance assessment programs. So, we call that technical direction and coordination.

We have some specific roles in waste package performance assessment, model development and actual exercising the codes as well as in total system performance. And of course, we have to provide the support necessary to the regulatory licensing function for it to be successful.

Let me mention the other area. I will in a moment talk about the transition status, and you will see that this is an area that is not transitioning in the near term. It is in a status of review whether it will transition at a point in the future. So, this area of environmental compliance and socioeconomics is one that we haven't staffed up yet at this

point.

And my nomenclature is the same as what you saw before, so if the numbers don't add up, that would mean that there is a TRW person in there, if the numbers down here don't quite add to what is in the box.

Moving over to MGDS development--

DR. ALLEN: Jean, remind me what MGDS is.

MS. YOUNKER: Mined Geologic Disposal System.

DR. ALLEN: Pardon me?

MS. YOUNKER: Mined Geologic Disposal System, which is repository.

Bob Sandifer who will be talking to you next about the 2001 exercise that we are conducting is the manager in this area. And within his areas of responsibility he has the exploratory studies facility design, repository waste package design, the ESF construction management, systems engineering and integration, and configuration management change control board.

You will notice and I might have mentioned on the earlier chart, you notice that in some ways we parallel the organization that we saw presented by Robby and Ray and Art, in that we do have the systems, the MGDS development and the support which was called secretariat. But, we have broken out a specific line function in the site characterization area to recognition of the importance of that particular

function in supporting Carl's operation.

So, in that site characterization area, you will notice that the primary responsibility here--you see all of our Woodward-Clyde Federal Services staff. Tom Statton is the manager in that area and he is also Woodward-Clyde.

To date, the principal areas that they are working in is in evaluation of testing and interpretation of test results as I mentioned earlier. Where we are heading in this area is for these guys to be a close to the primary data as it is being produced as they can be, so that they understand and can help us interpret what that new information means to the regulatory and performance assessment parts of the program.

They are working in the areas of integration through a number of responsibilities that they inherited this years, one of them being test coordination. The important one being test interference. For every job package, for every activity that comes through and gets approval to be initiated at the site, we do a set of analyses to make sure that tests--that there will not be downstream test interference that could cause a problem. If you start this test, another test you wanted to do will have some kind of faulty results and complications. So these guys are responsible for making sure that that type of work is done properly and for actually doing it and study plan coordination transition to

this group. So, the review development and making sure that the study plans get through the process and get to the head-quarters for approval is done under Tom Statton's organization.

The support area with Jim Frank as our manager is basically pretty much the same area that you saw with Ray's discussion of the secretariat. However, we also have, we have a large group that is working, just to go over the plans and procedures development for the project office, so that all of their kind of project level procedures for conducting work in the office are developed and reviewed under the auspices of this group. We also have a large number of people now in the records management area, and I think you have heard already that in taking over that responsibility, we are looking at areas where we can consolidated a number of separate facilities and perhaps be able to add a little efficiency to the program. This also includes information resource management and safety and health which is just for our own facilities.

DR. CANTLON: Before you take that one off, Jean, these the right-hand side, Zimmerman, are these the study plans?

DR. YOUNKER: No. I'm sorry. These are the actual programmatic, and quality assurance plans, and the adminis-trative plans and procedures for the way we conduct our business under the quality assurance program.

DR. CANTLON: Thank you.

DR. YOUNKER: No, the study plans are reviewed and coordinated by Tom Statton's organization in the site area. The site characterization group has that responsibility.

DR. CANTLON: Okay. Thank you.

DR. YOUNKER: The business management area is just about what you would expect it is, or would be from the name. Financial analysis, project control and administration and this is where all of our support people for clerical and all the people that make our life tough and full are in this box.

The functions project-wide planning and control system is probably the most important one from the standpoint of supporting the project office, because this is where the analysis of cost and schedule is done for the whole participant structure under the Yucca Mountain Project office. We do of course work with the project office to coordinate budget submittals. We will be doing facilities planning for them. We certainly analyze alternative funding scenarios and do a lot of "what affects" exercises as the various questions are asked about what would happen if different scenarios come down from Congress for this program, and provide support for audits. Just make sure that that whole area is healthy such that we can account for our costs.

MR. GERTZ: Jean, I would just like to emphasize for the board that particular analysis of funding scenarios. Last

year we did 53 different exercises in some depth. I think already this year we have exceeded that because of the various alternatives that are in the system, how much funding, what emphasizes this emphasizes something else. So, a lot of effort goes into that because we have to produce for whoever, internal budget, there are some meaningful documents to take forward.

DR. YOUNKER: I think if Dale was here, what Dale would want to say to you is, you know, it is so hard to decide too, how much staff effort to put into it. You never know which one is going to be the really important one, so you can't let one go by without making sure you've got your best people, you know, your senior managers involved and that it has the right information. So, I think Dale would express if he were here, a real strong frustration about that one, recognizing it is so important, but still just not having a feeling for just how much effort you can stand to put into that because your other responsibilities then suffer.

We have a pie chart to kind of give you an idea of the way we are spread right now, which we are at about 168 and the number kept changing as I was getting ready for the meeting. But we are spread--I tried to spread in about the same kinds of categories that I think you saw in the pie charts that Robby used. System engineering integration clearly is one of the areas, because you will see on my

transition chart that is coming up that we picked that up in October of '91, we already are built to a pretty good level there and probably won't have to grow that much in the real near future in that area. Some other areas we hope to grow depending on budgets, of course, and performance assessment, we have high hopes that if budgets are friendly to us next year, we will be able to grow in that area. The regulatory licensing, the same thing. And of course in the site characterization area. And can't not mention the design area, since of course those areas of responsibility are expanding dramatically and assuming the right scenarios we should be able to build to the full design teams that we need. We have the plans in place, and are cautiously getting ready to really ramp up for a full operation next year.

Okay. In terms of transition, as you know, our transition did get delayed. And, so as a result we have over about a two year period, we inherit a number of functions from the participants in the program. Many of them from SAIC or T&MSS. The management integration, as I mentioned, is one that we did take on the first of this year, this fiscal year. So, as a result we have moved into that area and spent a lot of time attempting to get ourselves organized and trained and up to speed and what to do to support DOE. Configuration management also came over in April, reg licensing. We took on pieces of it throughout the year, but as of April we have

all of the regulatory licensing responsibilities transitioned over from SAIC.

The records facilities, some of them have already transitioned. The central records facility will be transitioning in August. The local record centers we have already taken over, which is the one we mentioned earlier. The project control, the full operation of the complete planning and control system, is scheduled, I believe in the current version for August. There is some chance that this may end up a few months later than that just because of the major effort we are working on 2001. I think when you hear from Bob Sandifer next, you will see that it is very closely tied to having this system functional. We don't want to transition it at a critical time when we are attempting to use it to work the 2001 exercise.

ESF Title II design, we have already talked about. Performance assessment, we have some function--some responsibilities in that area already. The rest of those, especially in total system and waste package are to transition in October of this year. The same for technical data base management and transportation.

The transitions that are subject to review depending on the performance of the incumbent contractors are shown here for you. The environmental compliance area which is to be reviewed in June of '93 to determine if there is a need

for that area to be transitioned. The same thing for the whole training program, for the Yucca Mountain Project Office is subject to a review to determine whether it should be transferred or not.

Land access for site characterization is a relatively small effort, but that one is also subject to review. And then the outreach program that is provided from the SAIC Technical Management Support Services contract is to be reviewed in October of '93. And then the other ones that we have mentioned, sample management facility, for example and then the other participant responsibilities. We have mentioned, for example the USGS and the National Labs for the most part are not affected by the ramp ups that we have coming in for the next year.

Okay, in the system area now, what I am going to do is just walk through and pick out a few highlights for you like we did with the other presentations, just to walk through each of the line management areas. Pick out a couple; I won't go through every one of them. But, if you see one that perks your interest, please feel free to stop me and ask me a question.

As we said, in the Systems area, the regulatory licensing functions have come over completely as of April. We have an effort ongoing that is kind of a follow on, very low level follow on to the ESSE, the site suitability evalua-

tion that I managed. We dubbed it the integrated test evaluation.

What we were asked to do by Carl's manager for the site and the regulatory, Russ Dyer is to take the results of the early site suitability evaluation and attempt to use it in a practical way to see what kind of changes we would recommend to him that he should make in his site characterization program for the next FY with any kind of discretionary dollars that he has.

You know, if he is in a position where he could make some changes and make some shifts, we from this would try to give him some recommendations. If his primary driver was to be to evaluate those areas where the early site suitability evaluation says we have the largest potential for finding some unsuitability features. Some features at the site that would show the site was unsuitable. So, we are attempting to work on that. We owe Russ some input by middle of the summer. I guess the final report is sometime in September, I think, but we owe him some feedback on that. This is an internal effort. We are not going to put anything--

DR. NORTH: Warner North. Is there an interim document giving the scope of that exercise or some initial results of that exercise that we could take?

DR. YOUNKER: We have a management plan. I think you

may have already seen a copy of that. It seems to me that we sent that before. But, we have a management plan, we don't have any interim results yet. We have piles of papers is what we have right now, that we haven't analyzed thoroughly yet.

DR. NORTH: To pick up Dr. Domenico's question earlier, are you also looking at the needs of the licensing process in this integrated test evaluation effort?

DR. YOUNKER: Yes. As a matter of fact, we are. The way it was set up, it has--it is kind of a spreadsheet approach that you have seen us use before, Warner, and it has the first primary criterion that we used was site suitability. And we tried to take what we learned in early site suitability and bring that in and use it to basically rank the study plans.

The second criterion that we used was regulatory acceptance or regulatory assurance, and we are in the middle of working that one.

DR. NORTH: Is this effort linked at all to some of the budget exercises, the what if your budget gets reduced questions that have gone through 52 iterations?

DR. YOUNKER: Well, I would certainly like to tell you that it better be. Yeah. It would provide the basis for Russ to make those kinds of decisions and recommend to his bosses that certain types of tests should continue and other

tests should maybe be deferred or delayed.

The semi-annual site characterization progress report, as I mentioned is one of our primary responsibilities, so the sixth one is in the review process and the concurrence process, I believe.

As we have told we have worked on the annotated outline for a potential license application, worked issue resolution activities. You heard Art Greenberg talk about the EPA standard review and analysis efforts that we provided for that.

And, in the performance assessment area, one of the things our people are doing is attempting to kind of learn the program in a sense by getting all of the key players together so one of the big efforts that we had was to coordinate a flow and transport modeling workshop where all of the previous people who have been involved in flow and transport modeling for this program were brought together. A total of 60 people for three day conference. A great learning exercise, good technical exchange, giving our people a chance, the new ones particularly on the program to come up to speed and understand the work that has gone on who the key players have been.

The plans for the FY '93 for the regulatory licensing component of systems, we obviously will keep on with our deliverables like the semi-annual progress reports; continue

to work the issue resolution process; continue to coordinate meetings with you all if you continue to ask us back; and, support the issue resolution process.

In performance assessment, a lot depends in this area on how funding comes up for next year. If we are able to ramp up and really get our team in place, we will begin to do some actual development of codes, models and codes, and we will conduct a total system performance assessment iteration toward the end of FY '93.

If the funding is relatively flat, as you have heard talked about, then we probably will pretty much stay in the integration and support areas and not be able to build too much into this area, but we may have a little bit of work there.

We are doing a major review of performance assessment tools, and now I am talking about performance assessment tools at the MGDS level not a the total system level that Art Greenberg talked about.

And in this area we have done a fairly thorough review of the codes available for modeling unsaturated zone flow. And we want to expand that into complete review of all the codes that are available and will come up with some recommendations to the department as to which codes should be continued in the program and which ones should be left behind to get it down to a few key codes that we really put our

effort into.

Leon, you had a question?

DR. REITER: Leon Reiter of the staff.

Jean, in Dallas we heard two performance assessments presented. One integrated by Sandia, one by P&L. I assume the M&O had a limited role. Now, what is going to be in this new one? Are you going to be doing the integration? We heard some questions about this in the past.

DR. YOUNKER: Yeah. Our hope is to be in a position where we can actually participate in that and we will certainly coordinate and help define the problem the way we want--what assumptions should be made, you know, the way the problems should be constructed in working with Russ Dyer and his management team. But, we hope to be in a position to actually conduct a total system performance assessment ourselves.

DR. REITER: So, has it been decided that the M&O is now going to be the integrator of performance assessment and they are going to put all the pieces together and do the calculations also?

DR. YOUNKER: For the total system, I think that the answer is we intend to be in that position. We also will have that kind of a role in waste package. I think the idea is that through time we will evolve to a position where the National Laboratories' role in performance assessment will be

more in the model development and the basic research which is what they are really good at, we will go in more of the production mode.

DR. REITER: So, the National Laboratories will now have a diminished role in integrating and doing the total system performance?

DR. YOUNKER: I think over time we will probably move in that direction. But, Sandia will certainly still have a role in the near future in total system performance.

Moving into the MGDS, Mined Geological Disposal System development area; the significant accomplishments.

This year we did put together the basic plan for the 2001 exercise that you hear about. We have finalized our transition plan for the Title II responsibilities, which was a big effort. One of the things that we have had to do, in order to keep the design efforts moving forward at the project while the new document hierarchy is being constructed, we have had to revise the existing ESF design requirements, surfaced based facility requirements documents to make sure that they are in place to allow us to move ahead with the ESF portal, the north portal construction, in the beginning of FY '93. So, we have revised the current documents while we are actually working as part of the team that is building the new documents.

We have prepared readiness plans for Title II ESF

for the ACD for repository and waste package, and for the ESF construction management function. And we are working on waste package implementation plan, and that one you will hear more about from Hugh Benton, when he talks later this afternoon.

The FY '93 plans in the MGDS area: We begin the trade studies for the ACD phase of both the repository and various system designs; prepare project-level requirements documents to support ESF, Repository and EBS/Waste Package Designs; revise interface controls on the basis of the trade study results that we would be conducting; prepare supporting materials. We have talked a lot today about how important it is to have the appropriate information in the baseline and then to make sure that when you change that baseline that you have the same degree of information and detail to support the change as what you had when you had established the baseline. So, one of our important functions here is to make sure that we get that information packaged, in place to support CCB actions as the baseline does have to be change, and then begin conducting the studies to work on the quality activity list items.

By moving into the site area, we pick up a couple of these. One of the big efforts that Tom Statton's people has worked on is really learning the site program bottoms up, reassessing the scope of all the planned site activities from

now until 2001 as part of the 2001 exercise. They work in supporting interactions with the various oversight groups that we talk with. And, let me mention in this area that we have a number of integration groups that work in the project such as a hydrology integration group and a technical data base working group. And one of the key ways that our people are beginning to get a feeling for how the project works and learn the information they have to have in order to fulfill the roles that we are moving into, is to basically participate in all of these.

Because there is this type of interaction going on all the time in order to keep the flow of information, this takes up a lot of staff time just staying on top of all the different technical exchanges that are going on.

Okay. Plans for FY'93, we are expecting to move into a surface based testing coordination role for the project office. We are working on a technical assessment of the ESF seismic design beginning in FY-93; supporting the resolution of erosion and preparation of the final documentation for the technical resolution for calcite silica. We will be working to establish a field support group to work with the field test coordinators to make sure that the field program is operating efficiently.

This is one I will mention, just because it is really an important one that we are doing a lot of thinking

about. And that is, for the erosion topical report. One of the questions you have to face when you start to say, I think I have enough information to resolve this issues, is what is the quality status of the data? Well, much of that data was, not much, some of it was collected pre the approved quality assurance program, so you ask yourself the question, well I have to take it through the process of qualification to establish if there was a comparable quality assurance program in place such that your regulator will allow you to use that information and to make your primary arguments in closing an issue like the erosion issue. So, this is a good test case, I think. We are working. We have a team together. We are working to qualify the existing data for the erosion topical report.

Quickly through support operations. Significant accomplishments, we have already mentioned several of these in consolidated record centers. This plans and procedures report is a big effort which we did transition early. That we have completed transition plans for some of the software support. Microfilm center came with the records center, so some of these are the--these are the parts of the organization that has to function for us all to be healthy. Fortunately, we have a good team putting this together for us. Central records facility will transition in the next couple of months.

And, what we want to do in this area is basically continue to do what we are doing and do more of it. Strengthen the software development. We have a plan to consolidate all the records facilities. These are the areas that I think where we have the potential to gain some efficiency in the program as the M&O comes in. We are going to combine some technical libraries. These are the things, I think, where the overall attempt to put it together with a little bit of a new structure will probably give us some new benefit.f Also, the electronic document creation distribution system that you have heard mention will be implemented.

So, that was an attempt to give you in a snapshot what we see our role to be in supporting Carl Gertz in the project office.

DR. CANTLON: Thank you, Jean.

DR. LANGMUIR: Looking way back at page 20, you mention that an accomplishment in '92 was coordinating a flow and transport modeling workshop. Was it a document resulting from that workshop which described what came about and what was concluded?

DR. YOUNKER: There is a summary, whether it has actually been distributed or it is still in concurrence, I don't recall--I think it is available. We can check the status on that, but there is a summary. I just don't know whether it has been formally released yet. Carl, you don't remember do

you?

MR. GERTZ: I don't remember.

DR. YOUNKER: I have a feeling that it is so we can--I think we can probably--

DR. LANGMUIR: One other one for you. On page 23 you mentioned prepared readiness plans for a variety of things including waste package advance conceptual design. What does that mean you prepared plans for? And what did you come up with?

DR. YOUNKER: Well, readiness plans are basically--it is a procedural requirement to go through and make sure that you have all the prerequisites in place. So, a readiness plan is essentially the way you put together, what is it I have to do in order to take that function out or take on that responsibility. Does that--

DR. LANGMUIR: So there is not much substance to this thing, it is really a recipe for what you might do.

DR. YOUNKER: Well--go ahead Bob.

MR. SANDIFER: What we did is we simply cataloged everything that needed to be in place before we started work this fall, in each instance. So, we covered every detail that we could think of; procedures, management plans, equipment, personnel, all the pieces. And each one of these readiness plans addresses those elements. Now that will get us ready

for the readiness reviews that we will be subjected to this fall. All the readiness plans that she referred to do is internally tell us what we need to do to get ready for the readiness reviews, and in turn start the work.

DR. BREWER: This is Garry Brewer.

You are in charge of the socioeconomics component of this. I am new. I wonder what you do?

DR. YOUNKER: Well, that is an area that has not transitioned to us, so it is one of those that we don't really have responsibility except for an integration function. SAIC Technical Management Support Services contractor has that responsibility. I can ask--Carl, do you want to mention what they do for you in terms of--

MR. GERTZ: Yeah. Essentially part of the Waste Policy Act requires socioeconomic monitoring to mitigation, so we monitor the workers into the area. We keep track of a statutory or a report called the 175 report that listed 14 specific areas and what impacts we may have on the surrounding the communities by site characterization. So, it is those type of socioeconomic studies. It is different site studies, what would be the effects on local economies and local communities. It is not a very big program, but it is a mandated program by the Act.

DR. BREWER: Thank you.

DR. CANTLON: Other questions from the Board?

DR. CORDING: Ed Cording.

Jean, could you take a look again at figure 6 that you have there on the integration of the site characterization with program elements? The $764 million represents testing, as you said, not actual construction. And it looks there as if about $400 to $500 of that million is surface based testing. Is that--so the relatively smaller portion is in the ESF in terms of--

DR. YOUNKER: I think that proportion was supposed to be about right.

DR. CORDING: The other is that--is that 195 to 296 on the MTL? Is that when you--is that when the tunneling is being conducted, or what does that represent?

DR. YOUNKER: I think that must be the tunneling of the main testing level. Who knows? Somebody in the audience probably knows the schedule a lot better than I do.

DR. CORDING: And the ESF is being shown as getting up to real speed here by throughout fiscal '95, but I understand that October '95, which is the end of fiscal '95, is the time that the TBMs would actually start. So, it looks like that is showing the ESF at least a year or a year and a half ahead of the time that any construction, any excavation or tunneling would start. Is that right?

MR. GERTZ: Well, you have to tie each schedule to a funding profile. This one happens to be tied to a funding

profile that includes $75 additional funds in 1993. So, this is a funding profile--this is a schedule that supports the project receiving $320,000 next year to carry out our program. That is what it would look like.

DR. CORDING: So, if you get the $320 million, then you would actually start--

MR. GERTZ: Ramps on 10/94 with TBMs.

DR. YOUNKER: Yeah, the 2001 exercise has the assumption that that ramp up that goes to $700 million in FY '94. So this includes a funding profile with it.

DR. CORDING: And the portals would be started--what does that mean? Does that mean that excavating the cuts for the portals?

MR. GERTZ: No, the cuts will be done next year. That means concrete and rebar in the portal.

DR. CORDING: And I know there are a lot of projects where concrete and rebar in the portals comes after you get the tunneling done. All you need is a stable portal. That is one question I would have, perhaps we could talk about later.

MR. GERTZ: Yeah and that is some design details. But that is meant to be the concrete and rebar within the portal itself within the launching chamber. Whatever our current design deems necessary.

DR. CORDING: Okay. And launching chambers are often

drill and blasted the first hundred or two feet of the tunnel.

MR. GERTZ: And we do intend to drill and blast the first, I think, it's 170 feet is our current design, if I recall right now.

DR. CORDING: So, you could launch right from that?

MR. GERTZ: I don't have the design details in front of me, but the theory is the first 170 feet are drill and blast into the chamber. But, once again, that is tied to a different funding profile than we talked about earlier, because I talked about $240 million funding profile.

DR. CORDING: Okay.

The $900 million which was in that ESF evaluation a year or two ago, that $900 million included testing and excavation for the underground. Is that correct?

MR. GERTZ: That's correct.

DR. CORDING: So this is showing us something like $300 million for the ESF testing. Are we saying that the tunneling cost is about $600 million? Is that about how it is breaking down?

MR. GERTZ: That's a fair assumption right now.

DR. CORDING: That's about how it is breaking down.

MR. GERTZ: That's a fair assumption, on this cross the table analysis, that is fair.

DR. CORDING: All right. Thank you.

DR. CANTLON: Russ?

MR. MCFARLAND: Jean, in the review and reassessment scope of planned site activities that this chart was based on, did you do any prioritization? Was prioritization looked at is there on any follow on the TPT to establish these fundings and reassessment?

DR. YOUNKER: I would have to say that that certainly was part of the scope. Now, how much we have had time to do with the limited number of people we had to put on the site part of this, there will be some recommendations coming out of the 2001 exercise about potential scope changes or shifts in emphasis. That is part of our job to recommend to the department. But, I don't think the detail--I think our people would say that the details that they would like to be able to get their hands on to really do a good job, we didn't have time to put that together in this effort. But, there will be some.

MR. MCFARLAND: An additional question. As manager for systems, what are your schedules for reviews in terms of progress reviews on studies, progress reviews on assessments? Within the program, how often do you have reviews of activities?

MS. YOUNKER: Do you mean internal to the site office in Nevada?

We have basically monthly reviews of everything

that goes on within Carl Gertz's organization. So, we support those reviews. We helped put together the information for his line managers to present to him the status of cross-schedule and scope for every month period.

MR. MCFARLAND: Are there documents--is this documented at all?

DR. YOUNKER: Well, you know--

MR. GERTZ: Well, documented in a set of briefing charts.

DR. YOUNKER: Briefing charts. Yes.

MR. MCFARLAND: Thank you.

DR. CANTLON: Other questions? Board? Staff?

MR. ROBERTSON: Jean, could you put back up chart 17 a minute. I want to make sure we are all back on a reality check. That's the pie chart.

You know, we talked a lot about what the M&O has done out there, and they have done a lot with a moderate amount of people, but let's get a reality check.

Site characterization program is a big exercise going on out there. We have nine people overseeing that at this point. The design support that they have got are: five in waste package; six in ESF and construction management; and, eight in repository design; and five in performance assessment. There are 1,000 people working on this site characterization program out there. Until we ramp up in this

fall phase and get the staffing in there, you know, we are just catching the surface of it. So, I would not like to leave anybody with a conclusion that we have got all the answers. We are a long way from there. We have got a good framework, but this is just a very, very few good people, but they have got to have some more help before we can get to the bottom line answers.

DR. CANTLON: All right. Other questions?

(No audible response.).

DR. CANTLON: If not, Bob Sandifer Status of Mission 2001.

MR. SANDIFER: Good afternoon.

I would like to talk to you about the ongoing Mission 2001 exercise. It has been referred to several times during the day.

I'll do this by first talking about what Mission 2001 is, the approach we are taking, where we currently are, and finally what the deliverables or final products--what we expect to get out of this exercise.

First of all, what is Mission 2001?

Mission 2001 is a validation of the baseline, technical budget and schedule baseline of the Yucca Mountain Site Characterization project. It is being led by the M&O. All the major participants are represented. We are going to do the, or we have done the assessment of the feasibility, if

you will, of a licensed application in 2001, assuming the site is suitable and approved. We have done that first by looking at the work scope. What work is mandatory to get to this point? The second point is what does the schedule show? Is the schedule workable when we put all these pieces together? And finally, what is the budget? What is a reasonable budget to achieve this work? Not a fat budget, but a reasonable budget to assure that we do complete this work and reach the milestone. And finally, we want to leave this exercise and the methodology to incorporate refinements into the baseline as we move forward. Our baseline management, if you will.

Our intent when we run across a problem, something that is broke, something that needs correcting or this size-able savings, whatever the item is, we then turn look and see if there are solutions. Is there a solution that will fix the problem for example? If both of those elements are in place, then we are ready to go forward to DOE and get their concurrence to change the baseline. We won't do that until we have those elements in place.

The strategy that we followed first of all, make sure that we develop an MGDS that meets all of the require-ments. Second, focus our site characterization data needs on first of all evaluation of the site suitability, performance assessment, design and development and licensing. Again

licensing in the context if the site is suitable and approved. The other part of the strategy is to challenge the scope of work and the budgets that are projected to it. Challenge it at every opportunity and assure that our work scope is only the mandatory portion and that the budgets are what we have to have as opposed to what we would like to have.

Mission 2001 assumptions. The fiscal '93 funding corresponds to the administration request. That is, each participant has his split and he is to comply with that split. The project is not resource limited, however beyond 1993. The permits will not cause major delays. And finally, from a baseline standpoint, we are assuming at least in this exercise the 1988 SCP as modified by Option 30 of the ESF Alternative Study.

Now, I would hasten to add that you have got to get a snapshot somewhere. One can argue, well it is probably things that ought to be different in there. Yes, there may well be and they probably will be. But, you must find a spot in time, take your snapshot and do all of this, validate your baseline, and then from that point on, through good baseline management, you can make the adjustments that are appropriate to ultimately support your objectives.

DR. NORTH: Does this mean you are taking as given all of the study plans?

MR. SANDIFER: I an not sure I follow. The answer to that clearly from my perspective would be yes.

DR. NORTH: Okay.

So, in looking to see what is mandatory that has to be done, you take as given that you have to execute all the study plans?

MR. SANDIFER: That's correct.

Finally, as far as the assumptions are concerned, the test program that we currently have in place was amended from the SCP. There are several new elements in it and these are contained in '92 Yucca Mountain Site Characterization baseline document.

Now, to illustrate the point I was making a moment ago, that is, when we come across something that appears to be broken, appears to be a problem, or appears to be an opportunity to save sizeable amounts of money or schedule, whatever, then off line from the baseline, which is our normal focus, we will look at solutions, potential solutions that could solve these problems. And these are four examples.

The first is the heater test question. Basically, what is the time duration that we are comfortable with prior to license applications. Again, assuming that the site is suitable. We must be sure of ourselves. We must understand the problem and we must understand the solutions that are

available, and we must select the solution that fully solves the problem. If we understand the problem, but the solution doesn't full solve it, then we obviously hadn't been successful.

This is an overhead of, if you will, of the organization of the Mission 2001 Task Team. The project office interfaces with the site manager. We have a task manager designated within the M&O. He has these four functions reporting to him in this exercise. And in this box, is all the support personnel. M&O and participants that are helping to integrate all of this data. Such, that when we get to the end the data is consistent from participant to participant. We have all assumed the same thing, and we truly have a valid baseline.

Next I will show you generalize flow diagram of what we have been doing and where we are. We have--on the front end we define the task that we intend to complete. We define the organization that prepared our schedule and our key milestones. We have conducted workshops with the participants, hopefully to assure consistency and the methodology that we are using to input this data. Each participant including the M&O is prepared to call schedule and scope input. We in the M&O have coordinated this input into PACS, into the data base. We have reviewed the PACS output and at this point, we are in the revised refine mode with DOE. Once

we are satisfied and once DOE is satisfied, then we can move on and submit final data and issue a final report. Again, we are at this point today.

The current status, sometime ago we were successful in installing PACS work stations at each of the offices of the major participants. This was to facilitate data input. They can simply input into PACS their remote locations. Networks, budgets and scope of work have been inputted into PACS in each participant's case. We are underway with the effort to integrate the participant input. And finally, we expect to be done with this sometime in August.

This is a current milestone schedule where we are. This shows us being on schedule. But, I would caution you that these are difficult times in here because the quality of the effort is very much dependent on us getting all of the participants input consistent, that the schedule is workable, and that when we get out to August, that we truly do have a baseline that we can move forward with.

The remaining activities of this exercise: complete the integration of participant inputs; analyze critical path items obviously resolving them where we can; integrate budget with schedule; critically review. This is sort of the last shot in making sure that we have an integrated scope, budget and schedule package that is as reasonable as we can possibly make it. And again it only contains the mandatory

activities in order to support the milestone we want in 2001. Transmit the results to DOE for approval and with that issue the final report.

What products do we expect to get out of this exercise? First of all, we will have good, sound definitions of the work that is necessary to reach the milestone of 2001. We will have a baseline that reflects this scope of work and also reflects the schedule and the budget to support that work. We will have an improved data base to analyze alternatives that may have to be considered because of problems that will surely occur as we go along the way from here. And finally, we will have a comprehensive plan that carries us forward from here.

That is the end of the formal presentation.

DR. CANTLON: Questions?

Yes, Ellis. Dr. Verink.

DR. VERINK: I'll ask the obvious, on viewgraph number 5, you set up a question that I guess I better ask. What is going to happen with Busted Butte and with the robust package and the rest of these things that have been excluded.

MR. SANDIFER: Let me first address Busted Butte. We characterize that within the project at this point as the heater test duration as opposed to Busted Butte.

We are currently working off line as I indicated on a decision--I didn't say on a decision paper, but I said

these were being worked off line. We are developing a decision paper that first of all addresses the problem. Do we understand the problem? Do we appreciate what a reasonable and prudent heater test is, duration? We are looking at the drivers of that. Obviously, it could be regulatory. It could be the validation that a model requires a time beyond what is currently in the 2001 schedule, or it could be the scientific community saying this is what we need. This is what we would be comfortable with.

So, those are the drivers, if you will, that we are looking at. We need to understand the problem first. Then, we are going to look at solutions. What solutions are available for getting this? What are the risk with the solutions, and with the risk we will end up making a recommendation, obviously cost versus benefit is part of this exercise.

DR. VERINK: The same applies to the waste packages, robust containers?

MR. SANDIFER: These are being reviewed, but it is my judgment that when we enter ACD is when most of these issues will be resolved. It may be necessary to resolve them sooner, but they are currently being looked at. If you and the other folks here want to comment on it, it is more of an ACD issue. As you actually go into that exercise these are the things you want to make sure you have got on the table and

you have done the right thing.

MR. ROBERTSON: Let me make a comment to that and to Warner North's question originally about the SCP, because I think that is a valid question.

Everybody knows that there is bunch of debate going on about what we ought to do about the thermal loading scenario. Because of the compaction of the schedule that occurred because of the budget crunch in '92 and the potentiality for '93, we have gotten to the point where the long pole in the tent on the site characterization program is the thermal experiment, you know the thermal experiment in the mountain on the waste package. So we--that is one that has got to be looked at.

So, we've got a lot of alternatives here that we know are major swingers, but you can't overlay these on top of what you are trying to do in the way of getting a new, at least a new look at the current baseline. So, we drove a stake in the ground and said here is the baseline. We know these all exist. We are trying to look at the new baseline as it is laid out to accommodate these things if they may be, but we are not considering them at the moment, other than the fact that they may happen.

To come back to your question about the SCP. The same thing is true with regard to that. We would get into an

enormous nightmare if we were to essentially to go in at this juncture of trying to rebaseline the cost schedule and everything of the program and say, well, let's now decide what we may throw out of the SCP. Even on the--that perhaps our potentially is for erosion. So, we decided to drive the stake in the ground.

This does not mean however, that we aren't challenging the scope and cost and schedule attendant with the satisfaction of each of those plans, study plans. That's being done. But, the assumption is that the plans are all in there.

Now, another cycle that will occur once these basis of estimates are in place and we are satisfied with that baseline, the next cycle will be to decide what constitutes a new baseline, that new baseline may in fact recommend the removal of some site characterization plans where there is reasonable probability that you may not have to do it.

MR. GERTZ: I think that is one of the big points is we needed somewhere to start based on our most current information. And should any of these things or a modified site characterization program become our new program, then we have a baseline to change, address impacts on the baseline cost and schedule and then come up with a new baseline and disciplined manner. Which we have not had since probably three years ago, was a comprehensive baseline based on current

information.

And even as we talk though, as you are aware his first assumption for this one is that administration requests--we thought it was going to be plus $75 million, and that may not be a viable assumption come August, the very first part of our assumption.

DR. DOMENICO: Your second assumption is also very interesting, unlimited funding beyond '93. And your third and fourth are not without some problems.

MR. GERTZ: That is why we laid them out there, Pat, yes, sir.

DR. DOMENICO: Are there options in the event that the funding goes a long at the level that you have been getting in the recent past?

DR. BARTLETT: Of course, Pat.

DR. DOMENICO: Of course.

DR. BARTLETT: We make those assumptions because those are consistent with the Secretary's plan. And so far, we have not had to deviate from that plan, because one of the milestones to begin receipt in 1998 is a contract obligation and to begin disposal in 2010 we have no reason at this relatively distant point from that to change that yet. But, should be get into constrained resources, yes, then we will have to change it. But that is the basis for those rather optimistic assumptions at this point. As Robby said, we

drive the stake.

Let me add a little more to the comments of both Robby and Carl maybe, because it is very important. I want to underline--it is a point I made before and I guess we are all making. But I want you--I hope to really understand what this is all about.

The scope of work and the cost rate of work and the two of them multiplied together are different things. The cost rates, the $6.3 billion estimate is what has been verified for the extant scope. Now the key question is where did that scope come from. And, what adjustments might be made to it on what basis?

Where it came from is that it goes back into 1985 when there was a memorandum of understanding executed between the Department and the NRC, essentially setting broadly the scope of work estimated to be required to be demonstrate compliance with the regulations. And this was essentially the scientists involved in implementing the regulations for both the NRC and the DOE sitting down and thinking about what the work might be.

And then there was an evolution of workshops on that issue spanning a couple of years or more resulting in the site characterization plan consultation draft. First compilation of these estimates of scope of work required to demonstrate compliance with the regs.

Meanwhile, then and now still there is no explicit definition of methods and rules for demonstrating compliance, but you have these estimates. So the first compilation comes out as a consultation draft, get lots of comments and the scope goes up. And so the Department puts out then the final site characterization plan and the NRC comments on it and produces their site characterization assessment and the scope goes up.

That scope, the 106 study plans designed by that history is the baseline scope right now. And what it does represent is essentially the most comprehensive estimate of the work required as a scientist's basis of estimating what it would take to produce demonstration of compliance with the regulations. The regs are still in transit. We don't have the compliance rules and the scope was frankly very thoroughly gold plated to cover just about everything that everybody involved could think of as potentially beneficial to the forwarding of the scientific community.

What we are taking a look at now is what is the essential scope to get the job done. And I expect this to be a very penetrating analysis based on some estimate of potential risk approach to come up to the requirements rather than embracing everything and finding it was really down here somewhere. Because, frankly the costs associated with this scope are intolerable to a good many people. We want to see

what we can do to safely, in a sense, with some management risk, bring that scope of work down to something that we can live with and the regulatory system can live with.

And at the same time, as I have said earlier today, start to evolve what the requirements really all. So, we have all of this in process and that is what this is all about.

DR. NORTH: I really like the way you explained that, but I am concerned that you have to go back to the study plans and see what is gold plating you can live without and what is really essential to get the job done. And I use this one on the characterization of structural features early as an example, because it seems absolutely obsolete. This was written against drill and blast excavation of the shaft.

DR. BARTLETT: Uh-huh. The other factor there Warner, is the SCP is a statutory document and it is our baseline.

DR. NORTH: I understand that.

DR. BARTLETT: From which we have to reference every-thing at this point.

DR. NORTH: But, don't you need to go back and look at those 106 study plans and decide this is essential, and that is not and prioritize?

DR. BARTLETT: Uh-huh.

DR. NORTH: I missed where that was in this exercise. In fact I think I heard the answer that we didn't look at it, we

took the 106 study plans as given. That is the baseline.

MR. ROBERTSON: Correct. You are correct. That is the caution I wanted to put up here. You see him saying we are going to get to this baseline on the 14th of August, that is getting to the scrubbed baseline of the current program as it is defined as John just articulated. The next step is to begin to peel that onion. SCP by SCP. We have to do that. But, I mean there are literally millions of scientific and engineering hours that went into the make up of those study plans. And I can't with a handful of people in a two month or three month exercise here go back through that with the kind of assurance that we need for a program like this. So, we are going to have to systematically start back through that process, recognizing the statutory nature of it and the political sensitivity of taking pieces of that out if they are not appropriate.

MR. GERTZ: Warner, let me just add one thing. I believe and I will check and verify later that things such as the study plan you iterate, the estimate provided by the participant for that particular study plan is based upon the new thinking of ramps. It is not based upon shafts. It is based upon the new thinking of ramps.

The study plan is there to do the test. The specifics is probably based upon the new way we are doing business.

DR. NORTH: Well, I would hope, but I am not reassured because I saw a date with signatures in the front of this of April '92, so somebody presumably looked at it recently. And I am concerned about the schedule and cost implications that are built into the assumption that every two meters you are going to stop and take a photograph. That would seem like it is incredibly expensive.

MR. ROBERTSON: I will take an action to look into that.

MR. GERTZ: In fact, as I said, the reason I think that has changed, because one of the conversations I heard was that the M&O and the scientists agreed that you could move TBMs forward without stopping and protesting. And that is the basis of this 2001 estimate.

DR. NORTH: But it is not reflected in this document.

MR. GERTZ: No. It is not reflected in that study plan. It should be reflected in this estimate. It will be reflected when we change that study plan. Right now, we have not taken the time to update all our study plans.

DR. NORTH: Well, I certainly haven't looked at very many of the 106 and I wonder how many others have this kind of problem?

DR. BARTLETT: Maybe quite a few. That is why we are doing it.

DR. NORTH: Well, I hope there is agreement that the next stage beyond this particular stake is to go back through

the 106 and find out how many serious problems there are where there is an implication for cost and schedule which is simply not valid and go fix them. I realize it is an enormous job, but it seems to me it is incredibly important to get on with that job and have a realistic baseline instead of one that frankly suffers from a lot of, I'll call it history.

DR. BARTLETT: That is why we are driving to this on such a pinched schedule. Needless to say that the results that come out by mid-August are not going to be budget quality kind of estimates, but it will give us a first cut of what the real opportunities are. And, I might mention that a lot of the study plans have not been implemented yet, not even been written yet, because, they don't come until later. So, we don't have the total inventory to work against and we can bring the others up to speed with they can get into the picture too.

But, eventually we will be complete; we will be thorough; we will be incisive in this assessment of what can be done to affect not only cost rates, but scope and still produce a defensible result against the determination and suitability and licensability issue. That is what we are all about in this thing.

MR. GERTZ: Just to add some magnitude to it. I don't know Bob if you have got the estimate, but I think it is

4,000 or 6,000 activities that are involved in this particular analysis, both scheduled and resource loaded. So, it is fairly comprehensive. And once again, the SCP does represent our initial agreement between the EPA, the NRC, outside reviewers as the plan as we saw it in '87 or '88 whenever we issued it.

MR. SANDIFER: The 6,000 is much closer to the truth, Carl.

MR. GERTZ: Okay.

MR. SANDIFER: Again, I wanted to say that from the very beginning it was understood by the participants and the M&O this was an exercise, a snapshot to get a starting point. And that is what we'll end up having when we conclude this exercise, a starting point. Refinements beyond that certainly we recognize will be necessary.

DR. CORDING: Just another aspect of our concern as to what is the baseline and how the baseline is changing has to do with the ESF excavation plan itself. And it is somewhat the same sort of concerns that we know that you are in the process of going through some of these things, but you are still having to work with certain baselines. The baseline, what was it Alternate Option #33, I think it was, that was selected. It looked like a much improved scheme for evaluating the site, things we have been talking about over the last few years, a much improved baseline. But, that occurred, and

since that time, some of the refinements and the engineering going into that has been somewhat delayed and--so there hasn't been a chance to update that either.

So, some of our comments are in that direction. We are commenting on things that we are concerned that these get changed at some point and you are not locked into to the point that you can't adjust, because you are now moving into a portal development and things like that. The last plan that served as a baseline, was I think basically the 4 TBM approach.

MR. GERTZ: It is part of our Title I. We evolved from ESF alternatives to a Title I design, but it wasn't for TBM approach with Calico Hills and everything else.

DR. CORDING: Sure. And we saw some real desirable features of course, and we are very pleased to see some of the changes made, but at the same point it hasn't been engineered and refined to the point that I think it is the most efficient way of doing that project.

DR. DOMENICO: To add to what Warner said, especially the study plans associated with surface based testing. Those plans were written before we realized we had tritium and chlorine in the system. Those plans were written before we realized that there are some radionuclides presumably moving out of the areas where they have had the underground detonations because of the presence of colloids. So those test

plans are maybe a little bit old and I think if you look at those test plans with regard to your surface based program and activities, you may find that you may want to eliminate some of those wells, or change some of the plans to focus on the problems that have been more recently discovered.

MR. GERTZ: And we have the flexibility to do that as our principal investigators come up with better ideas. In fact Flint has changed some of his plans already in the near-field infiltration.

DR. CANTLON: Other Board questions? Staff?

Leon Reiter.

DR. REITER: Carl, you said that you have the flexibility to change the plans. I remember when we went around to talk to various people about the QA problems, one of the pleas we heard from the principal investigators was, for God's sakes please lets keep the plan stable. It is such a tremendous hassle to change these things that it is worthwhile living with a bad plan rather than going through having to change it.

DR. BARTLETT: That is why they are not running the program.

MR. GERTZ: I think the interactions between the scientists and the QA professionals through what we call a quality integration group has changed significantly over the last year and a half. And it is cumbersome to change a plan.

Let's not kid ourselves. We are in a regulatory environment where you document most everything you do. You provide an analysis for it that can be reviewed in 10 years. In other words, if you are going to change your plan, you had better have it written down as to how you are going to change it. But if it makes sense, it can be done. As I said, we made 36 changes in the last six months to the field work that was going on out there just to efficiently carry out the scientific investigations. So, I think we are figuring out how to do it a little easier.

But, still, we are working in an environment that is very cumbersome and detailed oriented, but that is the way it goes. Whether it is our environmental program, our regulatory compliance program for NRC licensing, our project control program, we have the GAO in my office almost everyday reviewing how I spend money. And that is why I need a $5 million system to keep track of how I spend money. You just go on and on. It is an expensive program, but it is part of the system that we have set up.

MR. ROBERTSON: Can I make one comment on baselines, because we have talked an awful lot about technical baselines.

From a philosophic viewpoint of someone who has managed a lot of large complex programs, the more specific and precise you have defined your current baseline, the

easier it is to change. It's a fact of life. The worse problem you've got is when you have got a fuzzy baseline and you get ready to start to change it and you start to debate at the fig leaf.

DR. BARTLETT: The National Academy of Sciences, as you may recall urges us to have flexibility. That does not mean that we don't have a firm anchor point from which we evolve through the configuration change control boards. Robby is absolutely right. One of my concerns has been the rate at which we can iteratively evolve and that is one of the reasons for the convergence. How fast can you execute the cycle of data acquisition. Data interpretation, management response, change to the system and then this iterative process all the time trying to converge. That is how all of these things come together. We are trying to redefine the program that has to be executed and to define the management system to actually fulfill the execution.

DR. CANTLON: All right. Let's take a recess and come back in ten minutes.

(A recess was had off the record.)

DR. CANTLON: The next speaker is Hugh Benton. He is going to talk about the Waste Package Design Alternatives.

MR. BENTON: I am very pleased to have an opportunity to talk about the Waste Package Development Program and the EBS Development Program of which the waste package is a part.

As we approach the end of the day's agenda, we approach the core of the problem, how are we going to contain the waste. We all cover an overview of the EBS Development program and then talk about some of the design options that we are considering as we approach the advance conceptual design phase which is scheduled to start on the first of October this year. And then review and show you an example of our technical approach that we will be using to guide the testing program through advance conceptual design and into the license application design phases. And then discuss the current activities, the near-term activities that are going on now and will be going on for the next year or two.

First, the EBS Development program. We are going to be discussing the development program for the engineered barrier system, not just the waste package which is a part of it. The engineered barrier system consists of the waste form, the spent fuel in its various configurations of burn up and fuel age. And of course, the high level waste glass. It also includes the canisters that the waste form may be contained in when it arrives at the repository; the basket within the container, the primary purpose of the basket being criticality control; fillers which may be placed inside of the containers and packing which may be used outside around the containers to retard the release of any radionuclides; air gaps both within the container and in the case of a

borehole emplacement configuration, the air gap between the outside of the container and the surrounding rock; any other material which might be surrounding the waste packages; the backfill which will be placed in the emplacement drifts; and we also include the near-field environment as part of the engineered barrier system, since we will be engineering the near-field environment through such things as control of the thermal loading. So all of these are parts of the engineered barrier system that we must consider.

Our goal and the goal for the development of the engineered barrier system is to achieve a design which first of all, obviously can be licensed, and has a very high probability of achieving a license can be shown to meet the regulatory requirements with sufficient margin to take care of the natural uncertainties caused by the fact of our inability to perfectly predict the performance of anything for the very long periods of time that we are talking about.

These are our two primary goals that we obviously must meet in order to be successful. In addition, we must achieve a design which is compatible with the rest of the waste management system including the repository, the MRS, the transportation system and all the rest of the components of the waste management system.

Finally, we must design a system which can be developed, can be fabricated, the waste can be loaded at the

repository, the waste packages can be emplaced, we can then monitor it and if necessary retrieve it. We could do all of these activities at an acceptable cost.

We will be using and we are currently using a systems engineering approach. We are currently in this portion of the program prior to the start of advance conceptual design. We are currently defining our EBS design requirements and developing design options, which we can then carry in to advance conceptual designs starting this October.

During that phase, we will evaluate the options that we have selected, which may be of the order of five or six in number. And during that period of a little less than four years, we will home in on the preferred designs. By this portion of the program, the early part of the license application design phase, we will have selected a preferred design and one alternate design. Then during the license application phase, we will in detail, engineer, develop and test the selected design. This will include the manufacture of prototype containers and the rigorous testing of them.

The research and scientific portion of the program will continue, of course, from one end to the other and will also continue past the license application in 2001. During this portion of the scientific testing program, we will be verifying the performance of our preferred design.

This flow diagram shows the waste package program. It does not discuss other elements of the EBS. Some of these block are shaded, which is a little difficult to see. The shading denotes those blocks which are the primary responsibility of the M&O and are being carried out by the M&O team. The other blocks which are not shaded are also within our purview from an oversight point of view, but they are primarily will be done by others, primarily by the National Laboratories and particularly Lawrence Livermore.

The top row up here shows our design development and also performance assessment in the second row. The middle row is our materials development program, and the bottom two rows takes care of the environmental portion, the near-field environment of which we are also--for which we are also responsible, and also the waste form characteristics.

Again we are in the pre-advance conceptual design phase. We are carrying out these specific activities and we will be moving in shortly into the advance conceptual design phase and carrying out these activities.

This flow diagram describes how we will be proceeding towards a successful license application, starting with the DOE mission objectives and the regulatory requirements which through an interpretation of the regulatory terms and the designed goals abide with the data base for the materi-

als, waste forms and site characteristics, will be able to develop scenarios which can then be used in the specific development of the engineered barrier system. There is a close interaction between the development of an engineered barrier system and the repository design which will be going on concurrently, and through the repository design, close interaction with transportation and the MRS.

The engineered barrier system development is closely tied to performance allocation and in this step we will be setting the performance measures and the parameters and the goals for the parameters that our design must meet.

This will allow us to develop models, component models and sub-system models which when combined with the test data will allow us to perform performance assessment operations on the designs.

After we have done performance assessment and uncertainly analysis, we should be able to answer the question of whether the selected design does or does not meet the regulatory requirements. If it does not, we must select alternate actions, and repeat portions of the process in an iterative fashion until we can answer this question yes, at which point we can proceed toward a license application.

This is a schematic representation of a potential repository at Yucca Mountain showing the potential repository here with the engineered barrier system in it. It gives a

schematic of the flow of ground water down from the surface through the unsaturated rock units and the saturated rock units.

If the waste packages and the engineered barrier system is breached, then potentially this flow of ground water can result in absorbing radionuclides from the waste package, which could be carried through the natural barriers, to the water table and to the accessible environment. Our objective, of course, is to delay that and prevent it as much as possible.

I would to describe some of the design options that are currently being considered and the reasons for them. As we have heard, we are starting with the baseline, with an SCP design which is a thin walled stainless steel container, 304-L stainless steel. It comes in several configurations. In the hybrid configurations for which there are three PWR assemblies and four BWR assemblies. This would contain 3.4 tons of spent fuel. Another configuration contains the high level waste glass in its own container. The SCP design is in a vertical borehole and it would require 40,000 to 50,000 containers for both the spent nuclear fuel and the high level waste glass.

We are proceeding from the SCP design toward the evaluation of longer lived waste packages which would be larger, significantly thicker walled, and would include both

corrosion-resistance and corrosion-allowance materials. Being larger we can contain more of the spent fuel up to our largest concept currently would contain about 15 tons. And having more spent fuel per container, translates of course into fewer containers which will translate into reduced costs.

These larger and much heavier containers can really only be emplaced in drifts. They are not applicable to borehole emplacement. And, the larger containers may reduce the number to as few as 11,000.

These are additional alternatives. On this view-graph and the next one, we have alternatives that will be considered doing advance conceptual design phase. We want to ensure that our alternatives encompass all of the viable possibilities, so that as we go into advance conceptual design, we do not arbitrarily eliminate any alternative which may be later proven to be a selected alternative. For instance, we are not sure yet what the thermal loading of the repository will be. Therefore, in our design of the engineered barrier system, doing ACD, we want to accommodate all thermal loadings from the cold repository at which waste packages are kept below the boiling point to a repository thermal loading which will be above boiling much, much longer than 1,000 years.

We will include both the borehole and the drift

emplacement, although all of our emphasis currently is on a drift emplacement. We will be providing radiation shielding for each of the individual containers or for the transporter. So, these will be two additional options.

We will be including sizes and weights of waste packages up to an operational limit. And we will decide by the end of this calendar year, what that operation limit should be of the order of 50 to 80 tons, probably.

We also want our range of alternatives to include the capability to load spent fuel assemblies for all like burn up and age without blending. In other words, we would like our designs to be able to accommodate a complete container of five year fuel with very large burn up rather than having to depend on the rest of the system to provide us specifically tailored blended fuel.

We want to allow for long term monitoring in the repository, including monitoring for perhaps a longer term than the current retrievable period; provide for selective retrieval so by which we mean that any individual waste package could be retrieved from the repository without disturbing other waste packages and for relocation so that before final closure of the repository and backfill, we could relocate waste packages to provide for the optimum thermal loading, whatever that turns out to be for the next 10,000 years.

Continuing with the alternatives, we need to accommodate future system wide decisions. For instance, as we proceed into ACD, we will be developing concepts which will accommodate universal or dual purpose casks or multiple element sealed canisters.

We have to accommodate both consolidated and unconsolidated fuel since both already exist. However we are not anticipating the consolidation of any fuel at the repository.

We need to accommodate the high level waste glass canisters. We will be using proven, reliable technology, and we are considering designs that could last substantially beyond a thousand years.

In our evaluation of materials, we have reviewed the alloys that have already been studied. These were fairly extensively studied in the 1980s, including the Austenitic stainless steel 304-L and 316-L. The 304-L is the current SCP design, although it is considered that it probably will be screened from future consideration because of its stress corrosion cracking problems.

The Austenitic nickel-based alloys, high-purity copper, copper-nickel alloy, aluminum bronze, nickel-based alloy and a titanium alloy. These have been studied and then last year Lawrence Livermore conducted an extensive evaluation starting with a large number of criteria that it was

important for the materials to meet, and with a large number of candidate materials and then ranking them in a mathematical effort in order to come up with the corrosion resistant materials which would have the highest grades--the highest scores.

These three materials, titanium grade 12, know as tico-qw and the nickel-based alloy C-4, now as Hastaloy and the Austenitic Incoloy 825, came up with the highest scores in that order. These three are also in order of cost by coincidence. Although the cost difference is probably not all that significant when it is manufactured in a waste package and all the additional costs of that operation are included.

DR. CANTLON: They are ranked in order of decreasing cost.

MR. BENTON: This is the most expensive, sir.

DR. CANTLON: Yeah. Okay.

MR. BENTON: The results of this effort are contained in the proceedings of FOCUS '91 and a formal report is currently in review.

As we start to look at specific designs we should review what the SCP waste package looks like. About 15 1/2 feet tall in the hybrid configuration with 3 PWR assemblies and 4 BWR assemblies. It is about 28 inches in diameter. In the configuration for high level waste glass canisters, this

is about ten feet tall, two feet in diameter. These are adaptable to emplacement in a vertical borehole.

For these we would need about 35,000 and here about 14,000 in the SCP configuration.

We are looking at the longer lived waste packaged which might look like this. This is one concept. This would have the same configuration of PWR assemblies and BWR assemblies that are in the hybrid SCP design. Encasing that would be an inner shell of corrosion resistant material. In our initial concept this might be one inch of Incoloy. And then an outer shell--the inner and outer shell could be bonded together. This would be corrosion allowance material and in this configuration could be three inches of mild steel for instance.

This would create a waste package which is not self-shielded, only partially shielded and would result in a total weight of 18 tons. That would mean that there is about five tons total weight for each ton of waste in place.

Another configuration would have more fuel assemblies contained. This one shows 21 PWR's in an inner barrier, an inner canister and an outer canister. This again could be one inch of Incoloy or some similar material, one of three selected. This probably mild steel, and if this were one inch and this were three inch the total weight would be 45 tons and we would have something in the order of three

tons of total weight for each ton of spent fuel encased in it.

We have considered the possibility that the proper configuration would be to totally self-shield each of the waste packages. In order to do that, we are estimating that about 12 inches of steel would be required. That is a very preliminary number. We do not yet know exactly how much this would be. This is an estimate. We would also need a neutron shield which could be something like borated aluminum which would not add too much to the weight.

If we had a limit of 80 tons which we are currently estimating will be our operational limit in a self-shielded package of this configuration, we could put only seven TWR assemblies or 16 BWR assemblies. That would mean about 16 tons for each ton of waste emplaced.

Any of these larger waste packages are adaptable to being placed in a drift. These could be spaced variably to take care of thermal load if the heat output of each of the packages is different from the others. We expect that they would be on supports such as this so that they would be off the floor of the drift, and we have some configurations of placement. These could be in the center of the drift as shown here or over to the side.

These are some of the attributes of drift emplacement that we think would be important to our design. Drift

emplacement will improve the heat dissipation compared to the borehole emplacement, since through convection, heat can be transmitted from the waste package to the entire surface of the drift will permit us to manage the thermal loading, not only at the time of initial emplacement but later. And, if the decision is that the thermal loading will be such as to keep the waste packages above boiling, then that thermal loading could be managed so that they could stay above boiling for a very long period of time.

As I mentioned it will accommodate the larger and heavier waste packages holding more assemblies than the SCP design which will reduce overall costs. Will make retrieval either of individual waste packages or the entire repository easier than if we had to go into boreholes.

We feel that it certainly should reduce any possible damage from a seismic event, since the waste packages will be unconstrained in a drift rather than being constrained in a borehole. And unless the waste packages are self-shielded we will need to do the repository operations through robotics.

This is a representation of a potential site at Yucca Mountain. The middle line is approximately the SCP design with about 48 metric tons of uranium per acre, requiring about 35,000 waste packages. If instead of that we increase the thermal loading, to something of the order of

130 metric tons per acre, which would mean depending on whether it is 20 year fuel or 60 year old fuel, something on the order of 65 to 175 kilowatts per acre, if we could increase it to that then we could reduce the number of waste packages to 7500 and we could reduce the size of the repository to about one-third of the SCP design. In the final slide, these two digits were reversed.

If on the other hand, the decision were made that the repository should be maintained below boiling, then we would need approximately twice the area of the SCP design and a little over twice the number of waste packages.

Now in looking at the drift emplacement it is important to have some concept of how we would move the waste packages in and out. This is just one concept which with the help of Morrison-Knudsen and Caterpillar we feel is a practical design, showing a waste package in the emplaced position and then a transporter that can carry a waste package in a transport position above the emplaced position which will allow the transporter to move over the waste packages which are already in the drift.

Another concept might be to have the waste packages over to the side of the drift and the transporter would go down the other side and the waste packages would be moved from the transporter into the emplaced position.

These I emphasize are only concepts at this stage.

We haven't even started advance conceptual design yet, so a great deal of work remains to be done.

Let me discuss for a minute our technical approach which will govern our testing program and our performance assessment program. This is an example of tables that we have constructed for each component in the engineered barrier system. This particular one will apply to the metallic container. We have similar tables for the spent fuel or canisters for non-metallic canisters and for backfill and for all of the components of the engineered barrier system.

For each component we described the function and the performance measure that must be used to describe the performance of that particular component. In this case, the function of the metallic container is to contain the radionuclides. The performance measure is the fraction of the containers breached. For each one of the performance measures we would have a range at least one, maybe more, in this case several, degradation modes by which the fraction of containers could be breached, either metallurgical instability, a range of oxidation and corrosion methods, or environmentally assisted cracking.

For each of these we determine what performance parameter needs to be measured, test it in order to determine what the performance measure will be. And our testing programs will then be designed to test these performance parame-

ters under a wide range of environmental conditions.

I just wanted to show that this is an example of the approach we are using to guide the testing program for materials and for the rest of the engineered barrier system.

And we discussed the current activities, the activities that we are conducting through the rest of this fiscal year and the next couple of fiscal years.

In design, we need to evaluate and select the concepts. This is currently going on based on a preliminary analysis of these eight primary criteria. There will be other criteria that we will also considered, but we believe these are the primary ones. Then as we start into advance conceptual design this fall, we will start a detailed evaluation of the selected concepts.

In the materials area, we need to perform degradation mode surveys of the iron-based corrosion allowance material. We know that there are gaps in our information of the iron- based materials. We need to identify those primarily through literature searches and then perform scoping tasks to determine the amount of information needed to close the gap and to lay the base for the tests that are going to be needed.

Some degradation model development has been done in the past, but has not been done in about the last three years. That needs to be restarted.

We will identify the parametric testing program we need to support model development. And we will be initiating that testing. Under our current hope for funding program, we would be initiating that testing early in fiscal year, 1994.

We are developing a test matrix of all of the parameters that need to be tested against the materials, the candidate materials that need to be tested. And, that plan will be completed this year and we will initiate the testing of those parameters and those materials as funding becomes available.

We also do not currently have a program to investigate non-metallic materials and we are anxious to start that and assuming funding is available that will be started next year.

For planning activities, we are revising the waste package plan in order to incorporate some of the design concepts that we have discussed this afternoon. And also there are some portions of the waste package plan which do need updating to bring it in line with the current program. We are also preparing a fairly detailed waste package implementation plan, which will guide our testing and our performance assessment and our design throughout ACD and also the license application phase.

And finally, we plan to start mass conceptual

design the first of October, this year.

Subject to your questions, Mr. Chairman.

DR. CANTLON: Thank you. Questions from the Board?

DR. LANGMUIR: We heard from John Bartlett last year that DOE had the right and the opportunity to mix and blend its fuel, the fuel from the power plants in order to maintain whatever thermal load they chose in any repository. You suggested on figure ten that you would avoid blending. And I wondered why you made that decision and what it was based upon? It seems to take some flexibility out of your disposal options.

MR. BENTON: Sir, I did not mean to imply that we were going to avoid blending. I only meant to imply that we were not going to start into advance conceptual design under the assumption that blending would be required, that we would be unable to make our designs work unless the fuel were blended. We will be flexible enough to be able to accommodate blended fuel, but we also believe that with drift emplacement and larger waste packages and the ability to move waste packages in the repository, that we can be flexible enough to accept fuel that is not blended. I did not mean to imply that we had made any decision that the fuel could only be accepted if it were not blended.

DR. CANTLON: Dr. Verink.

DR. VERINK: Hugh, I want to say how much I have enjoyed

your presentation. We all than you for what I think is a very important contribution.

MR. BENTON: Thank you for the opportunity.

DR. VERINK: The test program that you were talking about which I understood you are going to start in 1994, was it, the corrosion testing program?

MR. BENTON: We hope to start that program early in 1994. We feel that if we are not able to start long term material testing by about January of 1994, it will be difficult to provide enough data in order to complete all of the steps that are necessary prior to a license application in 2001. So, we need to start it by then.

DR. VERINK: You need probably five years or so testing it.

MR. BENTON: We wanted it to go as long as possible. Five years is one data point. We could do with a little less by increasing the risk, but something of the order of five years is what we feel is reasonable.

DR. VERINK: I enjoyed your talk.

DR. DOMENICO: You mentioned that if you wished to keep the repository below boiling you would require twice the area needed in the original SCP. Do I have that correct?

MR. BENTON: Yes, sir.

DR. DOMENICO: My question is, do you have enough space in that mountain and if you have to extend it out, does

anybody know anything about the geology of the added space it is going to require? That is probably something you can't answer, but there must be somebody here.

MR. BENTON: If I can refer that question to a geologist.

MR. GERTZ: I am not a geologist, but certainly in the SCP we have added expansion areas fairly well identified, many people believe with current spacing we could get to 100,000 metric tons. We won't really know until we get underground. That is part of it. Other people believe there is more than even--I think we are 1,200 acres now and they had 1,900 identified. Maybe Jean can help you a little bit.

DR. YOUNKER: That's right. In the SCP I think we had a number of expansion areas, mostly to the north and the northeast.

DR. DOMENICO: Toward the large gradient perhaps.

DR. YOUNKER: Right.

DR. DOMENICO: Right. Okay.

DR. YOUNKER: But we have enough data to know what the rock type is like there, so that if you get a handle on what causes that gradient, the rock type might be perfectly reasonable as a host rock.

DR. DOMENICO: I just asked that because, you know I would hate anybody to get the idea that the available space would be driving the decision on thermal loading. That is

the whole key. That decision should be made independent of space.

MR. GERTZ: I think we agree with you.

DR. LANGMUIR: What is going to be the average age of fuel at the time of disposal? It is not five years. Isn't the average age of few going to be more like 20?

MR. GERTZ: 28. I don't think that is the issue, Don, because in our hot repository we want to use even colder fuel to start with and pack it tighter. So, the age of fuel is not an issue on thermal loading.

DR. LANGMUIR: I just wonder what the size you have chosen for the SCP, what age fuel that assumed?

MR. BENTON: For the SCP ten years.

MR. GERTZ: Ten year old fuel, yeah.

MR. BENTON: The current age, the age by 2010 will be about 28 years.

DR. DOMENICO: But the SCP considered hot to cold, right, the thermal pulse dropping off at the end of five or six hundred years. Is that correct.

MR. GERTZ: Keeping it up above boiling for 1,000 years.

DR. DOMENICO: Oh, about a 1,000 years.

MR. BENTON: The SCP has it above boiling actually for about 1,400 years.

DR. CANTLON: Some of the other countries in looking at the engineered barrier have used various kinds of fillers

inside the canister. I noticed none of the models that you had up there had any thing they have used lead, shot, glass, beads, a whole array of different concepts that they have looked at.

MR. BENTON: We are considering fillers. We do have that on our list of engineered barrier system components to be considered. We just haven't progressed far enough yet to get to that level of sophistication. We may well want to use fillers either for both--perhaps both for criticality control and for thermal conduction. Frankly, we have currently done very little work on fillers.

DR. CANTLON: And a follow-up question, you also haven't looked or I didn't see in any of the options any kind of lead lining to improve the radiation shielding. Again, some of the other countries have looked at lead lining as a way of improving shielding.

MR. BENTON: You are right, sir, we have not looked at that. Our near-term effort is to determine at what weight we are going to be limited. And then we--after that we could decide what is the proper division between mild steel which has some corrosion advantages, at least the corrosion is quite predictable and in the environment of the potential repository would probably be reasonably low. So, we have to have a trade off between the mild steel and lead which might not do as much for us in corrosion and would sure add to the

weight.

DR. ALLEN: I didn't quite understand your observation that you thought the seismic stability would be better in the drift. You certainly do in terms of displacement, yeah, the more area you have around it, then presumably the better off you are, at least until such time as you backfill. But in terms of seismic shaking, which is certainly the much more severe problem, certainly it is going to be shaken seismically over the next 10,000 years, many times. Don't you have more problems with a very heavy canister getting that thing anchored down in some reasonable way to prevent it from rolling around in there, particularly if you want to maintain the ability for transporters to go over it and this sort of thing. It seems to me to some degree although that problem is not insolvable it is a little more difficult in the case of the drift emplacement.

MR. BENTON: Well, I certainly agree that in the drift emplacement we may have displacement--could have a displacement of a canister out of its original location by some small amount. By whatever amount.

In addition to it being in the drift, we are considering the heavier, more robust thicker walled canister. So, we believe that that in itself gives us more protection for a release of radionuclides due to a seismic event, due to a fracture of the container. If there were a severe seismic

event, then presumably we would have to go back into the repository realigning the waste packages and maybe dig out rock falls, or whatever else was necessary in order to restore the repository to its original condition.

But, we believe the more robust waste packages would be less suseptible to any potential release of radionuclides, from a seismic event.

We are estimating and these are all of course very preliminary estimates that waste package could roll from side to side in an open drift without significant damage. In fact, we are assuming that our test program of the prototypes will include severe drop tests similar perhaps to what is currently done for transportation.

DR. PRICE: But it may not be necessary to leave the drift completely open as you are describing.

MR. BENTON: Yes, sir. Right.

DR. MCKETTA: McKetta, Board.

Hugh you tell me how thick thick wall is. You have never said anything about how thin thin wall is?

MR. BENTON: The SCP design is 3/8 of an inch.

DR. MCKETTA: Why would you even think of that or even consider?

MR. BENTON: Sir, to be honest, I didn't.

DR. MCKETTA: I have one more question. And I think I'll have to ask it of Carl. I am new, Carl. I read two

figures and one is that this repository would cost about $6.3 billion. The other figure I read or heard from Jean in her very nice presentation was $748 million for testing. What is the other $5.5 billion, roughly.

MR. GERTZ: I can even roll it off the top of my head.

DR. MCKETTA: That is what I want.

MR. GERTZ: We spent about a billion dollars already, a little bit over a billion. We are going to provide in our $6.3 billion estimate a billion dollars to the state and counties for oversight and benefits.

DR. MCKETTA: To state and county.

MR. GERTZ: That's right.

Construction of ESF and other facilities, not the testing in it, but the construction of it and other facilities is about a billion dollars. That is three.

Waste package and repository design itself, the design of the waste package and the repository is about .8.

Project management, meaning the QA program, the infrastructure project control, all the project management things is about .7 I think. I am giving you all inflated numbers.

DR. MCKETTA: That is $4.7 out of $5.5. That's all right.

MR. GERTZ: And then there is some other miscellaneous that don't come to my mind right now.

DR. MCKETTA: Project management--is that M&O that we have been talking about today?

MR. GERTZ: No. It is all project management at the labs and everywhere else. We have to maintain a project control system, a sound QA program and those kinds of elements. Rent. Phones. Copy machines.

DR. MCKETTA: Thank you.

MR. GERTZ: Records management.

DR. LANGMUIR: The original SCP talked about borehole emplacement of the waste and you folks have made some calculations which suggests that it costs less per ton of waste to go to a drift emplacement. When you do that of course you are--depending on what thermal regime you ultimately decide to use, this then influences what kind of backfill considerations come into it. It is pretty tough to backfill something in a horizontal hole. But you can certainly backfill around it more readily like the rest of the world is doing if it is in a vertical hole. So, that has to be part of what you are thinking about when you decide why you might pick a vertical position or a horizontal position. It isn't just a matter of the cost of the package itself, it is what you can do with it once it is in there. Whether you can put an engineered barrier around that or not is involved in that decision, too.

MR. BENTON: Yes sir, Dr. Langmuir, I certainly agree.

In the SCP design there was a fairly small air gap between the container and the rock. So there was not a whole lot of room for backfilling around the container. We have not progressed to the point of being able to analyze what type of backfill would be best, either in the borehole emplacement configuration or in a drift emplacement configuration. That will come during our advance conceptual design and license application design activities.

The main reason that we feel at this preliminary stage that we could save some money by going to a larger package is that the cost of the fabrication of the container and loading the fuel in it and closing it and then verifying that that closure meets all of the requirements, is relatively insensitive to the size of the package. And the cost of doing that is very sensitive to the number of times you have to do it. So, if we can reduce the number of packages, then we believe that there will be some significant cost savings.

DR. CANTLON: Staff questions?

DR. DI BELLA: Carl Di Bella of the Board staff. You mentioned your revising the waste package plan. I assume that you mean the waste package plan of July '90?

MR. BENTON: Yes.

DR. DI BELLA: And if so, when do you plan to have a draft available and will that draft be made available to the Board at that time?

MR. BENTON: We intend to submit that draft to the Yucca Mountain Site Characterization Project Office for their review, next month.

DR. CANTLON: Any others?

MR. MCFARLAND: Russ McFarland.

You mentioned an operational limit of about 80 tons. Was there a basis for that?

MR. BENTON: I am sir, say that again?

MR. MCFARLAND: You mentioned a limit on the package size operationally of 80 tons.

MR. BENTON: This is an estimate and it may turn out to be a lower number than that. An estimate of what weight is practical to carry into the underground repository. There are several factors that need to be decided, what the ramp pitch is going to be and then there will perhaps will be a limit on the length of the package in order to make the turns in the repositories. These things have not yet been decided.

The primary limit is probably going to be what is a practical weight? We have said that we want to use current technology. We would prefer not to get into having to design transporters and lifting mechanisms for an underground environment which are considerably outside the envelope of what is currently used in the mining industry.

MR. MCFARLAND: Thank you.

DR. DOMENICO: To follow upon that, would 80 tons rule out the universal cask?

MR. BENTON: No, sir, I do not believe it would.

DR. DOMENICO: And the other point I think--

MR. GERTZ: Just as long as you have an 80 ton universal cask.

DR. DOMENICO: I should have thought of that, Carl.

The other point I think is I don't see any contingency loops in your diagrams because I get the feeling that a lot of this is probably premature because the canister you pick is going to depend upon what kind of geology, and hydrology and geochemistry you find. And, I could--and how predictable you think it is going to be over a long time period like 10,000 years. And I can think of at least a few conditions that will force you into a long-lived 10,000 year canister. And those maybe things such as that that are possible to be found in Yucca Mountain.

So, I get the feeling that your ultimate choice is going to be controlled by geology, hydrology, geochemistry and how well you think it could predict the behavior of that natural system and the canister may be a long-lived canister.

MR. BENTON: Yes, sir. We agree completely. As we proceed from this point on into our design phases we are making the conservative assumption that we need to have designs which are very long lived. And if it then turns out

that because of either reasons of excessive cost or whatever else, we scale back from that, hopefully by that time we will have sufficient data from the site so that we can achieve the proper balance.

MR. CANTLON: Bill.

DR. BARNARD: Bill Barnard, Board Staff.

Hugh, on your 27th slide, you list 8 criteria that you are going to use to evaluate and select candidate design concepts for your ACD. You don't list cost as one criteria. How important is cost in this evaluation?

MR. BENTON: We feel cost will be quite important. We do not list cost because we don't really know enough about it. We need to develop the concepts more so that we can then determine what the costs of the concepts are going to be. These are the 8 things that we are using to develop what the original concepts should be. And then during ACD we will get those concepts to the point where we can go out in to the industry and determine what the fabricated costs of those are. We are just not to that point yet. So, although we have some guesses about costs, our information is not complete enough.

DR. PRICE: Dennis Price.

I would like to suggest that the fabricated cost is only part of the cost figure and you have got a total system cost that really has to ring into this decision.

MR. BENTON: Yes, sir. I would agree. Definitely.

DR. CANTLON: Other questions from the staff? Board? Audience?

MR. GERTZ: John, I am sorry, while the audience is coming up I just wanted to finish out--I found my other--the rest of that money.

Systems engineering technical data base, performance assessment and the environmental and institutional support. So, those kind of things are in there.

DR. CANTLON: Makes the other $400 million.

MR. GERTZ: And John, let me provide you with something else that I don't have a view-graph of. This is a history graph of a different cost of high waste package and in some instances down here -- it is by year how we see the program.

DR. CANTLON: Very nice.

MR. GERTZ: The ESF you can see that is part of the--it will be a small part of the program.

DR. CANTLON: All right. Thank you.

MR. GERTZ; I need to respond to one other question some of your staff had. I have kind of a black eye here and it was not from being beat up by the Board or other people. My daughter is a fast pitch pitcher, and she is very fast but not very accurate some times. She threw one in the dirt and I didn't have the reflex to get my glove up in time.

DR. CANTLON: Papa is a little slow.

MR. GERTZ: I think so. I think so.

There was a comment I think that it was one of my bad calls, that perhaps--for those of you who don't know I do officiate football and basketball college and high school level.

DR. CANTLON: All right then, I think we are able to take a recess at this point. We have had our discussion period and we will reconvene tomorrow morning, 8:30 I believe it is. Yes, 8:30 here in this room. So, we are recessed.

(Whereupon, the meeting was adjourned at 4:40 p.m., on July 7, 1992, to reconvene at 8:30 a.m. on July 8, 1992.)

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