UNITED STATES OF AMERICA

NUCLEAR WASTE TECHNICAL REVIEW BOARD

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FULL BOARD MEETING

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Key Bridge Marriott

Potomac Ballroom, Salon C

1401 Lee Highway

Arlington, Virginia

Wednesday, January 6, 1993

9:00 a.m.

PARTICIPANTS:

JOHN E. CANTLON, Chairman of the NWTRB
CLARENCE R. ALLEN, Member of the NWTRB
GARRY D. BREWER, Member of the NWTRB
EDWARD J. CORDING, Member of the NWTRB
PATRICK A. DOMENICO, Member of the NWTRB
DONALD LANGMUIR, Member of the NWTRB
JOHN J. McKETTA, Member of the NWTRB
D. WARNER NORTH, Member of the NWTRB
DENNIS L. PRICE, Member of the NWTRB
ELLIS D. VERINK, JR., Member of the NWTRB
JEFFREY R. WILLIAMS, DOE/OCRWM
ROBERT F. WILLIAMS, Electric Power Research Institute
THOMAS L. SANDERS, Sandia National Laboratories
WILLIAM A. LEMESHEWSKY, DOE, OCRWM
DONALD GIBSON, M&O/TRW
CARL P. GERTZ, DOE, Yucca Mountain, Site Characterization Project Office

PARTICIPANTS [Continued]:

WILLIAM D. BARNARD, Executive Director of the NWTRB
DENNIS G. CONDIE, Deputy Executive Director of the NWTRB
SHERWOOD CHU, Senior Professional Staff, NWTRB
LEON REITER, Senior Professional Staff, NWTRB
CARL Di BELLA, Senior Professional Staff, NWTRB
ROBERT LUCE, Senior Professional Staff, NWTRB
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VICKI REICH, Librarian, NWTRB
FRANK RANDALL, Assistant, External Affairs, NWTRB
NANCY DERR, Director, Publications, NWTRB
KARYN SEVERSON, Congressional Liaison, NWTRB
PAULA ALFORD, Director, External Affairs, NWTRB
LINDA HIATT, Management Assistant, NWTRB
HELEN EINERSEN, Executive Assistant, NWTRB

P R O C E E D I N G S

[9:02 a.m.]

DR. CANTLON: Good morning. It's 9 o'clock. We'll get this session underway.

This is the second day of the meeting of the Nuclear Waste Technical Review Board. My name is John Cantlon. I'm Chair of the Board. We are looking in yesterday and this morning's session at the logistics of the nuclear waste management system, interim storage, transportation, containers, and so on. This morning's session will be chaired by Ellis Verink.

DR. VERINK: Good morning. I'm Ellis Verink. As John said, I'll be the moderator of this morning's session. My field is materials engineering, metallurgy corrosion. I'm the Chair of the Board's Panel of the Engineered Barrier System.

Yesterday we had some very exciting policy developments regarding interim storage. We received an update, as you know, on the MRS. We heard about interim storage from perspectives of both the utilities and the regulatory agencies.

We ended the day with a presentation and discussion by the representatives of EEI with regard to interim storage and their initiative in this area.

This morning we're going to continue the meeting and pick up where we left off yesterday. First, a DOE representative will discuss DOE's Multi-Purpose Canister study. Then an EPRI representative will discuss the recent EPRI so-called Universal Container Concept study. The last presentation of the morning will be by a Sandia representative who will discuss transportability issues of dual-purpose casks.

There's going to be time available for brief questions and answers after each of the presentations. We're going to maintain the schedule but we'll make use of any available time between for that.

Then I also want to call your attention to the discussion period following the last speaker of the morning. The purpose of this discussion period is to discuss anything and everything that we've heard about in the interim storage question both today and yesterday. So, gear up.

[Laughter.]

DR. VERINK: We hope the discussion period will be wide open forum for information and exchange on interim storage. We reserved an area across the front here for yesterday's speakers that are still with us, or their representatives, and today's speakers. I hope this will be an interesting grand finale to our day and a half devotion to interim storage.

Our first speaker this morning is Jeff Williams. Jeff is Branch Chief of the Storage Division of the Office of Civilian Radioactive Waste Management. He's going to talk about DOE's multi-purpose canister study, which I understand is a discussion of work that really pre-dates the new DOE interim storage initiatives.

Jeff?

[Slide.]

MR. J. WILLIAMS: Thank you. I'm happy to be here today. Hopefully I'll live up to the expectations that Bob Rasmussen and several other people spoke about yesterday.

As was stated, I am Jeff Williams. I'm a Branch Chief in the Storage Division. The study that we've embarked on is really a study that goes across the whole waste management system.

[Slide.]

MR. J. WILLIAMS: What I would like to tell you about today to give you a little bit of background about the study, a little bit of history, what lead up to it. Then I'll tell you about the study itself. I'll describe the canisters that we looked at, how operationally they fit into the system, how they could be employed.

I'll describe preliminary results of the study and identify advantages and disadvantages. Finally, we'll touch on some issues which I think were brought up by several people yesterday and some of the future activities.

Today what I'll be presenting is some preliminary data. We will be reviewing this next week in detail with EEI's Universal Container Task Force. We're looking forward to that.

[Slide.]

MR. J. WILLIAMS: I think as was brought up yesterday, Universal Canister is not a new idea. It dates as far back as this slide goes, 1985. Actually, it was earlier than that that they has been thought of. DOE did a study of these concepts in the '84, '85, '86 time frame.

In 1988 when DOE did their dry cask storage study, which was required under the Nuclear Waste Policy Act in '88, one of NRC's comments on the report was that they stated their concern with compatibility between dry storage at reactor sites and the waste management system.

When the MRS Review Commission came about during 1988-1989 time frame, I believe they also asked about compatibility.

As you know, the Nuclear Waste Technical Review Board has expressed interest in minimizing waste handling. While we've been dealing with the MRS potential host that Chuck

Lempesis has talked about. There were several concerns about handling bare fuel, and that it might be better to handle canistered fuel.

More recently, the interest at EEI. Bob Rasmussen told you about their study and their conclusions. EPRI employed a study that was completed last August, I believe. Then finally, the utilities resolution that Bob talked about that was passed in December.

The recent DOE analysis is not only the study that we're going to be focusing on today. We initiated a study about a year ago on this concept. That was completed last August.

As a result of that study, there were several advantages. As a result of the EEI and EPRI study, we embarked on a new study where we put together a team of people across the OCRWM system from our M&O contractor consisting of transportation people, system analysis people, waste package design, MRS design people.

[Slide.]

MR. J. WILLIAMS: We went into a rather large effort to take a very detailed look at how the canister could be employed in the system.

This new initiative was started in October '92. As I said, it was basically a follow-on to previous work that was being done. The objective of the study -- we evaluated the benefits, identified pros and cons, and wanted to determine what's the best way in which to gear our future work towards implementing the canister concept.

It's primarily a system study. It focused on parts of the system that we know best and that we could quantify. For example, we don't have an in-depth design of the repository surface facility except for that that dates back to the site characterization plan. So, we didn't look at that in detail.

This was not a design study. The pictures that I'm going to show you today are not designs, but they're concepts for the purposes of doing this study. We believe there's a lot of room to optimize the system. We'll follow this up with design trade-off studies.

[Slide.]

MR. J. WILLIAMS: I think you heard quite a bit about what this is. I'd like to define what we are calling, for this study, as the multi-purpose canister. It's been called the universal canister or universal cask. Multi-element sealed canister is used in industry, I believe. Another term that we've thrown here to keep everybody on their toes is a multi-purpose unit. Yesterday, Dr. Bernero called these things cartridges.

I think we're all talking pretty much the same things. They're sealed canisters. They hold more than one fuel assembly. They are a canister. The primary concept that we were looking at was a canister that is placed into separate overpacks for storage transportation and geological disposal. The intent is to never open that canister once it's sealed.

I think one thing that was definitely brought out yesterday, but what's important is that this canister has to meet all four different regulations. First of all, at the reactor, 10 CFR 50 regulations, we don't think is a big deal. However, some utilities may need to get a Part 50.59 license to load canisters.

The part for storage, they'll need to be certified in accordance with 10 CFR 72 for storage, Part 71 for transportation, and finally Part 60 for the ultimate disposal.

[Slide.]

MR. J. WILLIAMS: The major characteristics that we looked at for trying to put together a concept for the study are as follows up here. First of all, the canister has to have structural integrity, and it has to have a neutron absorption capability to ensure that it remains sub-critical during handling and transportation events.

It has to be designed to maintain temperature limits on fuel cladding. Right now that's about 380 degrees for storage. The repository people have established a temperature limit of 350 degrees Centigrade for their cladding and disposal, or goal, I should say.

The canister needs to eliminate the need to handle bare fuel. Obviously it needs to be compatible with the storage and transportation and disposal overpacks. The goal is to minimize spent fuel handling.

It needs to meet other thermal requirements other than cladding. There's different thermal requirements for storage transportation and disposal. It needs to provide containment.

One important part is for the study we said that this canister will not have performance allocation for disposal. I think Ron talked about that a little bit yesterday. But this important, and is something that we will look at further as to whether to allocate performance allocation to the canister. It is an area where we could probably optimize, in terms of cost, and so forth.

The reason why we didn't do that was we thought it may be an onerous requirement on the utilities to try to put together a disposal container and weld it shut to the standards that need to be met for disposal. But that again is something we'll look at in the future.

[Slide.]

MR. J. WILLIAMS: The preliminary design concepts -- since we have two viewgraph machines here, maybe I can try a multi-media presentation and put up a couple here. I didn't know this was going to be here, so I haven't practiced it.

[Slide.]

MR. J. WILLIAMS: Okay. What we looked at primarily were three types of canisters. We looked at a large canister, a smaller canister, and then also a thick-walled canister. The thick-walled canister is the one that we're calling an MPU. Some of these terms may start to confuse you. I'm going to try to keep you straight with them.

The large canister has 21 assemblies, PWR assemblies, 40 BWR assemblies. It would fit into a 125 ton transportation rail cask.

Primarily what we were trying to do here was to build the biggest canister we could that could be transported by rail, as well as the largest canister that could be transported by legal weight truck and then evaluate how they would go through the system.

The large canister is made of stainless steel. It has one and three-eights inch thick stainless steel around the outside. It has a basket that has neutron absorbing capability.

It's a structural basket in terms of being able to meet transportation requirements, which is probably a stronger basket than would be needed in a waste package disposal environment. So, what we're trying to do is meet three different regulations here.

I believe I said it had neutron absorbing capability. It also has shield plugs on either end. It has a shield plug on the top, and it has another one on the bottom right here. We said that these would be made out of carbon steel instead of lead, which is used in the industry today, the purpose being the repository people didn't want to use lead in the repository.

Again, these are concepts for the purpose of evaluation. The reason why we used two shield plugs on either end was we chose a system. We had to make decisions for the purpose of the study. We said that we would handle this canister horizontally.

The only reason we chose that was that that is the only licensed operational concept today, although we know that there are other concepts that are being designed that

NRC is reviewing and that we would look at in the future as well.

I think Ron yesterday mentioned the six different designs for the MRS. We believe all of those are compatible with canisters except for probably the pool concept.

[Slide.]

MR. J. WILLIAMS: Let me show you the small canister. This one only holds two PWR assemblies. It was sort of a disappointment. I would have like to have seen it hold more, but that's all we felt we could fit into a 25-ton truck transportation cask.

You notice, in order to do that, we had to eliminate one of the shield plugs. This one only has a top shield plug. So, it would have to be handled horizontally. Again, it has the same type of features as the large canisters, stainless steel, and the neutron absorbing capability.

[Slide.]

MR. J. WILLIAMS: The larger canister, what we call the MPU, was a little bit of an add-on. We were initially focusing on the large thin-walled canister and a small thin-walled canister.

Then we decided, primarily because of the Board's talk about universal casks, that we evaluate this concept as well, which we're now calling an MPU, a multi-purpose unit. It's a little bit different construction.

It has a thicker inner wall which provides containment and structural support. It's made out of alloy 825, a high nickel stainless steel, and surrounded by a ductial cast-iron material that would provide shielding.

You see the trunions on here for lifting. So, this is one canister that would be used throughout the system basically without overpacks.

We know that NRC has expressed concerns about ductal cast iron. The thinking behind this was that the containment is maintained by the internal canister. The only function that the ductal cast iron is performing is shielding. If we decided to pursue this concept, we may consider putting another wrapper around it as well to address NRC's concerns about fracturing of the cask.

[Slide.]

MR. J. WILLIAMS: Okay. What we did next was we took the canister concepts. We evaluated them in terms of scenarios so that we could see how they would operate throughout the system.

What we did was that we compared them to the Reference System. The Reference System that I'm going to talk about is the reference system for this study only. It's not necessarily the reference system that's normally referred to.

But we had to make a few changes in order to try to compare apples to apples and oranges to oranges. For example, in-draft emplacement at the repository was used for this study. The waste package that was used in the Reference System is a large 21-one element waste package that is a robust waste package, which is a little bit different than what is normally called the reference system. It comes from the SCP design.

In the Reference System we take bare spent fuel at reactors. We load it into transportation casks, both rail and truck transportation casks -- the ones that are being designed under the transportation program today.

The bare spent fuel is then unloaded at an MRS facility and placed into concrete storage casks. It's not to say that every bit of the fuel is loaded into concrete storage casks at the MRS. But there's a mixture. Some of it may be unloaded from truck casts directly into rail casks. Other rail casks that come in may flow through. So, we will not be handling every spent fuel assembly at the MRS.

Once the fuel leaves the MRS, the fuel that's in the concrete casks is then placed into transportation casks again. They are transported to the repository where the fuel is removed and placed into disposal containers.

That's the Reference System. We compared that to five different scenarios using the canisters that I just described. Scenario 1 -- I'll go back to the multi-media presentation here.

[Slide.]

MR. J. WILLIAMS: First of all, that's the Reference System. I don't think I need to say any more about that other than maybe, as I said, the MRS in the middle handles bare fuel. It has the capability. It has three transfer cells. They are to be able to transfer spent fuel from the transportation casks into storage casks.

[Slide.]

MR. J. WILLIAMS: This is Scenario-1 here which we compared to. What we tried to do was, this one uses all large multi-purpose canisters, the 21 element canister, with also some bare spent fuel that's handled at some of these reactors that we talked about yesterday. I think Dr. Bartlett mentioned the 19.

What we did was we tried to push the limit. We realized up front that you could get the most benefits from handling large packages. So we tried to, in this study, to push the limits in terms of handling large containers. So, we did some things like heavy haul and so forth, and some on-site simple transfer in order to maximize the number of reactors that could handle large canisters.

What we ended up with was the scenario that 93 percent of the fuel is handled in large canisters and seven percent is handled in the normal way with small truck casks. So, we have seven percent bare fuel in this system coming from 19 reactors.

[Slide.]

MR. J. WILLIAMS: The second scenario, what we tried to achieve here a completely clean MRS repository, where we had no bare spent fuel at all. So, what we did here was we have all large MPCs, multi-purpose canisters.

At the truck reactors, what we had to do, we actually have to employ a concept that was used at Three Mile Island to transfer bare spent fuel on-site from a small cask that's handled in the reactor to a large cask on-site. You may also have to apply heavy haul.

So we costed out what we thought this would take. We actually have a cooperative agreement in place right now with Sacramento Municipal Utility District to design a cask-to-cask transfer system. So, that's the second scenario we looked at.

[Slide.]

MR. J. WILLIAMS: The third scenario was trying to use the small canisters that I described along with the large canisters. Again, we have a completely clean system, but we have a mixture of about seven percent of the fuel in small canisters and 93 percent in large canisters.

[Slide.]

MR. J. WILLIAMS: Scenario number 4 came about because of the concern, or the study that's going on about a hot versus a cold repository. If you have a cold repository, the large canisters won't support that. Their heat output is too great, so you need to have small canisters spaced widely apart.

So what we did here was we evaluated the concept of using small canisters throughout the whole system. You will see that's not a very good system in terms of cost or dose.

[Slide.]

MR. J. WILLIAMS: The last scenario we looked at was utilizing what we call the MPU, or what may be called the universal cask concept. I showed you a large MPU. We did also design a small MPU. The whole system again is clean using that multi-purpose unit or what's known as the universal cask.

[Slide.]

MR. J. WILLIAMS: Then what we did was we looked at a number of criteria. In the time that we had we couldn't look at every criteria. We tried to narrow these things down.

Also, in terms of the design, there was lots of discussion about well, maybe we ought to have a mid-sized canister. Within the time frame we had, we felt that it was best to focus on these two and then leave a lot of these other things for further evaluation and to get something out that would try to simply the study.

So what we looked at in terms of the evaluation criteria, we counted up the number of handlings of spent nuclear fuel in the different scenarios.

We also looked at occupational and public radiation exposure, schedule impacts, costs. Then we also looked at a few qualitative factors.

[Slide.]

MR. J. WILLIAMS: What I'm going to present now are basically the results of the study. These are preliminary results. What this shows is that in the Reference System
-- I think Marvin mentioned yesterday there's about 300,000 spent fuel assemblies in the system.

Under the Reference System, the way I described it before, where we take the spent fuel and we handle some of it as many as eight times, some fuel assemblies two times. You count up 872,000 times that you handle bare spent fuel under the Reference System.

As I said, some of the fuel will pass through the MRS. We actually went through and had a computer model where we counted all the times that we would handle bare spent fuel, in other words, move it from a reactor into a transportation cask, or transportation cask into a storage cask.

Then we compared it to the five scenarios. These are the five scenarios -- one, two, three, four, five. You can see how in every case the number of spent fuel handlings decreases quite a bit from 872,000 down to around 300,000.

Then we also counted the number of times you have to handle heavy containers. A heavy container is anything over 25 tons. They are in the ballpark except for the small MPC, or the Scenario-4, where we have a large increase in the number of 25 ton lifts.

In the study, we didn't really look at accident conditions. I think this is one area where people talk about accident conditions in terms of a fuel drop. That's the one accident condition that was postulated in the MRS conceptual design report.

However, there's not much data on fuel drops, especially in the dry environment. I think that the data has counted about 34 drops in handling in pools with, I think, practically zero release.

[Slide.]

MR. J. WILLIAMS: Okay. The next thing we looked at was occupational and public radiation exposure. What we did here was we looked primarily at the main activities related to moving spent fuel.

In other words, we looked at what the dose is to load a transportation cask, what the dose is from transporting a cask, from unloading a cask, from taking the cask down into the repository.

We used actual data wherever we had. We used data that was supplied by EEI to calculate these figures. Where we didn't have data, we made extrapolations from existing data.

You see the totals here. This is in thousands of Person-Rem. One thing that doesn't pop out is you don't see a gigantic reduction in occupational and public radiation exposure.

As I said, we looked at all the operating features of the main flow path. What's not included in here and is in the design details, are things such as the radiation maintenance features, which we don't have the design details enough to compare them.

With the multi-purpose canister system, we believe the rad waste treatment facilities would be simplified. We also don't have in this calculation, because we didn't have the data, was the information from the cask maintenance facility. A lot of the results of that will depend on how they're designed, though.

Again, you can see that the handling of the small MPCs does increase exposure quite a bit. That's a result of the increased transportation requirements.

The increase in reactor dose is a result of another operation of welding shut a MESC at reactor. Actually we reduced this a bit from the information we got from Oconee by saying that we could employ a better method, if we were going to do it at all, reactors. We threw in some costs, in the cost portion of the study to get that further reduction.

[Slide.]

MR. J. WILLIAMS: This is the cost results that we looked at. These aren't really total system life cycle costs. These are costs that we looked at that we thought were sensitive to the multi-purpose canister study.

The first line up there is the utilities' costs. The way these were determined for this study were basically we looked at utilities. We went through our logistics model to determine when reactors were going to shut down, how much fuel they would have on-site. For example, Reactor A still has fuel for 10 years after shut-down. So, we calculated how much fuel it would have.

Then we put it all into dry storage. Under the reference scenario that's the cost of the utilities. Under the canister scenarios, those costs are reduced because what we did was we took the internal canister. It's costed out under waste package here.

So, in the bottom line you can see the total system costs, the Reference System -- this figure of $19.5 billion. With Scenario-1, which is to remind you that all large canisters with seven percent bare fuel, the cost is reduced by $300 million.

Scenario-2, which is all MPCs, no bare fuel, all large MPCs that employ the cask-to-cask transfer -- which is added in here -- the cost goes down by $1.3 billion.

A couple of things that I wanted to point out here is the MGDS costs. This NE actually means "not evaluated." As I said, we had the site characterization design. We didn't have anything past that, so we didn't have a lot of information on that.

I believe there is room for reduction there in terms of the surface handling facilities, but they really weren't evaluated.

There are maybe a couple of other things to point out. Reduction in transportation cost -- what we're doing here for the casks itself is we have a reduction because we're pricing the internal basket out of the transportation cask down here with waste package. So really all we're pricing out is the overpack.

MRS facilities -- we've talked about the simplification of the MRS facilities. You can see in Scenarios 1 and 2 how there is a simplification in construction or development costs, dropped from $1 billion down to $600 million or so, as a result of the decrease in the transfer cells. That also results in a decrease in operational costs.

Lastly, the waste package costs goes up quite a bit as a result of including the multi-purpose canister inside a waste package overpack. We believe there could be possibilities for some further reduction in costs there, as a result of taking credit for the internal waste package. But if we take credit for that internal waste package, the cost of that internal waste package may go up.

[Slide.]

MR. J. WILLIAMS: This is just a picture of what I just showed you. I don't really have much to say about it, primarily pointing out that the handling of the small canisters throughout the system to support the cold repository would be a large increase in costs.

[Slide.]

MR. J. WILLIAMS: A summary of the economic benefits -- I think I've covered all of this. MPCs show potential for a billion dollar savings in Scenario-2 where you use all MPCs. The small MPC costs twice as much. All the scenarios significantly reduce the utility costs. There's an increase in the waste package cost.

[Slide.]

MR. J. WILLIAMS: We did look at how we could implement this in terms of schedule. What we have here is the start of detailed evaluation and this year's design and licensing of the MPC.

Deployment at the utilities -- the way this breaks out is we believe we could have this thing ready to be deployed at utilities in the middle of 1997. This is regardless of MRS schedule, but it could be deployed at utilities in 1997 for the purposes of storage, for the purposes of being able to transport off-site to an MRS. We think that would probably take until the middle of 1998.

However, utilities could deploy this. This last portion in here in transportation is really fabrication of the overpack. So, a utility could deploy this with a high degree of certainty that they would be able to ship it off-site to an MRS in the near future.

Then the repository activities are going on simultaneously. This cask-to-cask transfer device that I talked about, we feel it would take a little bit longer to develop.

What I have here is the second generation MPCs. I think yesterday there was a lot of talk about what is the impact of the repository and so forth. This is scheduled to coincide with completion of the advanced conceptual design for the waste package.

So, once the advance conceptual design of the waste package is completed, then we would look at whether we need to change any of the designs of the MPCs.

There's been a lot of talk about, "Gee, you're throwing a lot of money into this. There's a lot of uncertainties in the repository."

I think one thing you have to remember is if you canistered this fuel, and you did it from 1998 up until 2001, there would only be a few thousand tons of it canistered out of the 84,000 tons that are currently available in the system. The worst thing that would happen

[Slide.]

MR. J. WILLIAMS: Some preliminary technical conclusions are that with the large MPC, at all sites we can get 100 percent clean MRS. It would provide standardization for on-site storage.

The large MPCs are not compatible with the low thermal loading. We believe that the upper bound of the multi-purpose canister is about 21 PWR assemblies. Also, we looked at the current MESC's that are being designed by vendors.

We don't believe, as designed right now, they're certifiable for disposal under 10 CFR 60 regulations. We also believe that for disposal requirements, we will need to take credit for burn-up in the design.

[Slide.]

MR. J. WILLIAMS: I think I've probably covered most of these, but just to highlight them here, MPC advantages -- it facilitates compatibility of at-reactor storage with the system. It allows shut-down reactors to proceed with expeditious decommission of their spent fuel pools.

It allows direct acceptance without repacking. It reduces contamination low-level waste concerns at RW facilities, reduces bare fuel handling operation, provides an additional containment barrier, and simplifies the facilities. This CMF is the cask maintenance facility, monitored retrievable storage, and the repository.

In addition, one that we left off here is that it could facilitate the retrievability at a repository, depending on what scenario we're talking about. If we're retrieving for the reason of a failed canister, it doesn't give you a lot of help.

[Slide.]

MR. J. WILLIAMS: To throw up some disadvantages, there's been a lot of talk throughout the meeting of how wonderful these are. We did want to put up a few disadvantages here.

There is additional operations required at reactors. They need to set up welding equipment. Under the way that we've developed the canisters today, which is a welded closed canister, we briefly looked at welding versus bolting. We haven't given that up at all. It's something that should be looked at in the future. We will interact with the utilities on that.

The standardized large MPC are not compatible with all reactor facilities. We'll have to have a small increase in fleet size. It requires the changes to the contract. I think I mentioned at the beginning that it does involve some amendments to existing utility operating licenses under 10 CFR 50.59.

[Slide.]

MR. J. WILLIAMS: Future issues to be addressed -- I mentioned the contract before. Reactor facility upgrades -- one thing we need to do is interact with utilities to determine which reactors actually would use these MPCs.

MPC licensing issues -- the burnup credit we know is an issue that needs to be solved, addressed with NRC. Opening and inspection requirements -- we've had some people tell us, "Well, gee, you're going to have to open these before every step." We don't believe that is necessarily true.

Certification for utility use under a general license -- Bob Bernero talked about the general license. That would be the best way to go with these -- the license and certification schedule, and any other issues that NRC may raise with respect to this.

We have interacted with NRC last December. We invited people from Part 60, Part 72, and Part 71. We hope to continue that interaction.

There's been some concern about how NRC does a step wise approach to licensing. They may have to do this for this concept. However, we would hope to continue to interact with all aspects of NRC as the concepts move on.

Repository uncertainties -- I think somebody yesterday mentioned the canister filling materials. If

I do want to mention that the Swedes have been using filling, but I've heard in the last couple of months that they've gone away from a filled canister. I don't know the reasons why and I don't have any details on that. But that's something we need to look into.

How much shielding is required in the repository itself is an issue, whether the repository needs to maintain a hot or cold thermal loading, and the degree of performance credit. Those are all issues that we need to address in the future here.

[Slide.]

MR. J. WILLIAMS: Our future activities are continued interaction with the utility industry. As I said, we plan to review this with them next week, and will continue to do that over the next few weeks.

To actually develop a design, develop a conceptual design -- again, they are just concepts for the purpose of evaluation. They're not actual designs. We need to develop design criteria. I think Bob Rasmussen talked about that yesterday. Develop the transportation overpack designs, and then refine the system designs itself for the MPC concept.

That's about it. I guess in conclusion out of all of this at least my own opinion is that the more you use these, the better it is. To get the benefits of the canister system, you need to maximize the use of them.

Canisters are going to happen in the utility industry. There could be an advantage in DOE taking control and standardizing the canisters.

That's about all I have.

DR. VERINK: There will be time for perhaps one question if there's a burning question in somebody's mind.

MR. J. WILLIAMS: I tried to take up all the time so there's would be any.

[Laughter.]

DR. VERINK: A no-burn program, right?

DR. PRICE: Ellis, are we going to come back to discuss this?

DR. VERINK: We're going to be back at this. Why don't we hold the questions, then, because we are burning pretty close.

Okay. Thanks a lot, Jeff. I appreciate it very much.

MR. J. WILLIAMS: Thank you.

DR. VERINK: Our next speaker is Bob Williams of the Electric Power Research Institute. Bob is the Materials and Systems Development Department head in the Nuclear Division where he manages the external fuel cycle program.

[Slide.]

MR. R. WILLIAMS: Thank you very much. I appreciate the opportunity to be present before Board.

I want to thank you as well for the opportunity to interact with the Utility Universal Container System's Task Force, and periodic interactions with many of the Department of Energy contractors and entities in the Yucca Mountain program.

[Slide.]

MR. R. WILLIAMS: Today I want to briefly provide a perspective on the universal container system, and overview of the EPRI study, sort of a layman's, a four-factor or a five-factor evaluation of how the big chunks of this system interact together, where I talk about the big chunks as being the waste package, the spent fuel acceptance, MRS and transportation, potential changes to the repository, impacts on at-reactor storage, and just a slightly different spin on how a phased-approach to implementation might be brought about.

[Slide.]

MR. R. WILLIAMS: Yesterday afternoon Clarence Allen asked, "What's happened that has changed this perspective on this system? What are the changes that have lead to a universal container when we were using small packages a few years ago?"

I think you can run through these changes in any order. I'm an engineer, so I tend to look at it as a cost utilization problem. But when I put on my public acceptance and program acceptance hat, I conclude that probably the item that belongs at the head of the list is the potential for better public acceptance of the waste disposal activities.

These have lead, in turn, to the consideration of a more robust, multi-barrier, waste disposal package. There's also a potential for simplification of the MRS and transportation activities.

The second item is something we've tumbled to only in the past year or two, and that is the potential for

Ten years ago we weren't worrying much about shut-down reactors, but as the time of repository operation has moved out to 2010, there turns out to be about 1,000 reactor-years of operations that would be required in spent fuel pools before the oldest fuel first shipment dates start to ship fuel off-site.

A sealed package, we've seen, has potential benefits and simplification of operations throughout the systems. I think the numbers that Jeff Williams just presented, I'm seeing for the first time. They're very impressive. They illustrate again where the DOE study has gone much beyond the EPRI study. I support that.

Another thing that has changed has been the ramp or decline access. Decline is a mining engineer's term for a ramp that goes into a mine. This permits larger packages to be considered and have heretofore been considered.

Steel cables have limited the size of emplacement packages to around 60 tons on the cable. That, in turn, restricts you to a waste emplacement on the order of one and a half or two, or maybe two and a half tons, at the most, with the balance of that tied up in shielding for the material that goes up and down the hoist.

[Slide.]

MR. R. WILLIAMS: Now, EPRI began a feasibility evaluation about 18 months ago. I'd really like to acknowledge the special efforts of the two investigators on the study -- Barry Mcleod and David Jones.

There's an awful lot of personal blood, sweat, and tears that went into this report, and as a project manager I'm extremely grateful for the amount of extra work that these fellows put into the project.

We wrapped up this study in the summer of this year. We've had a number of meetings to exchange data. Members of the TRB staff, and particularly, Woody Chu, has a copy of the draft EPRI report. We can make additional copies available to anybody, or you're welcome to reproduce the copy you have. We expect it to be through the EPRI publication process now in three or four more weeks.

Our overall objective was to present a preliminary evaluation. Let me emphasize preliminary. We've used the term "universal container system" because we want to encompass the family of multi-element storage canisters and multi-purpose casks.

It's a little bit unfortunate that compared to the previous speaker, my MPC is indeed a large metal cask, not a MPU. So, just indulge us in our differences in nomenclature for the time being.

The MESC is Bob Bernero's cartridge, or the thin-walled steel container around the basket of spent fuel. The multi-purpose cask is indeed a large metal cask so as those in use at Virginia Power.

Now the questions yesterday raised the question: What is the significance of economics to this total thing?

[Slide.]

MR. R. WILLIAMS: Let me walk you through what we're thinking about in terms of the MESC and then maybe give you a very common sense feeling for why we would initially foresee the MESC as being perhaps the principal version of the universal container system. But certainly some prototype, multi-purpose cask could be used.

Now what we tried to diagram here is that there is a central nugget, the thin-walled steel basket that marches through the system, getting different overpacks. This could happen for the first five or 10 years.

The use of different overpacks permits the different functions and different stages to be optimized. For transportation you want to have impact resistance. For storage, a low cost shield. For disposal, a shield in a corrosion resistant element.

Now the bottom line is that until we've got all of these things pinned down, you would rather go with a $200,000 or $300,000 nugget than a million dollar package that might have to get thrown away. It's as simple as that, in my view.

[Slide.]

MR. R. WILLIAMS: Now the other thing -- forgive me if this sounds a little bit like preaching, but one of the lessons that I've learned over the years is, "Don't be mislead by the apparent precision in cost estimates."

In a moment you're see that my numbers are about $10 billion different than the previous speaker's. But there's an easy explanation for that. I'm dealing with an 86,000 ton single repository system. Jeff Williams, I believe, was dealing with a single repository at Yucca Mountain dealing with 63,000 rather than 83,000 or 86,000 tons of fuel.

But as John Bartlett said yesterday, there are about 2,500 different scenarios that he sees in implementing this system. The E.R. Johnson study picks about four of those scenarios and evaluates them.

You'll see that we've made slightly different assumptions in hardware concepts, so between the scenarios and the hardware concepts, the projection of the future, in can talk about here.

The reason you carry three figures in these studies is so that you can do some sensitivity. When you're taking 10,000 small items, you need to carry along a few additional decimal points.But let me reiterate, we don't particularly believe any more than one or two of these figures at this point.

The next thing we did is that we tried to examine a number of end-of-spectrum cases. We realize that you can't have 100 percent MPCs, and you can't have 100 percent MESCs. But these are intended to obtain some bounding results on the study.

Another thing I would like to warn against -- and I think it's a tribute to the Department of Energy and to the people who are managing this program -- is that I don't think we will ever prove with engineering cost studies precisely how to proceed.

So, I would caution that we not try to prove the adoption of one particular variant of this system over another with detailed cost estimating exercises, and instead extract some lessons learned and then proceed on the basis of detailed assessment. But do check the details.

Now in just a moment you will see that there are very big dollars that we're looking at in the self-shielded waste packages. Maybe I should just wait for a moment to cover that point.

[Slide.]

MR. R. WILLIAMS: To reiterate, the simplified evaluation that we went through is that the waste package and the engineering costs are going up. How can we minimize it?

Spent fuel acceptance and transfer are very complicated with 300,000 or 400,000 handling operations that?

The repository is a big ticket item. It's got $6 or $7 billion. If you're looking around for savings, you surely want to look at the big ticket items, not the little ticket items.

Finally, we're starting to see the effect of extended on-site storage at reactors, it's starting to cost

Then, finally, how can we corral the thing? How can we bring it into implementation in a way that doesn't disrupt the present program, and in a way that's manageable?

[Slide.]

MR. R. WILLIAMS: Now because we didn't want a drib and a drab of a repository to be left over, we chose to evaluate a system that disposed of 86,000 tons of spent fuel rather than 63,000. So, this is a single repository system.

Now I think it's interesting the first item on this particular breakdown -- the $11.5 billion -- is an item that's discussed on this afternoon's agenda. That basically is how the Mission 2001 is going to spend the remaining $6 billion that hasn't been spent here in development evaluation.

Now it was beyond the scope of our study to figure out how the multi-purpose cask or the universal container system would impact the Mission 2001 program. My intuition is that it will assist it greatly, but we have claimed no savings in this particular category.

The other items -- this list of bold-faced numbers over here indicates the order I want to march through these other big ticket items -- the waste package, the repository, the MRS and transportation system, and the on-site utility storage.

Now in this particular breakdown, which shows a multi-element storage container system handling 55 percent of the spent fuel, we come up with a $1.6 billion savings. I hope everybody in the room realizes that that's within the error of studies like this. We're essentially at a break-even.

[Slide.]

MR. R. WILLIAMS: I have already talked about the caveat that we were not able to look at how the universal container would impact the design and evaluation costs, but I'm pleased to see that DOE is focused on that.

[Slide.]

MR. R. WILLIAMS: Now the next part of my presentation is intended to talk about item one in this cost estimate, the way that waste package might be impacted by the universal container system.

Now, what I've tabulated is the spectrum of package costs that exists in the site characterization program. These costs have gone from $31,000 for the thin-walled two metric ton package to $213,000 for a two and a half ton package with a ceramic lining that was presented to the EPA Science Advisory Board as one of the approaches to address the Carbon 14 problem. Now on a 86,000 ton repository, you would be looking at $7.4 billion in packages.

Just to give yourself a rough figure of merit, $100 per kilogram of fuel disposed, multiplied by the 86,000 tons of fuel, says that you've be looking at $8.6 billion in packages.

Now as a figure of merit, the WIPP program, the total repository at WIPP, was constructed in the 1980s for under a billion dollars. Now it's probably fair to scale that up to $1.5 or $2 billion to compare it to these numbers, but we're talking about numbers in waste package that are several times the cost of the WIPP repository.

So naturally looking at this from the utility and the public perspective, we wanted to see what could we do to minimize these costs.

[Slide.]

MR. R. WILLIAMS: Because it was a study on a shoe-string, we took some existing multi-purpose casks and multi-element storage containers and costed them out.

Without belaboring this in too much detail, the 21 PWR system has got a built-in learning curve. We have assumed that the learning curve effects would take this cost down into the $500,000 per canister range. We add about $1.7 billion for corrosion overpack. That's how we come up with $6.8 billion.

Now if we're not able to realize the economies of scale, you can see that we're looking at $12 billion for packages. So this is what says to me that over the next three or four years there will be a lot of pencil sharpening going on because there are billions of dollars involved in this robust waste package.

Now in engineering studies -- and I've done a lot of them in my career -- you like to have everything be strictly comparable. So, the question is: Why are we comparing a 24 PWR to a 21 PWR multi-element storage canister and multi-purpose cast? The short answer is that in a cheapo study you use existing designs rather than

Now you can see by the numbers here that if these were scaled to equivalent size, the difference in cost between the multi-element storage canister and the multi-purpose cask would be even greater.

The reason, I think, is pretty obvious from a common sense point of view. If you've got three or four layers, you've got a build-up of tolerances. So you end up with a slightly bigger package that weighs slightly more, that costs quite a bit.

That's why over a period of 10 or 15 years, I would expect the designs of the MESC and the multi-purpose cask to come together. The other thing is that the MESC has had no real incentive to reduce the diameter. When you're putting baskets in a concrete dog house, it doesn't matter if you have six inches more diameter. The concrete dog

Now, the minute you start putting expensive corrosion overpacks around the thing, there's an incentive to sharpen your pencil. So, I predict that the diameters of these things could be engineered down from nominally 68 inches down to the range of 62 or 63 inches. That will help bring the price of the MESCs down into the range of the round-off error between the multi-purpose cask and the multi-element storage canisters.

[Slide.]

MR. R. WILLIAMS: Now I think it's incumbent on me to remind you that there's some tremendous optimism -- some would say realism -- built into the costs of the multi-purpose containers.

As I say, we've based the cost of the large package on a $500,000 multi-purpose cask. Today it would cost $1 million or even $1.5 million to buy that. But the unit cost is what the Germans have accomplished in building these casks in serial production. They have built roughly 400 casks to store the fuel from a pebble bed reactor. This is an HTGR that's got tennis ball-size graphite fuel elements instead of the large prisms that are typical of the U.S. HTGRs.

So, this is $5 per kilogram of cask weight, that times 100 tons is what leads to $500,000 as the metal cask price.

But to reiterate, that's having to come down from $1 million or $10 a kilogram. So we could be talking about

Another way that pencils can get sharpened is on the shielding criteria. In the back of my hand-out package, I have a little diagram that shows the weight to payload ratio and the different shielding thicknesses.

[Slide.]

MR. R. WILLIAMS: One of the things that needs to be looked at is if you would accept 100 or 200 MR per hour, probably knock it down from 14 inches to 10 inches.

So that's another of the ways that we can work around this question of whether a 100 ton or a 120 ton package is really feasible or not.

Here the dynamics of why you want to go to bigger packages if you want to put a big shield wall on. In the small package, you've got a one to 30 payload ratio. In the big packages you've got a one to eight payload ratio.

[Slide.]

MR. J. WILLIAMS: There are going to be three main streams -- and I really like Jeff Williams' visuals that illustrate that. That's better than anything I have here. But we're going to basically have three steams of fuel -- conventional fuel assemblies coming together, MESCs coming together, and multi-purpose casks coming together.

The economics of the system in the near-term are going to be driven by the need to ship the bare spent fuel assemblies. The reference option that I would extract from the cases we looked at were that only 55 percent of the fuel in the system could be handled in the multi-element storage canisters.

The other 45 percent has to go by conventional shipments. That results in about 70 or 80 percent of the same number of truck and rail shipments as in the present system.

So you don't see a major reduction in the MRS and transportation, because it looks like you're only able to impact that to the tune of 20 or 30 percent.

But in the near-term here, the next five years, we can look into various types of intermodal transport. I

A couple of years ago we did a conceptual design of an on-site spent fuel transfer system. It appears right small cask, the large cask, transfer system.

We've also done a conceptual design of a High Integrity Impact Limiter. It's a device that would fit

So these, of course, are available to the Board and to the Department of Energy to use in there on-going study. I brought these copies to leave with whomever is appropriate.

[Slide.]

MR. R. WILLIAMS: There's just one cartoon to show how a fully enclosing impact limiter that's made up of three different layers of shock-absorbing material could be used to ship storage casks that haven't been designed for the impact resistance of transportation casks.

This would permit, for example, conceivably the shipment of the trans-nuclear casks that have not been designed with highly impact resistant materials and might assist in the qualification of the ductile cast iron casks for the same purposes.

I want to shift to item two in the cost breakdown, which in round numbers is the $7 billion repository item. This is a cartoon. This shows a nominal two foot diameter waste emplacement drift compared to a nominal 14-foot diameter drift that might exist if you were able to do horizonal emplacement of a cask that was nominally seven or eight feet in diameter.

Right now it's really up in the air. Some of the designs that are being looked at are looking at tunnel diameters as big as 30 feet.

[Slide.]

MR. R. WILLIAMS: There's one minor inconsistency in my presentation on this viewgraph because of round-off. This $7 billion over here is the $6.9 billion here, and the $5.3 billion is that same $5.3 billion.

So it looks like, if you sharpen your pencil and go after repository savings, you might pick up $1.7 billion from a myriad of factors.

[Slide.]

MR. J. WILLIAMS: My time today does not permit me to go through all of the different cost breakdowns that lead to the roughly $1.7 billion savings.

This particular viewgraph is in a back-up package that has been made available to the Board. But my contractors could walk you through each of these particular categories.

[Slide.]

MR. J. WILLIAMS: Let me remind the Board that the way the books are kept in this program, operating costs over a 30-year period are multiplied in, and then added up just as if they were a capital expenditure. So, for example, in the waste handling building, we've got 30 years of operations that has taken them from three-quarters of a billion dollars down to $400 million.

Let me just reiterate some of the things that I think the Board and the utility industry will both be looking at. Some of the key factors to determine whether we end up saving $1.5 billion in the repository, or whether we break even, or spend a little bit more even, is to determine what size of a package can really be in place.

There's a point of diminishing returns in most things. Things march along and then, boom. You can keep going on to bigger sizes, but you start to pay. We certainly don't want to drive the system to 120 tons if 100 tons, or even some smaller number, is a reasonable package emplacement size.

But I think the Board, I hope, from just these numbers here, sees the incentive to look at large package sizes because we're talking numbers in the one, two, and three billions for the economy of scale and package sizes.

What tunnel diameter for the emplacement drifts? Now, the thing that comes out of our study is that you can't do back-filling for between 30, 50, or maybe even 70 years, depending on the heat load in the package.

So, rock stress considerations may dictate that you would rather have a small tunnel than a big tunnel because the small tunnel over a 70 or 80 year period is less likely to shed chunks of rock out of the roof. They get in the way of things. That, in my mind, is all subject to detailed evaluation by real experts, like Dr. Cording.

What are going to be the mechanical requirements on the packages during handling? Is there any real "g" load requirement on the basket structure? In some aspects of the package licensing, there is a "g" load requirement that's imposed on the basket structure. But in other instances there isn't.

So, all of these things will ratchet in to what does the final design look like as it goes through the

One thing that our study has not touched on hardly at all is: What is the effect of having to work in repository drifts that are 100 degrees Centigrade and is 212 degrees Fahrenheit, or 300 degrees Fahrenheit, 140 or 150 degrees Centigrade?

If we're on the low side in some of these estimates, I suspect it's in the area of the design of the equipment for   the people to enter these drifts and do the various measurements and emplacement activities.

So at any rate here we're talking about two numbers -- $6.9 or $7 billion. We might get it down to

[Slide.]

MR. R. WILLIAMS: In the area of the transportation and the MRS, the total cost of these two

The delta is correct, however. There is about a $300 million saving that is possible from these two accounts. The reason is that for any realistic scenario, we still have 70 or 80 percent of the shipments going on that existed in the previous program.

I really think, though, that the effect on public acceptance of these robust packages -- better packing systems, the appearance of robustness, is something that is just as significant as the few millions of dollars that we are talking about in these two categories.

[Slide.]

MR. R. WILLIAMS: Now just to reiterate, the fourth area -- you can see what the perceptions of the industry were a few years ago. It looked like the cost of at-reactor storage until the DOE program would come on-line was numbers of the order of $200 million or $300 million.

Then the experience of certain shut-down reactors, like SMUD, Shoreham, LILCO, Fort St. Vrain -- others came to the fore. Suddenly we see a cost category that instead of being $200 million, is $2.6 billion. Some of the numbers that DOE presented yesterday and today move this number up into the $3 or $3.5 billion range.

So, the ability of the waste management system to facilitate off-site transfer is something that we just tumbled to. So, again that is the answer to Clarence's question of yesterday: What's changed that has lead to the interest in this system?

[Slide.]

MR. R. WILLIAMS: There is one little slightly different spin that I would put on implementation strategy. I think maybe it's very nearly the same sort of the thing that the Department of Energy has been thinking about.

But just arbitrarily I break the program down into phases -- four year increments, or something; Phase l, Phase 2, Phase 3, and Phase N.

Phase 1 is right now. Basically I would suggest that we would just plan to accept existing fuel types plus MPCs plus MESCs. We would move as rapidly as we can to license these for both storage and transportation. We should be very close to resolving those kinds of issues.

But what we would do in the short term is use these designs to set conservative envelopes so that we

In the short term I would suggest that we just under $100 million in a program that's $31 billion or something. So, we shouldn't get all hung up over a few dozen MESCs or MPCs that can't go all the way through the system.

Now as quick as we can -- and I would suggest realistically it's probably 1996, I think we can come up with designs that are likely to be repository capable, but we won't have been able to prove that yet. It will probably take another four, five, or six years to prove that the MESC and the MPC are repository acceptable.

But sometime in Phase 3 we would have the repository requirements confirmed. We would be able to move ahead with improved designs, perhaps designs that have skinnied down the wall thickness, more realistically addressed shielding, corrosion requirements.

So, in a sense, that would be my suggestion on how to corral a rather complex set of options and alternatives. It's kind of like corralling a bunch of horses. You get them in the corral and then pretty soon you get them all marching in the same direction.

[Slide.]

MR. R. WILLIAMS: So, in conclusion the EPRI evaluation found the UC system very attractive. The major advantages included the simplification and the reduced handling, personnel exposures, et cetera, due to sealed containers.

The considerable storage advantages at reactors and MRSs, the potential for repository savings, and the surprise, really, in large savings in the potential for more rapid off-site transfer shut-down reactors.

Finally, this is making a virtue out of the necessity -- the potential to minimize the rather substantial cost increases that we would see incurring in the use of the more robust waste packages.

So, our evaluation -- admittedly a very preliminary evaluation, encourage the DOE study and adoption of the U.S. UC system as a spent fuel acceptance option.

That wraps up my planned presentation. I would be happy to answer any questions or wait until the panel discussion, whatever your pleasure.

DR. VERINK: There will be time for a few questions if the speakers will please identify themselves and their organization. Carl?

MR. GERTZ: Bob, I just have two quick comments. First of all, changes leading to the universal container system, I don't want to give the Board or the audience a false impression.

But when you talked about steel cables and mine hoists, the design of the Yucca Mountain repository was emplacement design for repository was always ramps.

MR. R. WILLIAMS: Well, I appreciate that. I didn't realize that. I've been around here a long time. Thank you.

MR. GERTZ: Okay. We always had ramp design for emplacement -- tuff removable ramp and a waste emplacement. That's one.

Second, I need to just take a little issue when you talk about WIPP, waste packages, and repository design at Yucca Mountain because WIPP is not subject to Part 60. They're going to have 100,000 55-gallon drums. That's their waste package on record.

MR. R. WILLIAMS: I wasn't going to bring that up, Carl, but I appreciate your doing that.

MR. GERTZ: Okay. They don't have sub-systems of Part

60 to comply with for transuranic disposal like we have for high-level waste. So, we're really comparing different regulatory requirements on both projects.

MR. STUART: Yes. My name is Ivan Stuart, Nuclear Assurance Corporation, Chief Duck Salesman.

[Laughter.]

MR. STUART: I have a clarifying question and then another technical question of what you were talking about. Your MPU, as I guess you called it, did I understand that to be sort of a stand-alone, thick-walled, that didn't need overpacks, or does need overpacks?

MR. J. WILLIAMS: As it was designed here, it does not need an overpack. I think I stated that we might have to evaluate the potential for a transportation overpack because of the ductial cast iron for shielding.

MR. STUART: Okay. Thank you. My other question was: I didn't quite see anywhere where you covered the neutron shielding requirements in your design. I heard you talk about the neutron criticality control, but it appeared as though the shielding aspect wasn't there. Did I miss something?

MR. J. WILLIAMS: On the MPU?

MR. STUART: No, really all of them, but particularly the MPU.

MR. J. WILLIAMS: On the canister itself, that shielding would be in the transportation impact. In the MPU, I think it would be in the ductial cast iron, would provide that shielding.

DR. VERINK: Bob, I think you're next.

MR. HALSTEAD: I had a couple of questions for Jeff as well. These will be quick. These are clarifying questions to set up a comment later, Bob.

You said the 125 ton version of the MPC was not compatible with any of the lower thermal loading scenarios. Did you do any kind of analysis to see what the largest MPC that would be compatible with a low thermal loading scenario would be?

MR. J. WILLIAMS: I believe that's rather small. I think maybe you might be able to address that best. You, Mr. Benton, from the Repository Project Office.

MR. BENTON: Hugh Benton from the M&O. Of the order of three or four assemblies for package would probably be the limit for a repository that was maintained below boiling throughout.

MR. HALSTEAD: On your list of future activities, Jeffrey, and in your discussions, I didn't hear any discussion about taking input from the railroads. You know, they're going to feel very strongly about any package over 100 tons.

Is it safe to assume you've got some plans to talk to the carriers as well as the utilities before you go too far with this?

MR. J. WILLIAMS: Of course. We have a very detailed implementation schedule that we're working on. Yeah, we would take input from everybody. Dr. Bartlett

MR. HALSTEAD: I would suggest that your own NTIS study, plus the past experience, talking to the railroads about operating protocols, plus the recent discussion from the FRA dedicated train workshop would suggest that you

MR. J. WILLIAMS: Yeah we haven't designed it yet.

MR. HALSTEAD: I know, but you're shooting for a schedule. That's my third point. That's an awfully optimistic schedule you drew up. I don't know if we want to interrupt the flow here by putting that schedule up again or not.

But do I understand that you think you can have MPCs ready to deliver to the utilities in 1998? That's the way I read the schedule.

MR. J. WILLIAMS: Yes, that's right.

MR. HALSTEAD: Well, I think that's a point that we could discuss at some length, but that seems extremely optimistic to me.

Thank you.

DR. VERINK: We seem to have some heavenly interference here.

[Laughter.}

DR. VERINK: Maybe we should take advantage of that and go three minutes early for our break.

MR. R. WILLIAMS: One item, if I may, sir. Let me just close by observing that Dr. John Cantlon received a letter from Ken Golliher who is the Transportation Program Manager for some of Leo Duffy's transportation programs.

He points out in this letter that the Department of Energy is developing a similar concept for the vitrified waste that will come out of Savannah River and Hanford.

So, in that sense the two systems would be compatible. By starting on the small packages, one would obtain the fabrication experience that's necessary to make the bigger packages reliably and cheaply. So, there's some synergism in the two programs.

Thanks very much.

DR. VERINK: Dr. Barnard?

DR. BARNARD: I'm Bill Barnard, Board staff.

Question for Jeff and for Hugh Benton. You've concluded that the large MPCs aren't compatible with all thermal loading. What sort of assumptions did you make about the age of the fuel? If you age the fuel long enough, can't you still --

MR. J. WILLIAMS: I think it was a lot of years. Maybe Hugh can address that better.

MR. BENTON: When I was saying three or four assemblies per package for a cold at low boiling, we were assuming that the fuel was not abnormally aged. This would be the system accepting the fuel under the current schedule.

DR. BARNARD: Do you plan to look at aging in your analysis? You can either age the spent fuel at the reactor at the MRS or even underground within the repository in order to accommodate a lower thermal loading if you had to.

MR. BENTON: Yes, and we have done some looking at that, but not in detail.

MR. R. WILLIAMS: Bill, if I could just jump in on that. It appears right now that events have lead to the average age of the fuel. If it arrives at the repository under existing schedules, will be 28 years. So, we'll get roughly 30 years of aging automatically if we pursue the existing acceptance schedules.

DR. VERINK: Russ McFarland?

MR. McFARLAND: Yes. Hugh, the assumption you made on a cold repository, was that absolutely no rock above boiling, a little bit of rock above boiling? What were the assumptions that lead to that conclusion?

MR. BENTON: That assumption was that the skin of the waste packages would be below boiling, so we would not have any conditions of boiling and condensation causing water films on a waste package.

MR. McFARLAND: Thank you. A question to Bob. On your caveat, you indicated that the design and engineering costs are heavily controlled by factors such as exploratory shaft design. I assume you mean exploratory studies facility design. What were those factors you were referring you?

MR. R. WILLIAMS: I am not an expert. I would not try to speculate here, just shooting from the hip, on how this package system might assist the Mission 2001. I'm

I noticed in reading the Board report last night that there was a lot of discussion about the difficulties of schedule. But in many ways we are involved in a process that's aimed at licensing. This is not a construction project. This is a licensing project. John Bartlett says that far more eloquently than I do.

But the bottom line is that there are some approaches to licensing that can be used to make the schedule appear less onerous and less arbitrary. I would encourage the Board to start looking into various types of validated and staged licensing approaches.

DR. VERINK: Thank you.

Let's reconvene at 10:45.

[Brief recess.]

DR. VERINK: Can we reconvene? We need to get started. We're ready to begin.

Our next speaker is Dr. Thomas Sanders of Sandia National Laboratories. He's going to discuss Sandia's look at the dual-purpose cask transportability aspects.

Tom, it's up to you.

[Slide.]

DR. SANDERS: Thank you, Board Members, for the opportunity to make this presentation to you today.

The first thing I would like to do is throw about three more different acronyms at you. One of them is called a transportable storage cask which is another bird of a different name. It's very similar to dual-purpose cask.

When we conducted a study for DOE about five years ago, the nomenclature had changed from dual-purpose to transportable storage cask. The acronym is TSC.

I'll also be talking about two other types of casks with different acronyms -- a storage only cask, called a SOC and a transport only cask known as a TOC. So we can add that to the on-going list of acronyms that we're generating during this session.

The work I would like to report on, like I said, was initiated by the Office of Radioactive Waste Management about five years ago through the transportation program. At that time there was an attempt to develop a family of casks. Part of that family of casks included the dual-purpose, or transportable storage concept.

What we were interested in, from a transportation perspective, was: What kind of an impact at storage cycle -- the storage cycle at that time was envisioned to last up to 40 years -- could have on the transportability of that cask following the cycle?

By transportability, it's a term that we meant to imply: How is that cask expected to enter the transport environment and meet all the environmental conditions that could be encountered in that environment, and respond to those conditions? What was the impact of the storage environment preceding that transport action on that capability?

[Slide.]

DR. SANDERS: This is not a multi-purpose concept. It wasn't intended to be at the time. What is this transportable storage cask? Again, and I'm going to keep reiterating a couple of things throughout this presentation, is a cask is intended to be used for interim storage of spent fuel or high-level waste until a Federal storage or disposal facility is available at which time that cask would be assembled in a transport configuration and shipped to that facility.

[Slide.]

DR. SANDERS: We heard yesterday, and through a couple of other talks over the course of the last couple of days that there's really no historical precedent in the United States for transporting a spent fuel shipping container after a long-term storage cycle in the loaded condition.

There are regulations for transport and there are regulations for storage, but there are no specific regulations or guidelines in place for this type of a concept.

[Slide.]

DR. SANDERS: Why is that important? It is important because the cask has to be licensed for storage and certified for transport before it's placed in the storage service in order to have any kind of reliability from programmatic perspective, that that cask could still be transported as it was intended to be 20 to 40 years in the future.

What's the major benefit of this concept? The benefit only occurs if you can transport that cask without opening it, without opening it after 20 years, returning it to the pool, evaluating the contents, evaluating the capabilities of the cask, performing various types of maintenance inspections, and so on.

If these types of casks have to be returned to the pool, unloaded, and taken through a very detailed examination, then you have the same concept as you would with a storage cask. It's returned to the pool, unloaded, and then the fuel transferred to a transport cask.

[Slide.]

DR. SANDERS: So what's the issue? About five years ago we investigated the technical issue, and if you had to perform inspections on this loaded cask prior to shipment that required the loading, then the benefit of the concept, in terms of dose reduction, in terms of economics and everything that we've seen presented earlier in this session, are lost.

[Slide.]

DR. SANDERS: But Battelle's Laboratories did some life cycle exposure calculations on the basis of a dual and compared that to a storage cask cycle, combined with a transport fleet.

The savings incurred as a result of avoiding that additional unloading/reloading cycle amounts up to about 45 person REM over the 40 years with this scenario. That represents about 25 percent of the exposure burden associated with a storage-only function combined with a transportation function, if indeed these casks could be transported after that storage period.

Even if you had to do additional monitoring of these casks to ensure that the transport capabilities were maintained during this storage cycle, up to 100 percent

[Slide.]

DR. SANDERS: The issue, as we saw it -- the team that was working on this particular issue -- is analogous to the philosophical basis for the transport evaluations. The transport regulations have two sets of performance criteria. One is termed normal conditions of transport, and the other is termed accident conditions of transport.

TOCs, transport-only-casks, are designed to envelop potential handling and transport environmental degradation that may occur during normal operations. That's applied to the design basis as an input and incorporated in the design such that that doesn't affect the cask functional and accident response capabilities which serve the primary safety functions of these casks.

One big issue is that these things are maintained, or those capabilities are assessed annually as required by regulations in a form of a maintenance test. These maintenance tests are designed track any degradations that accident conditions.

[Slide.]

DR. SANDERS: In our opinion, as a result of this study, what is missing is a definition of what is called normal conditions of storage. These normal conditions of storage should somehow be incorporated into the overall design of this package, that envelopes, any potential storage cycle degraded environments, or any uncertainties in those degradated conditions that could impact the cask ability later in transport.

Degraded environments are corrosive, radiation temperature, and time related. Also, there's a need to define some sort of in-service environmental and functional monitoring requirements that ensure that the design basis and environmental assumptions you made relative to that storage cycle are not exceeded, and ensure that in the absence of the ability to open these casks and inspect them, that the functional capabilities in terms of their containment, criticality control, heat transfer and shielding effectiveness, have not been degraded.

[Slide.]

DR. SANDERS: Our assessment looked at a 40-year period primarily because we thought that was a bounding value at that time.

Current storage regulations require dry inert environments and temperature limitations. We wanted to look at those and see if they were applicable, see if they were sufficient to ensure that the cask could meet the transportation criteria later.

We also wanted to do an assessment of the impact of storage conditions on other transported functions of the cask, other storage conditions meaning exterior effects and so on.

If you looked at a transportable storage cask as a system, what would that system look like in terms of design features, inspection requirements, and any fuel and cask monitoring requirements that may be in excess of those required by storage regulations.

[Slide.]

DR. SANDERS: All this work is documented in the Sandia report. Co-investigators on it were Brimhall, Gilbert, and Greer from PNL. Brimhall and Gilbert are experts in the area of storage effects on spent fuel of long-term dry storage. Also, McConnell and Ottinger at Sandia and Bob Jones as a consultant.

[Slide.]

DR. SANDERS: We didn't do a whole lot of additional data development, but there's a significant breath of data out there related to long-term dry storage effects on spent fuel parameters.

We also looked at the data bases and tried to come up with data relative to dry storage environment conditions on cask components and materials -- typical materials and components one would see in a cask design. From that, we tried to assess a post-storage condition of the system in terms of transport reliability.

To put all this in perspective, 40 years ago was 1953. Transportation was regulated by the Post Office. The AEC didn't even exist and Sandia had just been divorced from Los Alamos. The nuclear weapons stockpile consisted of one bunker that's still sitting out in the back-40 at Sandia.

Twenty years ago in 1973, NRC was still just being envisioned. EPA didn't exist. There was no CERCLE, RCRA, or whatever.

What we're talking about here is coming up with a design definition that's going to survive possible regulatory instability in the future. Ten years ago in 1983 the leak rate requirement on a cask was 10^{-3} cc's per second at a Delta P of one PSI.

Today as a result of technology advances, it's 10^{-7} cc's per section. That is the definition of leak type from the regulatory perspective. In the order of magnitude,

That's the kind of perspective I'm trying to get into this particular presentation what's needed in the transportable storage cask scenario is to define up front during the regulatory process. Today if indeed these types of things go into service, sufficient design and operational procedures that are agreed upon by regulators from both storage and transportation branches, have sufficient confidence that those are going to survive the intervening storage period.

[Slide.]

DR. SANDERS: The guidance and philosophy from the regulatory perspective certainly exists for dry storage, transport, minimizing radiation exposure to the ALARA concepts of 10 CFR 20.

But there's a disconnect in that there's no guidance for dual-purpose role of storage and transport. When you go to multi-purpose, that disconnect is added by a factor of one.

[Slide.]

DR. SANDERS: Transport regulations are laid out in the Code of Federal Regulations, Title 10, Part 71. Some that have a significant effect on a dual purpose concept is sub-part (g), Part 71.85, which details acceptance tests that must be performed on these casks prior to placing them in transport service. There's a detailed test for shielding criticality, heat transfer, and containment capability of these casks.

Also, 71.87 concerns routine determinations, which we call pre-shipment tests that have to be performed prior to shipping a transport cask loaded with spent fuel.

Some of these routine determinations include visual inspections of internal cavities, internal criticality control features, and so on.

In order not to unload this cask 20 years in the future, some system has to be developed wherein those routine determinations and acceptable tests and the annual maintenance test requirements of 10 CFR 71, which use the acceptance test, can be derived from externally.

Reg Guide 7.9 outlines the annual maintenance requirements and specifies that those maintenance requirements be a repeat of the acceptance test. These acceptance tests involve unloading the casks, placing radiological sources inside, measuring shield effectiveness, measuring heat transfer effectiveness, measuring criticality control effectiveness, and so on.

Also, there's been packing review guides published in the past that expand on the definition of these maintenance tests.

Again, these maintenance tests are designed to identify any degradation that has occurred in the transport cycle of this cask over the year and make sure that degradation is uncovered and an assessment performed as to whether the cask should be removed from service or not.

[Slide.]

DR. SANDERS: Our goal is to try to define this normal condition of storage environment, in other words, design this environment up front. If you know you have something that's going to degrade over the storage life of the cask, compensate for that in the design, monitor 20 years ago.

In particular, any effects that might occur on the integrity of spent fuel and the reliability of these primary safety functions is very important.

[Slide.]

DR. SANDERS: We took what we call a qualitative comparative risk approach, that is, we looked at a transport cask and all the features of the system that surrounds that transport cask -- the system being record keeping, being procedures, being regulations, being typical operations.

We looked at those features in terms of how is the reliability of the system maintained. We then took that and compared that to an identical TSC with the additional storage function imposed and said, "Well how does that change?"

From that we tried to define operational design conditions in addition to transport considerations that may be needed to maintain comparable reliability of that TSC.

[Slide.]

DR. SANDERS: This is really pretty simple stuff. You start out using fairly simple fault tree type of analyses. If you would look at a transport cask, take a cursory look at what kind of factors could affect its ability to respond to transport conditions. When I say respond to transport conditions, I mean the accident conditions that are enveloped by impact, fire, and submersion-type events.

Obviously there's always the finite -- very small -- the design basis of environment could be exceeded beyond that covered by the performance requirements in the regulations.

You could also add diminished system reliability as a result of operational error or inadequate assembly procedures. Each of these blocks could be traced down in finer and finer detail, but this is kind of an overview.

You can also have diminished component reliability as a result, primarily, of undetected design development or fabrication errors, or undetected damage or deterioration.

The transport regulatory system designs in maintenance tests, pre-shipment inspections, and other activities that are designed to detect possible damage or deterioration. Also, acceptance tests are designed in to detect possible errors in design development and fabrication.

[Slide.]

DR. SANDERS: You can put all that together. This is a rather busy slide. I'm not going to go through it in detail, but the whole process of developing a transportation only cask system includes a number of distinct features that start with definition of technical limits.

Technical limits are the safety limits that are required. Criticality -- any effect of less than one is the technical limit. The limit on the allowable amount of release, particularly its source term, is a technical limit.

A radiation limit of 10 millirem per hour at two meters is a technical limits.

Those technical limits have to be met under certain described conditions called performance requirements. The accident conditions of transport are performance requirements.

Those are summed together to come up with a design. Design is then submitted for certification and regulatory review. Design is then fabricated and tested. These tests are designed to make sure it's fabricated as intended and so on.

Once the cycle starts you have periodic maintenance evaluations, like I said, to make sure that

In addition, transport casks are only certified for five-year periods. At the end of the five-year periods, a regulatory review is required wherein any changes in regulations, any changes in technology could have an impact on the defined safety of that system, have to be evaluated.

How do we crank that five-year requirement into the 20 to 40 year life of a storage system?

[Slide.]

DR. SANDERS: We went through a whole bunch of

What we were trying to do was compare the TSC to the TOC. Where we had a failure or error modes that were applicable to both types of system. We looked at the uncertainty reducing measure that's in current practice for the transport system and tried to determine whether that practice was equally applicable to the TSC system, or even capable of being performed.

[Slide.]

DR. SANDERS: We then rank all these failure modes as a function of the failure modes' potential effect on transport reliability, the importance assigned to it by similar effects on transport system reliability.

That importance was the measure of how much regulatory review was required, how much maintainability inspections and so on were required, and also how that failure mode differs from similar transport cask failure modes.

[Slide.]

DR. SANDERS: Some of the major issues that came out of this analysis, to summarize, were obviously spent fuel integrity after storage.

The only way to qualify an acceptable containment requirement for a cask at this point in time is usually what's called a source term approach. If you don't use a source term approach, that source term approach depends on the ability of spent fuel to withstand transport conditions.

If the ability of that spent fuel to withstand those transport conditions is affected by the storage cycle, it has to be factored in.

Zero reliability after storage cycle was a major issue. Corrosion of internal welds during a storage cycle was identified as a major issue.

Effects of structural properties on containment materials as a result of the radiation thermal and atmospheric environments during the storage cycle had an effect. Criticality controls have similar things.

We considered poisoned burn-out, or depletion, as a possible issue. If you have neutron poisons incorporated in these, they are in a neutron flux for 40 years period. Is there a potential for burn-out? If there's a potential for burn-out, then the effectiveness of these criticality control features is diminishing.

Structural properties on basket materials was a major issue. In-service deterioration of heat transfer

Also, environmental degradation of the neutron shield was a factor. For all categories -- and again these necessary, and some standardization of procedures for record keeping and data processing in monitoring that environment over the 20 to 40 year time, and keeping track of those data points, integrating them prior to transport, was also necessary.

[Slide.]

DR. SANDERS: It is not as bad as it seems, though. Based on available data, we were able to draw some

Of the expected cladding failure mechanisms -- and we evaluate creep rupture, stress corrosion cracking, cladding oxidation, uranium oxide oxidation, and hydride formation cracking -- none appeared to be of a major issue. This is on the basis of 30,000 fuel pins that have been observed during current storage cycles by PNL.

Gross ruptures are not predicted for any dry storage conditions. Even if thin-hole hair line crack-like flaws did occur during storage, they would not have a significant impact during transportation.

[Slide.]

DR. SANDERS: Again, we looked at the radiation effects and the long-term time and temperature effects on these types of materials.

[Slide.]

DR. SANDERS: We even looked at the extended neutron exposures up to 40 years at seven times 10 to the 16th neutron per centimeter squared. That's a very conservative assumption.

We found no adverse radiation effects expected for iron, copper, or aluminum alloys. Also, no degradation of gamma shield materials or expected effects on neutron poison materials such as boron.

[Slide.]

DR. SANDERS: Heat transfer characteristics shouldn't be affected too much during a storage time. Certain environments such as inert gas -- there will be no change in an oxidizing environment. They may actually increase. Certainly the decay heat generation is going to go down over that time. In summary, no change in convective, conductive, or radiative heat transfer.

[Slide.]

DR. SANDERS: There are some conclusions relative to the basket configuration and criticality control features, however, that will affect virtually any concept.

It is our recommendation that flex traps probably should not be used. This second bullet used to say "aluminum should not be used."

The first time I gave this presentation, it was at an international conference about five years ago. I was the last speaker in a list of duel-purpose cask vendors. There were six vendors before me from France, Germany, Japan, England, and America. Every cask had an aluminum basket.

[Laughter.]

DR. SANDERS: So I changed this to say that aging effects on aluminum should be carefully evaluated prior to using an aluminum-type material for structural members of a dual-purpose cask. That's because they are significant.

I think, Dr. Verink, you will agree with me, there are some significant questions relative to aging effects on

It has nothing to do with radiation. It has nothing to do with the atmosphere. It's just long-term effects.

Neutron absorbers -- the calculations show the burn-out is virtually negligible.

[Slide.]

DR. SANDERS: Welds is a major uncertainly mainly because there's a lack of data in that area as far as long-term isolated storage.

To accommodate the seal problem issues, there's no elastomeric seal, to our knowledge, that's going to survive an environment up to 10 to the eighth rad of integrated exposure. Ten to the eighth rad of integrated exposure would occur after about eight years of storage.

Our recommendation for seals is that a dual closure concept with installation of a separate independent closure meant for transport conditions only be accomplished prior to transport.

[Slide.]

DR. SANDERS: Again, long-term aging for ferritics and alloys are not expected to be adversely affected.

Aluminum is a question. There was no data. That doesn't mean that we believe there are problems, but no data was available with respect to aging effects on depleted uranium and lead.

[Slide.]

DR. SANDERS: Again, this was a comparative analysis. Out of that comparative analysis we tried to identify some technical issues that were significantly different from the transport cask and the transport function to warrant further investigation.

In some areas the TSC system could be even superior to that of a transport only system. That's because you've got 20 years to uncover an error you may have made in pre-loading and assembly.

Most of the error sources and failure modes are identical for both types of systems. Many of the accepted storage-only cask practices, such as maintaining an inert environment, maintaining temperature limits in a 300 to a 400 degree range are immediately applicable to this concept.

There's still some concerns related to in-storage deterioration that have to be factored into the design in the beginning. There's a concern relative to unanticipated storage conditions. If you're going to factor into the design anticipated storage conditions, how are you going to monitor the system such that what is unanticipated can be readily observed.

There's some need for additional data on long-term aging and exposure effects. However, no adverse effects are expected for many materials and components of these casks. They are virtually identical from a transportable system to a transport-only system, except for certain identifiable materials.

[Slide.]

DR. SANDERS: You'll find that there's some additional areas that have to be evaluated. There are regulatory vendor, Department of Energy, or whatever interaction.

How those are incorporated in the design basis needs to be looked at. If there are data uncertainties, and we want to design dual-purpose concepts today that will survive the next 40 years, what assumptions do we have to make relative to design basis? What do we have to monitor in the interim period to make sure that any uncertainties in those assumptions can be validated prior to transport.

Some of the methods that you might use for that might be a control cask type of a concept wherein one out of a hundred casks is periodically removed from the storage service and put through its paces relative to the transport maintenance inspections.

That inspection result is translated to all the other casks, which it should be capable of doing, provided all the other casks are maintained in the same exact environment.

Acceptance evaluation of the fuel in the cask shouldn't be any different than currently exists for transport casks.

There is a need for what we call post-loading inspections and data initialization. This monitoring over a 40 year period is going to result in a dearth of years.

Validation monitoring -- procedures have to be standardized. If you have 40 to 50 different sites that

Prior to transport, I think all this data has to be integrated into some sort of a post-storage functional assessment. That assessment would detail: What was the effect of this period on the ability of that cask to perform as intended in the transport environment.

Pre-transport operations and inspections would be similar to those for the normal transport casks except you can't open the cavity, again, unload the fuel and inspect all the fuel, inspect the cask, and reload the cask, and perform the assessments.

Assembly and transport wouldn't be any different than it is now. One final activity that would improve reliability may be some sort of a post-transport validation assessment of the first few incoming casks. These are one-time, single-use casks. Prior to returning them to service, they might be inspected. Again, any assumptions that were made down here in the design basis are validated.

[Slide.]

DR. SANDERS: There are some preliminary guidelines that came out of this relative to design basis, just some steps that we thought would marriage this transport and storage function.

These steps are outlined in the report. Again, all this stuff is documented in the report. I will be glad to get you guys copies of it.

Again, activities were based on available data, available comparisons of regulatory constraints between transporter systems and storage systems, and so on.

It's not as bad as it sounds. In my opinion it can be done, but again I would like to stress that 40 years ago

I think we also have to say the same thing about technology advancements. Anytime there's an advancement in technology it could have an impact on the acceptability of an old practice.

That's about the extent of this. Thank you for your attention.

DR. VERINK: Thank you.

We're about to start our question and answer period. If there's a question for the current author, give him one shot before the rest to entertain.

Yes, Bob?

MR. HALSTEAD: Bob Halstead, State of Nevada.

Tom, one of the issues that's been coming up in a number of instances where utilities have proposed use of dry cask storage, in situations where you have public hearings and public concerns expressed, is in the area of continuous monitoring of casks and storage. This is something that I think would apply both to storage only and transportable storage casks.

What types of monitoring could be done on a continuous basis with existing technology and at reasonable costs to address those concerns about cask performance while they're on the storage pads at the reactors?

DR. SANDERS: You would have to look at it from the three primary functions that have to be performed -- sealing, containment and criticality control. Then you look at it from the effect of what can possibly degrade relative to those three functions.

If atmosphere degrades the capability of one of those functions, in my opinion you would want to monitor atmosphere. If radiation source term degrades one of those functions, you can certainly monitor the external radiation field, extrapolate that field back into the cask, and determine whether your source has changed or not.

If structural capability of the basket is a concern, and structural capability would have an impact fuel assemblies due to the self-shielding of the fuel. If the fuel is rearranged, you're certainly going to notice that in the radiation survey.

Containment is an issue. You can certainly monitor the pressure of the cask and determine whether the pressure is decreasing as a result of continuous leakage. But you can't monitor how that system is going to respond in the transport environment.

MR. HALSTEAD: No, I'm just speaking about the storage phase.

DR. SANDERS: Those are the kinds of things that have to be decided. We made some recommendations. Our role license one of these things. Monitoring is going to be very important.

DR. VERINK: Thank you.

Now, then starting of the general discussion, I'm going to ask that the members of the Board and the Board staff have first crack at the questions.

Would anyone like to be a lead-off questioner?

Warner North?

DR. NORTH: Warner North. Perhaps this should go to Jeff Williams.

I'd like a little more explanation on the burn-up credit issue, how important that is, what kinds of calculations were done to take that into account?

MR. J. WILLIAMS: For the study that was done, we didn't really go into detail into the calculations. We assumed burn-up credit for transportation purposes, just to make it equivalent to the current cask designs, in discussing it with the repository people, they believed that for long-term criticality purposes, that burn-up is a requirement.

Maybe somebody from the Repository could address any calculations that have been done to date, but for the study purposes, there aren't any calculations included.

Do you have any additional information?

MR. BENTON: Well, for the Repository, if we can take burn-up credit, then we can increase the number of assemblies per package. That's what we're trying to do. So we would be hopeful that we can have a system that will recommend to the NRC burn-up credit.

DR. NORTH: Are there plans for further work on this issue?

MR. BENTON: Yes, sir.

DR. NORTH: Okay. We'll look forward to hearing about it in the future, then.

The second question I would like to put could be addresses by either of the Williamses -- Bob or Jeff. I would like to ask about the sensitivity to the assumptions about decommissioning of reactors.

One of the messages coming out of Bob Williams' presentation was the importance of this issue and the potential cost saving. But the question of: What is the future for the nuclear reactors and which ones are going to be decommissioned when is one in which we obviously have a good deal of uncertainty.

So, could you expand on that area a little bit?

MR. J. WILLIAMS: Okay. Jeff Williams with the DOE. I will try first.

We have looked at the costs of decommissioning reactors for a number of years now. The way DOE evaluates is we look at when the reactor shuts down. We then allow it to sit there five years. Then we start calculating the

Then we've calculated the costs of maintaining those reactors. There's not a lot of data on that. Our initial calculations were on the order of $3 million a year. Then we updated that to $4 or so.

We had it reviewed by the utility industry. They said that was low by a factor of two to six. I think yesterday there was people that talked about a range of $6 to $20 million a year in operating decommissioning reactors.

We've looked at that in terms of total life cycle costs. The impact of removing fuel from reactors is obviously a big one.

For the current study, I think what I said we did was we assumed that after that five-year period, everything went into dry storage.

There is a movement towards doing that. The Rancho Seco Reactor, I believe. Yankee Rowe is trying to get a system license where they don't have to continue to operate their pools.

That's about what I can comment on. I don't know if I

MR. R. WILLIAMS: Bob Williams, EPRI.

Let me just chime in with one additional thought. There is a requirement in Section 803 of the recently passed National Energy Policy Act to assess the adequacy of Yucca Mountain for disposal of other wastes than spent fuel and

I think it would be very appropriate for DOE to consider that sort of planning in studies that they would do in the coming year.

DR. NORTH: I would still like to hear a little bit more about what happens to your calculated savings numbers if we have more nuclear reactors being taken off-line, as opposed to going through life extension, how that might change your calculated savings.

For example, could the number be double what you showed up under a reasonable scenario?

MR. R. WILLIAMS: I would argue that, yes, it could very easily. My numbers are based on a thousand reactor years. We were only taking credit at $2.5 million per reactor year.

If it's some number like $8 million or $12 million, we're talking $8 billion or $12 billion in savings instead of $2.5 billion.

DR. NORTH: Well, it would seem to me that this issue is sufficiently important, and there is sufficient interaction with the question of schedule for the development of these multi-purpose containers. So, I hope we will see a lot more discussion and analysis on this

It would seem also this is a very important issue for the Nuclear Regulatory Commission. They sit on both sides of this issues -- both the waste considerations and the question of extended licensing for plant operations, and all the regulatory requirements that may affect the utilities' decision of whether they're going to keep the reactor going or shut it down.

So, that's an issue I think both DOE and NRC ought to be very concerned about. From the waste point perspective, we'd like to hear more about it.

DR. VERINK: Dennis Price?

DR. PRICE: Jeff, I wonder what you think would happen to your numbers if you were required to look at the no MRS option.

MR. J. WILLIAMS: Which numbers, the cost numbers?

DR. PRICE: Yes, across your alternatives.

MR. J. WILLIAMS: We've done that. We haven't done that in conjunction with the multi-purpose canister study. I don't really want to speculate, I guess, on what the results of that would be.

We've got extensive data on the Reference System versus a no-MRS system. I think Ron showed some of those figures yesterday that show that as the Repository is delayed, as the capacity of the MRS increases, there's a cost-savings by adding a MRS as a result of the extensive reactor costs for decommissioning.

In terms of the multi-purpose canister impact, I really would rather not speculate.

DR. PRICE: But if you're required, in essence, then, to go to at-reactor storage because of an unavailability of the MRS option, and you start looking at your alternatives, I would think you would get into some rather dramatic changes?

MR. J. WILLIAMS: Yes, in fact, I'm trying to think how that would work right now.

As I said, we haven't evaluated it. I thought about that before I came here and brought some of the information we had on the previous studies. But again they didn't include the multi-purpose canister.

I don't know. I guess I would have to sit down with the numbers and give it some thought before I gave you an answer on it.

DR. PRICE: Okay. It was unclear to me in your presentation. I thought you introduced, as part of your study, something about public perception. It was unclear to me what actually you did and how you factored that into your comparison.

MR. J. WILLIAMS: That was one of the initial qualitative factors that we included. We didn't go out and survey anybody. It was just sort of a guess by our people that work in that area.

The bottom line basically was we thought for MRS purposes that it would have better public acceptance if we handled all canister fuel versus non-canister. That's about the extent of it.

DR. PRICE: Okay. You indicated that you thought it was onerous to put the cask closure on the utilities. I wonder what's behind your thinking in there? What are the alternatives to that if you don't put that on the utilities?

MR. J. WILLIAMS: All we're saying is that the way we designed this canister is to be welded shut. Right now there's only two reactors. I guess the third one just got licensed recently to do that operation.

It's just an extra operation that the utilities haven't normally been doing. Part of the standard contract that we have in place says we'll pick up their spent fuel in transportation casks. It's not a requirement. It's an extra operation at the reactors. That's something that we could work with the utilities as to how it got done. It might not be that big of a deal.

DR. PRICE: Okay. With respect to Mr. Sanders, and your review of some of the regulations and regulatory requirements, I think yesterday Mr. Bernero said that no changes in the wording of regulations would be required to embrace some of these concepts.

What I'm wondering is in your view of it -- not in his view of it -- but in your view of it, would these concepts be better served if there were some regulatory changes?

DR. SANDERS: I think you're making an investment in the future. You want to lock in the requirements in

In my opinion there's a little bit of looseness between the two sets of regulations -- 10 CFR 71 and 72 acceptable 20 years, 30 years from now. I don't think that exists now. That's a personal opinion.

MR. HAUGHNEY: This is Charlie Haughney, NRC.

I'm hardly one to speak for Bob Bernero. However, I'd like to mention that in my view, Dr. Sanders made a

Having said that, we certainly have two separate regulations on the books that we think we can use, and are using right now in the licensing review of one particular cask, and about to start on a second, which we expect to receive shortly for dual-purposes -- storage and transportation.

But I think his points are very thought-provoking and deserve attention. Having said that, I'm not sure no matter what we do in the next few years will guarantee that these regulations, such as they may transpire, would survive the test of 40 years of vigorous oversight by all groups in this society.

I think we can try to do that, but I doubt if we can accomplish it.

DR. PRICE: It's a little interesting to me, the concern about 40 years and surviving 40 years in a repository that we're going to seal up after 50 years is going to last for 10,000 years, and we're going to be able to do that right.

[Laughter.]

DR. VERINK: Don?

MR. LANGMUIR: Don Langmuir, Board member.

Bob Williams mentioned that the average fuel age right now we're dealing with is 38 to 40 years. I wondered thermal loading, if you use the larger casks?

MR. R. WILLIAMS: Just for clarification, I meant to say 28 or 30.

MR. LANGMUIR: I'm sorry. Let's try that one, then, on Jeff. Is that the kind of age that you used in your calculations?

MR. J. WILLIAMS: I'm not sure exactly what the age was. We have a waste logistics model that goes through. He may be talking about at the Repository; is that right?

MR. R. WILLIAMS: Yes.

MR. J. WILLIAMS: Okay, where I believe our average pick-up year, I thought was on the order of 17 lower than that.

MR. LANGMUIR: I guess I'm still wondering what kind of loading we're going to get out of a large cask with an average age at repository of 28 to 30 years? Is that

MR. R. WILLIAMS: From the perspective of the EPRI study, the decay rate between 20 years and 50 years is really quite flat. That is the period. I could dig some numbers out of the report. We could discuss them at the break.

But from our perspective for repository emplacement, it's a question of waiting for an additional 10, 20, or 30 years before you back-fill in order not to violate fuel center temperature limits that are presently thought to be around 350 or 380 degrees, Centigrade.

Now, that brings up an item that was discussed by Dr. Sanders again. We really need to pin down what that real limit is. Presently that limit is used in storage

MR. GERTZ: Carl Gertz.

Our Repository design concepts for hot repositories above boiling for 1,000 or 10,000 years do look at waste age of 20 to 30 years, the current schedule in waste acceptance. So, our hot concepts do look at that.

As you are aware, and you will hear a little bit later this afternoon about our systems studies. One of them is that there is a loading study. What is the best thermal loading from all aspects, from the regulatory waste isolation aspect.

We don't have those answers yet, but we're going to come up with a thermal loading strategy so we don't have to continue debate: Is it cold or hot? We're going to pick one and say this is our reference case. It may not suit every single aspect of the system perfectly, but it's our best overall approach.

MR. LANGMUIR: What we heard this morning says, yes, that the larger waste packages are the cheapest ones in terms of the overall systems' behavior, which puts some pressure on that aspect of a repository design, too.

MR. GERTZ: Keep in mind our Reference Repository design is the repository design that takes advantage of

DR. VERINK: Garry Brewer?

DR. BREWER: Garry Brewer, Board Member.

This really gets to one of the qualitative issues that both of the Williamses started with but never spent a lot of time on and that has to do with the process of licensing.

Would someone just explain to me how the process works and about how long you think it's going to take?

MR. J. WILLIAMS: I wouldn't mind letting Charlie Haughney trying to address that.

[Laughter.]

DR. BREWER: Just to give you time to think here, as I'm sitting here looking at the whole problem, there are two issues that seem to stand out the most -- trying to fix the cost of what it will take in the decommission situation if you've got assemblies and pools. That's changed by two orders of magnitude in terms of the estimates from $200,000

The other issue has to do with how long it's going to take to get this thing licensed? Is it going to be all together? Is it going to be in three parts -- storage, transport, and disposal?

Please explain how you guys are thinking about this? Someone?

MR. HAUGHNEY: Well, I need to ask you a question. Are you talking about this multi-purpose cask, licensing that?

DR. BREWER: Yes.

MR. HAUGHNEY: Okay. It could be licensed in a number of ways. You've mentioned a couple of them. It coupled so that they aren't imposing contradictory requirements on the applicant. All those sorts of things could transpire.

Now, trying to estimate the time that it would actually take is, quite frankly, virtually impossible. It's a first-time review. It's a new and different animal. There's no way to judge the quality of the application before it's achieved.

There may be parts that are missing or defective when it's received that require a substantial rewrite, or yet it could be a very high quality application that requires very little interaction in terms of correspondence or other exchanges between the NRC and DOE.

I've been talking about the technical or safety review of the document. There's questions about the procedural aspects of the licensing review in terms of

Now a lot of those things can go on in parallel, but they just make the practical notion of a well-defined schedule, based on a concept, just not possible, I'm sorry to say.

DR. BREWER: So what are the implications of what we've heard mostly this morning?

MR. HAUGHNEY: First of all, I think a lot of these ideas make a great deal of sense. Having just laid a very pessimistic figure intentionally, the success stories that I've seen in licensing can typically point to an applicant who has been in contact with the NRC long in advance of actually not only filing the application, but starting to write it with any degree of serious effort.

Now DOE has, in fact, started some discussions with us. I'm not going to characterize those initial discussions one way or the other, other than being early information exchanges. They don't allow me to predict the ultimate success or failure this particular part of high-level waste licensing.

The other thing is, I think, it helps if the organization is highly staffed with senior people who have experience in the licensing arena and have licked all their wounds of the past and can deal with us on a knowledgeable and experienced basis.

When you see those sorts of combinations put together, the chances for success are much higher because we don't have to do as much education and get into difficult discussions early in the middle stages of the process.

You know, when you have the fifth round of questions and answers on the same technical subject, and it seems you're not getting anywhere, and the process has been going on for months and months and months or years, it's very frustrating to all sides. But those things sometimes happen.

DR. BREWER: Right.

MR. HAUGHNEY: They can usually be pointed to errors at the start.

MR. GERTZ: Garry, I'd like to follow a little bit. Most of what has been discussed has been the licensing for storage and transportation. When you add that to the appropriate disposal container, that's even well beyond that.

The best that maybe we can do at this early time frame would say whatever container is will not degrade the disposal aspects of it. I would still think we're going to have to look at an overpack for disposal or something, and follow our normal licensing process for waste isolation in Subpart 60 containment and everything else.

I don't see the disposal answer getting solved in the near-term.

DR. BREWER: Right. I believe there's another comment.

MR. R. WILLIAMS: Bob Williams.

I might just chime in with one additional thought. EPRI, Department of Energy, and lead utilities participated in cooperative agreements programs under Section 218 of the original Waste Policy Act.

That lead to the licensing of the NUHOMS system and to the metal cask system. Similar follow-on agreements have been conducted on the vertical concrete cask.

Now I think discussions will be underway -- just to pick a few examples because they're here at the table -- perhaps Duke Power representing the multi-element storage container, and Virginia Power representing metal casks -- can participate in some way in the DOE program.

What we learned the last time around is that the utility expertise in licensing, and the DOE clout in terms of resources and Federal facilities where proof tests can be conducted, works out to be a productive way to move ahead on licensing.

Now I would be remiss if I didn't remind the group of Commissioner Carr's remarked at the last high-level Nevada and other interested members of the public can participate and comment.

So frankly I think some innovations need to be come up with. Perhaps you've heard the word "phased" or "staged" licensing where some sort of approach, at least

But here we are in a brain-storming mode. So, I would encourage the Board to keep this on the table and on the agenda.

DR. VERINK: Garry?

DR. BREWER: Thank you very much for all of that.

I wanted to follow up on one other qualitative issue. Dennis, my colleague, put his finger on it. What makes any of you believe that any of this will increase

[Laughter.]

MR. J. WILLIAMS: I guess our only thoughts on there were the interactions we've had with some of the yesterday. It's a tough problem.

DR. BREWER: Each of the presentations -- and this is not critical, it's just an observation -- started with the assertion that what will follow will increase public acceptance of this system. That's an assertion, and it's an assertion that could be backed up with some work.

DR. VERINK: Maybe it would be appropriate at this time to ask Bob Halstead if he would like to make a comment

MR. HALSTEAD: Thank you, Mr. Verink.

I do want to address the public acceptance issue in the comments I make. I had asked Dr. Verink if I could have about eight minutes or so to make an extended comment.

I'd like to start by sharing with the Board the recommendation that the State of Nevada made regarding dual-purpose and universal casks in December of 1990 and briefly review the things that have happened in the last two years.

Then, taking into account the presentations that we heard yesterday and this morning, tell you how we would be restating that recommendation if we were remaking it

Now what we said on this regard in December of

1990 in our comments on the preliminary design reports for the Cask System Design Program, was this. One of seven recommendations was to expand the cask development program to include dual-purpose storage transport casks. I'm going

We said, "OCRWN should immediately expand the firm reactor cast development program to include one or more dual-purpose cask design. Ideally, OCRWN should consider a family of dual-purpose casks ranging in size from 30 to 100 tons.

"OCRWN should also aggressively investigate the concept of a storage transport disposal cask, the so-called universal cask, using generic disposal site criteria.

"The dual purpose cask design should be subject to the same vigorous scrutiny recommended by the Nuclear Waste Project Office for transport-only casks. The full cost of development should be provided through competitive contracts similar to those currently in place between OCRWM and General Atomics and B&W Fuel Company for the transport-only casks."

Now, what's happened in the last couple of years? It's January 1993. We do not have a MRS site. I sure don't want to disparage the efforts of the negotiator. I think it's a low probability, personally, that we'll get a MRS site. But, of course, we have to continue to consider this.

We still have the same candidate repository site, and that is Yucca Mountain. It's unlicensability is unproven. You know it's politically controversial. We still have not received any plans from the Department of what their contingency proposal will be in the event that Yucca Mountain proves unlicensable.

Not surprisingly, we have a lot of increasing anxious utilities who are worrying about what they're going to do with their spent fuel in the present time and certainly for every year past 1998 that we don't have some facility for Federal acceptance.

Now consider the progress of the current DOE cask design activities. Let me go out of sequence and talk about Phase 2 rather than Phase 1 because Phase 2, the high-capacity advanced technology casks started earlier.

You will remember the RFP for that program came out in mid-1986. Five contracts were issued in mid-1988. Two designs -- the GA-49 -- I'll consider that as one design -- and the B&W BR-100 rail cask design were selected by DOE in December of 1989.

Preliminary design reports came out in May 1990. Then the DOE's independent Management Review Group report came out in October of 1992 and told us that after six years and several tens of millions of dollars spent, we had a truck cask that needed a lot of work. I hate to be so

Now consider the Phase 1 DOE cask proposal. This is for increased capacity cask using existing technology. As I recall, Dr. Bartlett first started talking about that initiative about July of 1991 or so. Some of us in the business have been expecting the RFP for this program to come out since the fall of 1991.

As I heard the discussion yesterday, the schedule is now for the RFP to come out in October of 1993. Now, perhaps taking two and half years to do the RFP means that the implementation, once a vendor is selected, will proceed very quickly. I personally don't find a basis for confidence that that is the fact.

The conclusion we would draw from this recent experience is that DOE and their contractors have a decided tendency to underestimate the amount of time that will be required for design work.

I say this not to be overly harsh or critical. I say it with great empathy, given the technical challenges resolved in licensing a transport- only case. I think you know what the design teams are up against.

But I stand by this conclusion. Anytime I hear a DOE person give me a design schedule, I increase it by 50 percent if they're taking stakeholder input in the beginning, like they should.

I increase it by at least 100 percent if they unfortunately decide not to take the stakeholder and put it to court over them. As you know, we're not shy about going to court where we think we're facing deficient work.

Also consider the developments in the commercial cask field. Now, as I understand Bob Bernero's presentation yesterday, we've got six different storage systems currently licensed at five reactors. We've got about 12 different storage systems in various stages of licensing, including four reactors specific applications that he talked about. I know of at least two others that are pretty far advanced -- SMUD and Point Beach. I'm sure there are others.

In addition to that, you know you've got work far underway by Nuclear Assurance Corporation on their dual-purpose cask. I would like to be optimistic, Ivan, that your ducks are going to get a license soon. But, you know, we've been talking about just a couple of months for the last two and a half years.

We also know that Bill Lee's duck, the Pacific Sierra nuclear transporter is at least far in concept.

Now in addition to that, I would argue that there are a couple of other designs in the licensing hopper.

Obviously the CASTOR, and I believe the TN-24 and the TN-40 also have some possibility of being licensed as dual-purpose casks. There are probably some that I couldn't remember this morning.

Conclusion: The opportunity for standardization of the transport system, looking at the up-front interface with the utilities -- that time has past us. I think it's possible that we can achieve some standardization for something on the order of 60 percent of the spent fuel

But I think what we've already seen is a serious fragmentation of approach on the part of utilities who have been, frankly, thrown upon their own devices to provide for their post-1998, as well as their near-term needs. That has a lot of implications for the way we proceed with the design of the system.

Now, summarizing what I heard in the last couple of days and the various presentations by Virginia Power, Duke Power, DOE this morning, and Bob Williams from EPRI, my biggest concern is schedule uncertainty in the development any type of a universal cask.

I think Bob Williams probably is the most realistic. The way I read your schedule, Bob, it looks like you're looking for something around the Year 2002 as a the ultimate discussion of what kind of cask might be used as a disposal cask.

Here are my concerns about the schedule uncertainties. I think Charlie did a really nice job of discussing the schedule uncertainties from the NRC's standpoint. I won't reiterate my points about the design team activities, but I think, again, there's a lot of uncertainty in schedule there.

But also consider, I don't think any of the schedules that have been presented today specifically include time for extensive stakeholder input. It's got

It's got to come from the transportation corridor of states. Certainly it's got to come from the carriers. I think, in particular, the railroads are going to have a lot of say about the way that large casks should be designed. We need to hear them early.

Additionally I heard no discussion of time for completion of the human factor studies that this Board has been so articulate in described and I should say so forceful in redirecting the Department of Energy's transport planning.

Nor did I hear any time allowed for the issue of full-scaled physical testing of prototypes which I believe area in terms of public acceptance, although it, by no means, guarantees public acceptance.

I'm sorry my time has gone a little over. How would we make this recommendation today as opposed to December '90 for redirecting the DOE cask program to address the issues that we've talked about in the past two days?

I'll be very brief, and if we need questions, I'll elaborate, then. One, we would speed up the Phase 1 cask development program. I cannot, for the life of my, understand why it's necessary to wait until October of '93 for the RFP. Maybe there are some technical problems we're not aware of.

Certainly that program needs to be speeded up in order to address the utility concerns that we don't have current technology, higher capacity transport-only casks available.

Secondly, I would just drop the Phase 2 cask program. Sorry to be harsh to friends at Babcock & Wilcox, and General Atomics. I think it's a distraction to continue with the high-capacity transport-only cask program.

Third, immediately -- and I know immediately in the Federal sector is difficult where you have fiscal year planning problems -- but translate immediately to mean as soon as possible initiate a design competition for dual-purpose casks, a family of dual-purpose casks in at least three sizes -- between 25 and 100 tons.

I'd like to see Ivan Stuart's duck fight it out with Bill Lee's duck, fight it out with whatever other proposals the vendors are ready to come forward with.

I think the goal ought to be to have those dual-purpose casks available by mid-1998. I think that's an extremely challenging goal. I think if the program is shaped right, there's a possibility of meeting it.

Fourth, I would immediately, or as soon as possible the Federal system allows, initiate an aggressive detailed study of universal cask designs. That effort ought to envelope the variety of universal cask approaches with and without overpacks that we've heard discussed in the last two days.

In particular, that program ought to focus on the front-end interface with utility storage systems. It should particularly address the possibility of apply overpacks to the dual-purpose casks that we would be developing for early availability.

Now, let me make four other recommendations for how I think the cask program ought to go even if our recommendations about the Phase 1 and Phase 2 dual purpose, and universal casks are ignored. I think there is some generic advice here about acceptance by a variety of publics.

The first of these is common management. Supervise all of these different cask efforts. Normally that's such a common sense statement I wouldn't make it. But those familiar with the history of cask programs here can understand that it's probably best stated.

Secondly, in the early and continuous inclusion of all the important stakeholders -- the utilities, the states, environmental groups, certainly the carriers, as well as the utilities and the regulatory agencies.

Third, we really need to make sure that we have done a comprehensive human factors evaluation before we proceed to any final designs.

Finally, I really think a key, but not the only key to public acceptance is a commitment to physical testing of full scale prototypes. My personal opinion is that that ought to be part of the design competition process. It ought to be done before the final application is presented to the NRC. This way you don't have to change the regulations. You don't need any change in legislation.

Now there are a number of other things that affect public acceptance. This Board has heard our statements about the way the Western Governor's Association has developed a safety program in cooperation between DOE and the states that deals with all the operational issues, I think that there are some other issues as well. But I think the operational safety planning and the commitment to full-scale testing are really keys to public acceptance. No matter what else you do to accelerate the program, if you don't deal with those public acceptance issues, the program is not going to go very far very quickly.

Thank you. I'm sorry I have taken so much time.

DR. VERINK: I will switch back to the Board and the staff to see if there are any questions or comments.

[No response.]

DR. VERINK: Anyone in the audience? Yes, Ivan?

MR. STUART: Ivan Stuart, NAC.

I think there was a bit of a misinformation to one of the Board member's questions about burn-up credit. The two Williams, if I might ask you the question -- on the subject of burn-up credit, of course the NAC does not require it, and as I understand it, the MESC concept that SMUD and DOE are pursuing does not plan to require it.

So, is it not a case that presently the active transport systems are not planning to use burn-up credit? Is that a fact?

MR. J. WILLIAMS: My understanding on it is that the Phase 2 cask program was planned -- the B&W and GA cask were planning to use burn-up credit. For this study we said we'll be consistent with that, but we didn't do any detailed calculations. The real driver for it, we believe, though, is the Repository. You're right about SMUD and your cask.

MR. STUART: Is it also a fact, Marvin, in your concept that you would or wouldn't ask NRC to change the burn-up credit's position?

MR. SMITH: Marvin Smith.

I think in our concept we would certainly take an initial approach without burn-up credit. But I certainly think, as the people from the Repository have pointed out, in the Repository regime, it's probably essential.

So, I think that research and development in that area is quite important. But I think you have to proceed, probably initially, without it.

MR. R. WILLIAMS: Bob Williams of EPRI.

Let me just chime in first, from an economic, and then a technical perspective. If you have 10,000 casks, and you spent $50,000 per cask on poisons, you end up with a half a billion dollars in poisons. So, you're poisoning a fuel that's already poisoned with its fission products. It seems like it's in the public interest not to waste a half billion dollars.

So, we're not quite ready to give up on burn-up credit. Now, this evening I'll be flying down with Bob Rasmussen and some of the Duke people where we're conducting experimental measurements in a cooperative program with Sandia and Los Alamos and through the efforts of EPRI, to look at various ways of developing meters or measurements that confirm that administrative mistakes have not occurred which would be a criticality issue.

So, because it's a half billion dollar issue, we're not ready to give up on it. But I think the proposition was correctly stated, you would be foolish

DR. VERINK: Yes? Carl?

MR. GERTZ: I just have two comments. Garry, I would like to expand your question a little bit about licensing because certainly it comes to the Project Manager

Many of the people right up here -- Marv Smith and Bob Williams and I -- went through a process where we developed some dry storage technologies at a DOE site. Eventually Marv got a license. You saw the 12 casks on there.

That was done in probably -- from start to beginning -- four years from even doing the prototypes -- or less than that -- out at Idaho, until he had them on line at Virginia Power. So, there are aspects that can be done.

On the other hand, no one has ever licensed a repository or the sub-parts of that before and the most licensing cases of nuclear power plants. There's 100 of them on line. The 100th one may have taken eight or ten years.

So, you can go all over the screen on that. I just wanted to provide that insight.

My only other thought -- a comment on what Bob Halstead said. Certainly he and I have discussed lots of these aspects, although transportation is not my responsibility, but certainly working with the public in Nevada is. Many of the things he said I generally concur with.

Bob, I would ask you one thing, if we're in a rush to procure Phase 1 casks, I was under the impression that we have somewhere to put it in 1998. Do you have any insight as to where it might go in 1998 as opposed to Chuck's indication yesterday of the probability of a MRS not being there.

[Laughter.]

MR. HALSTEAD: That is a good point, Carl. In fact, you could argue if there is a need for the Phase 1 program.

My endorsement of it is based on two thing -- one, wanting to keep open the options of having a current technology, particularly truck transport casks. But I think also we need an augmented capacity rail cask in the event that we have an MRS, and in the event that you want to use transport-only casks.

I would say, secondly, there has been general concern on the part of the utilities that the casks we have unload a pool at a reactor as a result of some occurrence.

I'm going back to the analysis that the MRS Review Commission developed in their case for Federal interim storage for emergency purposes.

I think there are a number of reasons why you might want to proceed with augmented capacity casks using current technology. But I personally see it more as an insurance program.

Also, if you were to actually cancel the Phase 2, the transport-only cask program, then I think it would be important to have some casks with greater capacity than what we have today.

MR. GERTZ: Thanks, Bob, because that's the way I view it. That becomes a trade-off as to funds available and insurance.

DR. VERINK: Bob?

MR. R. WILLIAMS: One brief comment. I wouldn't want to go through a point-by-point discussion of Bob Halstead's remarks. But I think the record should reflect that there is no agreement with all of them. I think many of Bob's remarks were constructive.

But you could start from the perspective that the glass is half full instead of half-empty. I think, for example, pursuing the GA and B&W cask as a back-up, as a contingency program, is part of a viable contingency plan so you don't put all of your eggs in one basket -- yet another new procurement program.

So, these issues, I think, are beyond the scope of discussion of my expertise. But I think the record should reflect that there's another side to the story there.

DR. VERINK: John Bartlett?

MR. BARTLETT: Yes, John Bartlett, DOE.

I would like to comment on Dr. Halstead's comments, which I thought were very sound and, as usual, very articulately presented. I hope you will make those recommendations, Bob, to the Department.

Working from that, I would like to pick up a question that Dr. North asked yesterday afternoon. Basically he asked: Would you take money away from the Yucca Mountain program to fund at a higher level these activities with regard to storage and transportation?

Carl has a few objections to that. But I would point out that what Dr. Halstead has recommended is basically what I would call a comprehensive low-risk program which indeed would give a fairly high degree of assurance of providing technologies in timely fashion for some of the contingencies that the program has to address.

But it also does cost money and it would take a significant budget allocation. What I want to point out at this point is that one of the recommendations, one of the initiatives that the Secretary has taken for the future, is a recommendation to the Office of Management and Budget, to take the program, what is called off-budget, to take it out of the trade-off game that is played with respect to appropriations.

During the past few years, the appropriations to the program from the Nuclear Waste Fund have been on the order of one-third or less of the revenues to the fund annually from the rate payers to the utilities.

What it amounts to is that the program is being starved by the Federal appropriation process, from the funds that should be available for its implementation, to fulfill the agreement that was established by the Nuclear Waste Policy Act.

One of the most important things that can be done by all parties here is to urge and to help support the Secretary's initiative to go off-budget in order to provide the funds necessary both to support progress with regard to Yucca

Mountain -- because one of the points that David Leroy makes very often is that MRS siting is, in very large measure, contingent on progress with disposal because the potential hosts are vitally interested that that is not going to be the de facto for every repository.

So, all of these things do interact highly. They need adequate funding. An importantly particularly measure that might assure that is the action that the Secretary has recommended, to take the program off-budget.

So, I would urge all to support that action in order to get adequate support, adequate levels of effort with respect not only to transportation and storage, but also the Yucca Mountain, and to move all aspects of the program forward in an effective fashion.

DR. VERINK: Thank you.

Any other questions from the Board or the staff?

DR. PRICE: Dennis Price.

I was just wondering, Dr. Bartlett, several comments have been made about this very ambitious schedule for this particular program, the multi-purpose type program.

Do you have any comments? You've seen schedules fade and fall and so forth. This is an ambitious schedule. It appears to be. Do you have any comments about the validity of this schedule?

MR. BARTLETT: I concur that it's ambitious. It's aggressive. It is, in fact, high-risk in terms of meeting the schedule.

I think it could be met if there is diligent attention paid to meeting the milestones and really pursuing, as has been suggested here, an up front effort to minimize the down-side risks and failings that could come from not paying attention at the front end to the licensing issues, to the design issues, to the acceptance issues, et cetera.

It needs to be front-ended loaded in order to have success with the schedule as it's established. I think, frankly, that the most likely potential cause of detail to the schedule, or insufficiency, incapability to meet the milestones, would have to do with the licensing process, the certification process.

There it behooves the Department, as was suggested, to make a very significant effort at the head end to minimize the problems associated with that.

I think it is potentially a doable schedule if it is adequately resourced. But that is a great uncertainly. It has been historically. Dr. Halstead commented on the delay in the procurement process.

Very frankly that has to do with the need for quality assurance, detailing, Federal bureaucracy, and insufficient resources to prosecute the case, to get that blooming procurement on the street. Frankly, that's a typical bureaucratic action that if we don't have enough resources to address it, that's what happens.

DR. PRICE: Thank you.

DR. VERINK: Other questions?

[No response.]

DR. VERINK: Any final questions from the audience?

MR. SMITH: Marvin Smith.

There's a comment I would like to make just briefly on the subject of the schedule.

I'm speaking for myself now, I would like to point out a couple of things that the utilities have tried to encourage in this. One is that we would work together on this very cooperatively with the Department of Energy and the other interested parties.

We have had, of course, quite a bit of experience in licensing. We're well aware of the difficulty with predicting any sort of licensing schedule. But I think what we're looking at here is what we believe is a concept that merits being worked on. I think certainly the '98 arises simply because that's a number that's in the Nuclear Waste Policy Act that certainly has a significance to utilities.

I don't think that if this program went forward and there was some period after '98 before it was completed, that it would mean it would be a failure. But certainly if we don't aggressively pursue it, it has no chance of being completed at any point in time.

DR. VERINK: Ed?

DR. CORDING: Ed Cording, Board member.

I just wanted to ask a question regarding a related topic in regard to the repository end of the universal or multi-purpose cask.

What is the status of the studies on transport into the Repository, drift emplacement, recovery, the fitting of this type of cask into the underground. I guess the question I would like to ask is when would be a good time for us to interact with the presentations on the concepts of bringing it down into the Repository in the ramps, and then storing it underground?

MR. GERTZ: Ed, let me just say that while those are part of our advanced conceptual design activities, which have just started this year, they are not funded to any great extent this year. We're doing some scoping studies in support of Jeff, but it's really very top-level scoping studies.

The things you talk about must absolutely be done as part of a conceptual design, and eventually a licensed application design. But for the '93 year -- and I'll briefly allude it to it during 2001 -- we have not had resources to allocate it to this in lieu of drilling or get ready at the ESF.

We both have just limited our activities for advanced conceptual design for both waste package and repository design this year. We hope next year to pick them up aggressively.

But certainly anytime on the next five or six months we can tell you where we're at, but I guess I'm going to tell you ahead of time we've not done a lot. We won't have done a lot this year because we have just now put the resources on.

It's back to what John said. It's only so much money to go around. There's lots of things that are the right thing to do, but with only so much money, you try to do the things as a program manager you think that will move the program.

DR. VERINK: Dr. Cantlon?

DR. CANTLON: It would seem to me that we're approaching the close-out time now. While this terminates the look that the Board wanted to have on the logistics, this afternoon's session on the road map, looking at the overall system study, and the update on the Mission 2001 that Carl is going to present, in a sense are part of the same overall look at the system.

So, we invite as many of you as possible to continue with us this afternoon. We'll assembly at 1:45.

[Whereupon, the meeting was recessed for lunch at 12:30 p.m., to reconvene at 1:45 p.m., that same day.]

AFTERNOON SESSION

[1:48 p.m.]

DR. CANTLON: Good afternoon. We will get the afternoon session underway. Both the Session Chairman hope that colleagues will communicate to them our appreciate for their presentations.

This afternoon, as I remarked earlier this morning, will be focused on, in a sense, the Big Picture, looking at Gertz on the 2001 operation.

Our first speakers are Williams Lemeshewsky and Donald Gibson, who are going to bring us up-to-date on the roadmap, which were promised in October, but we will take it as we get it. Thank you.

[Slide.]

MR. LEMESHEWSKY: My name is Bill Lemeshewski. This topic is a little bit different than the morning session, in that we were requested to provide a status on where we stood on a roadmap effort that a lot of you, I assume, are familiar with.

I am up here to give a little background on the approach and scope to this effort, and I am going to then introduce Buzz Gibson from the M&O, that will talk about the detailed progress to date on it.

I should say as -- in the Systems Engineering and

Program Integration Division, I am the Acting Director. I am also the Branch Chief for the Systems Engineering Branch where this effort resides.

And we are responsible for studies, modeling, requirements documents, engineering management plans, configuration management, just a general background.

[Slide.]

MR. LEMESHWESKY: Quickly to go over what we define the roadmap effort to be, since the term roadmap has different meanings to a lot of different people.

It is an effort to implement decisions and to get on with the program, basically. And I have the three boards that lead one into it.

It is a decision level -- the third board here summarizes it best -- if you can't write a set of requirements documents for the program, you haven't made the decisions and resolved the issues the you need to implement the program.

So, number one, it is a continuation of efforts that have gone on for at least the last six years that I am familiar with, of trying to tie in schedule issues and requirements documents, studies and modeling work.

It is basically to provide a framework to make decisions and to implement those decisions in the program, using issue resolution, requirements documents and system analysis terms, and to come up with an integrated version to do this, so we don't go through this constant dual looping, in making more complete decisions at the appropriate.

I will get into some of those and you will hear two examples of those from Mr. Gibson.

This process, the ultimate goal of this activity is to do the requirements document that leads into a design, that actually then get constructed -- licensing traceability -- all those issues come in.

As you know, we have been doing and reporting back to you all on our system study results. And we want to make sure this process here would aid to getting those results into the program by decisions, by requirement documents, by filling the voids of those gaps that we have had to work around, where we don't have hard decisions on storage options, canister casks -- those types of issues that affect system level points in the program.

[Slide.]

MR. LEMESHEWSKY: The approach that you will hear today, and we have talked about it once before, is to identify the key issues in the program, we have identified as basically about seven.

From those seven, it probably flows out to another hundred, or two hundred decisions that need to be derived, implemented or locked in, in terms of decided on and put in a document, so a designer can get on even and still make design trait studies later on.

These decisions that need to be made, translate into system studies, and into requirements that would go into our requirements documents.

The step in here, and we have done it once before, in existing schedule document that I will talk about, is to integret this decision hierachy in with the program schedule, and identify milestones and then backup the studies and information that one needs in order to perform that study.

The last board here formulates the detailed analysis -- is once we get in and do these studies, there are a lot of parameters that need to be determined for the sake of the requirements document, and that is what we are going to call a Phase II effort.

[Slide.]

MR. LEMESHEWSKY: This document, the scoping chart here is to really get across the architectual concept of the requirements document in this program, which basically center around our lead document, and a family four headquarters program element type documents, that across this dotted line, would derive down and be traceable to project level documents, for the sake of traceability requirements flowdown, etc.

So this roadmap that we are talking about, are those headquarter systematic type issues, that need to

Obviously, as you will hear, there are plenty of sublevel design decisions that need to be made at a project level, that always need to be integrated, so that they fit. We just can't do things that are not traceable, as well as it might go against an interpretation of a CFR, or a design solution. It might be best, but it has to be reflected up and down the chain, in terms of not only traceability, but compatibility, cost inpacts, schedules, etc.

We have talked before, and I won't elaborate on our revised document hierarchy for the program, but these are the acronyms and names for their names.

My point is to say that the roadmap is scheduled to completion. These documents, not only the first versions of them, but also when they are complete, fleshed out, and have sufficient numbers in them, can be not only fed down, but given to the A&E's at a lower level, where they are interpreted at the Project Office for Yucca Mountain's Storage and Transportation MRS type project offices, and turned into design drawings.

[Slide.]

MR. LEMESHEWSKY: My last chart before Buzz Gibson talks is to cover a lot of background issues on here, just to basically frame it.

I have to say today, we are not where we expected to be six months ago. We expected to be a little further ahead on this roadmap.

But the flipside of it is, and you have heard it today in terms of the studies, we are further ahead on our studies and modeling efforts. And it just isn't an appropriate time now to integret all these activities.

We are basically in a Phase I effort, as we said, to identify those issues in the sublevel activities that need to be tracked.

We have been doing this with different people since '86. I know I have been, but since the M&O's involvement, we have got sufficient manpower to make this happen.

You have heard the studies of throughput, thermal loading, the MRS handling studies -- things that we have put together, and now we want to crank all those into one common roadmap that will get these decisions implemented in the program documents.

The activities in -- it's not a new list of 200 items, but if you remember two years ago, we did a functional analysis of the physical system.

In developing those documents, we came out with a hundred plus issues that needed to be resolved on the program -- either decisions or trade studies, in order to complete those documents.

That set of documents, as well as the previous scheduling of issues, it is an appropriate time, with other two plans that are being developed.

If you see that right around the start of this calendar year, '93, and we need to crank in our analysis, so that when we do it, we do the study once and get all the numbers and decisions that we need out of that study, rather than cycle through it a few times.

The original thermal loading study has triggered a Phase II in that, and that is going in the right direction as we perceive for the sake of decisions, educating the people, on what are true system impacts, but at least from a headquarter system study, we are not going to come up with numerical answers for everything.

Part of it is to look at the true system impacts across those elements, and then let the designers solve

But we want to look at some of these impacts, that if we make the decision, we have properly framed their qualitative, if not quantitative impacts, before we go off and lock it in.

I guess that's -- our effort here is to tie in these two analysis plans to resolve this, and then start working a schedule against -- what we are doing now is planning our Rev. 1 to our requirements document, so that we can schedule block changes in the future, that will have each day of the week.

So it is block changing to the requirements document, make it complete, and lay out the schedule so that they are done in the proper sequence.

Because as you all know, if you start at the wrong end of the horse type of thing, you can just drive yourself the wrong way in these decisions.

Unless there are any questions, I will have Buz Gibson talk about the implementation of this effort, as well as a couple of examples of where it is.

DR. CANTLON: Before Buz starts, perhaps you could help. What is it that you learned -- that you didn't know six months ago, that give you a more realistic view now of how long it is going to take? What happened.

MR. LEMESHEWKY: I have to say, it is basically priority and resources, what we have been focusing our attention on, honestly, or doing some of the other studies of people that do systems analysis, and supporting Jeff Williams on that all-purpose canister study.

We have a family of requirements documents that are being issued this month, that have required, on the order of nine months worth of effort, and we are in the process

I would have liked to have this more completed, but the studies have been ongoing, the modeling activities have been ongoing. This, to me, is the core effort.

Once we can get this down and documented and used as a tool, as well as a framework across the program, we can more better schedule these decisions, and implement them in the program.

Because it is nothing -- there is nothing more frustrating, not to have an answer, but yet, nobody is either working to do, or aware of it in the baseline documents that the program has to go by officially.

Not just discussion of yes, we are going to go that way. That doesn't really hack it to a person who is out in the field trying to go by a set of documents and say, should I do this, or should I not do that.

We have to then put it in, go through our change control board, our QA technical review of these changes, our impact assessment, budget schedules, and crank all that in.

It is lip service, although it is good for that to talk over these issues. But they have to be implemented, and it is just taking more time to implement, and to do it right.

Because we have to go back and consume all the previous efforts, all the previous issues, and try to put them in a proper framework.

And, as you will see, we did this -- looking at handling and common canister type approaches in the past. And now with this initiative, we have got to fit that in, so that as any new ideas come up, or any consolidation efforts come up, that we keep marching with the same, not roadmap, but be able to adjust it and go on, and not go back and reinvent these studies.

DR. CANTLON: So, in summary then, a shortage of resources of people and then changes that you were unaware of at the start.

MR. LEMESHEWSKY: Correct.

DR. CANTLON: Second question would be -- so many

Now that you got a two year limbo period in which we don't know precisely what the regs are going to read, how does that affect what you are doing?

MR. LEMESHEWKY: We have a system, at least for a requirements documents when any new reg comes out, it is implemented into our data base against our existing document. That was our ARMS data base system.

And so, we have set up a process that as the regs over the next 20-50 years get revised, we can look at the impact and say, yes, this reg changed, but there is no impact on design, no impact on license, or there is, and we then have to go assess it for costs.

But that has got to be done on an ultimated basis, and that system is just -- will be implemented next month. other.

But we are basically tracing technical requirements that come out of the CFR family, and then, implemented this reg, and it shows itself by either this drawing, or by this interpretation, or by this study.

So that as, you know, people who come and go from the program, will have a traceable data base to say that we know about that revision, and the affect of the revision is x, and we have implemented it, design changed to take it into account.

Right now, it is just a data base of requirements, traced back to our documents that have gone through technical review, and have been issued by our Change Control Board.

So we have a system under there to track that, but it is not part basically of this roadmap. This is a decision roadmap to complete those documents.

We have another loop, as the requirements change to implement those, just to keep current. Because that has to be computerized. This can just be charts and issues.

DR. CANTLON: Other questions of Bill before we go on? Yes, Warner?

DR. NORTH: I would like to make a comment here and I am finding that I am repeating some things I said at meetings a couple of years ago. And the reason I am repeating is I still have the same concerns.

When I hear you describe this system, it seems to me what you are describing is something that is very detailed, that meets needs you have for accountability and traceability, across an extremely large set of requirements in the various code of federal regulations, that the program must comply with.

It is an extraordinarily cumbersome system to try to use as a decision roadmap for strategic planning. Because it essentially says we got to have all the details in there, before we have got something that you can use.

MR. LEMESHEWSKY: We have those.

DR. NORTH: But it takes you an enormous amount of time to do it, and here it is, years later, major decisions

I think in the last day and a half, we have heard a lot about the importance of the casks, and seen some very appropriate systems engineering studies being done.

The thermal loading issue -- we are still waiting on that one. Hopefully, we will hear a little bit more

And I am very concerned about a philosphy that you are going to do the planning on a system which is very, very detailed, looking at legal requirements. And that furthermore, you are doing it with a, we got to build it all, put it in place, and then we can use it, as opposed to

The same holds for systems engineering. Start with a simple version and then iterate it. And on a later iteration, get in all the detail you need for the legal requirements, the accountability/traceability.

In the meantime, give something to the people who need to make decisions that will assist them in that process before all that detail is in place.

So I am very disappointed, and I would like to express that at the outset. I really hope that you will learn how to do systems engineering, in such a way that it can be very useful as a roadmap for those with decision responsibility, and as a guide to all the interested stakeholders represented here, of how to understand this very complex problem, and all its interactions.

And that you don't impose on that same system, the need to deal with all these detailed requirements. If what you have is a system for meeting legal requirements, please don't represent it as something you are going to use for strategic planning, because it won't work.

MR. GIBSON: Could I address that?

DR. NORTH: By all means.

[Slide.]

MR. GIBSON: I have a -- please forgive my voice. I have something of a cold. My voice only returned about noon today, so.

What you describe as a decision process for systems engineering, or what you perceive we are doing, I would have to agree completely. It would be an absolute nightmare. It is not very useful for making strategic decisions.

It is certainly not very useful for making some of the fundamention decisions that you need to resolve some of these issues. And hopefully, by the time I get through with some of the more details and specifics of what we are putting in this roadmap, I hope will have answered that concern. Because I don't believe we doing that.

I believe that -- hopefully, what you will walk away from this -- is seeing that we are trying to boil down, at least to the system level, now there are many detailed project issues, and decisions that need to be made.

But at the system level, we are attempting to boil down the issues into those that are key critical issues, that need to be resolved, and address those in two separate ways, one of which is the analysis and work that needs to go in, to support the making of a decision at the strategic and policy level.

The second level is given that you have enough information to make that decision, what effort and analysis needs to go into implementing that decision at the detailed level.

The details in most cases are not needed to make these decisions. The details come as a consequence to the decision, and manifest themselves, at least to the system level, and the system requirements documents.

I don't expect you to believe me until I least talk about it. I believe that is what we are trying to do. I think that is what you were getting at.

DR. NORTH: We got interation number one on performance assessment. I would really like to see iteration number one on the overall systems engineering, stripping out as many -- as much detail as you need to strip out to get it done, and then show us from that, what detail you need to make it better, and get to the legal requirements as you need to do that, to address your statutory responsibilities.

That doesn't necessarily have to be done on the same time scale, as helping the top management of the program to make decisions.

MR. GIBSON: I agree with that.

[Slide.]

MR. GIBSON: I will go as long as my voice holds out. But, to talk a little bit about the overall process, because I get into the issues that we currently are carrying in the roadmap -- the fundamental process for resolving

There are several aspects of each of these issues in making the decision, only one of which is a detailed technical analysis or a systems analysis.

There are many other aspects of all these decisions, and I am not going to get into it in detail here. But the licensing clearly is of issue, regulatory issues. There are various stakeholders that have to be considered, as well as the NEPA process slipping into this.

Now the roadmap that I am going to talk about is the one which provides the list of issues and those key elements associated with those issues, that we believe are important to supporting the decision.

[Slide.]

MR. GIBSON: And let me just make a couple of other comments about this chart.

The effort that has gone on to date, has been to try and boil down the plethora of issues into a manageable set, identify a larger hierachy, which I will show you later, which is not a unique hierarchy.

Try and schedule that effort to help guide the decision makers and then define the key elements of the analyses and work that needs to go into making those decisions, so that we can help guide the analysis and take a first cut at scheduling that.

This is a dynamic program, so some of that schedule, I believe, in the next few months is likely to change. I will give you a cut at where it is at now. That effort has been done.

The next effort is to really try and define in a greater level of detail, the specific things that need to be compiled to support the decision-making process -- and not to be confused with the level of detail that then subsequently is needed after a decision is made, to implement it in such a way that you have something you can design to or do a lowr order spec. That's the next Phase II effort, if you will, on this process.

[Slide.]

MR. GIBSON: The set of issues that we came up with at the system level is this set - identification of an MRS site, can be phrased in a number of different ways, how the program is going to deal with waste acceptance.

Thermal management of the repository is clearly an issue. The use of multi-purpose canisters or casks -- forms in quantities of waste to be emplaced is not a major issue, but it is an issue that needs to be resolved, for the sake of the system. MRS storage and transfer modes -- again, that is at issue. In many cases, it is of issue because of the prior issues on the chart. It impacts those.

System waste throughput -- again, that is not a critical issue, but it is one that needs to be resolved in order to support the design -- and how operations are going to be handled after after receipt begins.

That is an issue because there is a substantial amount of thought that still needs to go into that particular area.

[Slide.]

MR. GIBSON: The first cut, there is a large list of issues associated with this program. Any group here could sit down and brainstorm issues, and come up with an extremely large list.

In order to be able to put those in a laogical hierarchy, and reduce them to a list that is manageable, we had to put some boundaries on that issues box.

The chart that Bill showed, that showed the requirements documents versus the project level documents, was one way of doing that --if we define the system issue as those things which really are going to manifest themselves in the system level requirements documents, and we tried to stop it at a level of detail that got down into the design or might represent an impediment to the decision process, although many of those issues will be talked about or resolved as a part of this whole process.

[Slide.]

MR. GIBSON: The current hierarchy, and as I said, this is not a unique hierarchy, ideally you would want to iterate in a circular fashion, through these decision, until you tried to optimize your results.

To a certain extent, the amount of study that has gone on in this program to this point and time, allows you to come reasonably close to come optimum with this set, in doing them at this point and series. They have been done iteratively to a certain extent.

The order that we have in here first is determining some baseline for the thermal management strategy, the repository.

It doesn't necessarily need to be a final decision on what the thermal management is going to be. It does need to be some decision on what a probable range of thermal strategy is going to be in the repository, in such a way that you can now go ahead, and make some of the subsequent decisions, realizing that at some later date, you may want to revisit those decisions.

And that always has to be considered when you go through and make these decisions. I call it the downside risk assessment, if you will. What might change as a result of revisiting a prior decision.

Determining the approach to accommodate lack of an MRS site, or what is the waste acceptance approach going to

What approaches are we going to take. It is clearly a decision that needs to be made before some of the subsequent decisions.

An example of that is determining your system design that will accommodate a thermal strategy. There are a number of ways to accommodate various thermal strategies, be it a cold or a hot strategy, that could cause a perturbation, for example, on the MRS. Not necessarily, but could.

As such, you would like to know what your system construct is going to be on waste acceptance, prior to deciding where within your system, you are going to place design aspects, to accommodate a different thermal strategy.

Again, your thermal strategy impacts may impact your decisions on a cask/canister approach. Thermal strategy, for example, could impact the peak thermal loading that you would want to put in a multi-purpose canister, for instance. You would like to know that before you make a multi-purpose canister decision or your overall canister cask approach.

Clearly that approach constrains your MRS storage and transfer mode. It may define it for you, for that matter.

Quantities in forms of waste can affect waste throughput. That is kind of self obvious, and why those are ordered in that particular way.

Although in terms of the decision-making process, it is not clear that these two decisions are comparative to making fundamental decisions on these other issues.

[Slide.]

MR. GIBSON: The schedule that was currently constructed for making these decisions was based, predominately on the existing MRS schedule -- development schedule.

Since most of those decisions impacted an MRS design against the baseline schedule, those decisions needed to be made in sufficient time, so that your MRS design was stable, long enough to be able to meet the baseline schedule requirements.

If indeed, you couldn't make those decisions, you would need to go back and revisit the MRS schedule. So, for the first cut at these decisions, the attempt is to make those in an order and in a time that supports the existing schedule.

I mean, you clearly want to try to do that. That -- when you see the schedule, gave us -- that we wanted to accomplish all of those decisions, basically, by the end of 1993, in order to support that schedule.

[Slide.]

MR. GIBSON: I am not going to spend much time on this. The dates are drafts, draft dates, basically going from 1993, end of 1993 and cascading back, in the order that they were on there, which are the same decisions on an earlier chart, the same flow, an attempt to make a first cut at what the likely thermal strategy, the repository areas at the end of February, and then just leaving time from one decision to the next, in order to incorporate that decision into the next decision-making process.

[Slide.]

MR. GIBSON: As I commented earlier, I will go through a cursory example in a little more detail of one of these decisions.

But the Phase II effort is to blow this out in much more detail, than it currently exists, and that is the detailed data that we need to make the decisions and so on, and the detail task schedule, in order to meet the dates that I had on the chart.

[Slide.]

MR. GIBSON: An example of one of the things I am talking about, and I will break down one of the issues for you.

It is a multi-purpose cask and canisters. I chose this one because it is one of the ones that we know quite a operational simplification.

And there are other reasons it is of interest. I mean, there is a strong utilities interest, and there was some NWTRB interest as well.

We try and cast the issues into something that is a little bit more positive, and change them from an issue to a decision that needs to be made.

I am going to assert that no issue is ever resolved, as long as somebody contests the decision. It remains an issue.

So you can never completely resolve to everyone's satisfaction and issue. You can, however, as a program, make a decision and move forward.

[Slide.]

MR. GIBSON: Associated with this issue, there are a number of system alternatives that have been looked at, and are being looked at in a fair amount of detail.

There is the baseline system, which has transport -- and I am including in this the existing MRS construct. So, a baseline, for the sake of the board,the decision roadmap, as it exists today, has the MRS construct, as it did exist.

I am not addressing that change, except that I have it in one of my decisions, and that a decision that needs to be made.

The initial, which you are familiar with, the baseline with rail and truck cask from the utilities to an MRS, and MRS has dry vertical concrete cask storage with rail transport from the MRS to the repository.

Another alternative, our MPC's with some sort of overpack. Basically the same series of steps, possibly with different overpacks, possibly not.

And a comment at the end, with an MPC, as emplacement, you can use an MPC as your emplacement, which would be a goal, but it is not -- you have to recognize when we look at it, because it is not critical. You could, if you had to, open it up and use a different waste package. That is possible.

Transportable storage casks is simply a case that uses the same cask for transport and storage of different waste packing, and then the universal cask, which is simply an MPC with an integral overpack.

So with each issue or decision, there clearly is a set of alternatives. Those are the primary set of alternatives, I believe, for the cask/canister approach.

[Slide.]

MR. GIBSON: It is of interest to add a system level, because it has a bunch of system element impacts at a high level. And this is an example of some of those throughout the system, on each elements of the system, of waste acceptance, transportation, MRS and MGDS.

Having discussed this for the last day and half, I haven't been here, but I am assuming, that none of that comes as a surprise or would be any information.

[Slide.]

MR. GIBSON: This particular decision is interrelated with the others. This is an example of some of those interrelationships, if you will.

As I mentioned, the thermal strategy could impact the thermal loading that you can have per MPC, as an example. It can strain the number of elements you would have in an MPC.

Throughput is going to help combined with that, define the number of shipments you might have to make. And that is going to impact safety. That is a safety issue, or a cost issuie, for measuring those things. And clearly, a decision on cask and canister has an impact on MRS. It either constrains it, in the case of an MPC, or flat out defines it, in the case, for example, of a universal cask.

[Slide.]

MR. GIBSON: The next step, after interrelating those decisions, is figuring out what the right set of discriminators are, the right things that need to be evaluated amongst those alternatives, that support the decision process.

And the first cut at this has been aimed exclusively at the decision process, and not aimed at the detailed specification requirements, or the detailed color of which bolt you are going to put in the system.

An example of this one, these are the same -- again, I am constrained by not having seen the earlier versions, but these are fundamentally the same measures of effectiveness, or discriminators that were being used in the multi-purpose cask study, with just some minor additions.

System cost is obviously of interest. Radiation exposure, which translates into health and safety, handlings, schedule impacts are of interest from a programmatic viewpoint.

As a decision-maker, that is important. Waste package performance and the case of the cask and canister study is also very important, because some of these have an integral problem.

These are quantifiable to a large extent. Maybe not exactly, but these are quantifiable measures or discriminators.

[Slide.]

MR. GIBSON: There are other discriminators that obviously come into the decision making process, and here are some of those, calling this qualitative.

Obviously, perception of utilities, the host site, public are of great interst. There are regulatory licensing considerations. Contract impacts -- in the case of the multi-purpose canisters and that sort of thing.

You are familiar with that from earlier discussions, as well as design and operations flexibility.

Those are of interest.

A decision such as this is not pure dollars and cents. They are a whole number of things that need to be done.

In some cases, the efforts to evaluate individual things here can translate directly into constraints or

For example, the evaluation of health and safety, which will allow you to calculate the number of handling shipment miles, and those sorts of things.

With a little refinement after the decision is done, the same analysis that got you there will get to some change and requirements.

That is all I have got.

DR. NORTH: I have to say I am terribly disappointed. I think what you have just given us is a very superficial overview of issues in this example, which we have been into in some depth, in the last day and half.

I look at your milestone chart and your mileage that in two months, you are going to have an analyses of the thermal loading issue done, and I have to say, I don't give you any credibility on that.

These things are hard. They take a lot of work. There are many pieces of analysis that need to be done to the level where you develop insights, such as the issue of the swimming pools versus dry cask storage for de-commission reactors that we heard about.

That is the kind of level at which we learn something about what is important in the program. I think this board identified sometime back that we thought the whole issue of engineered barriers and research in support of it, was extremely important, and it is gratifying three years later to have a meeting where we focus on the multi-purpose cask, and I think the justification for our original judgment is amply displayed.

My question is, why did it take us three years to get here? And I think the answer is lack of effective, strategic planning to figure out what ought to be the most important issues that are driving this program.

And I am frankly extremely disappointed that after all the meetings, presenting plans for plans, for this kind of analysis, I don't see a strategic planning system in place that will give the systems engineering basis for making top management decisions.

And having said that, it is a challenge to the program, because I think you ought to be horribly embarassed, and I think you ought to be presenting to us, at the earliest possible opportunity, such as our next Board meeting, what you have done to fill this vacuum.

DR. CANTLON: Any further Board comments?

DR. PRICE: In case there is any question about Warner's position --

[Laughter.]

DR. PRICE: I would like to state my agreement and I would like to just wonder a little bit, about how things do -- why things do take so long.

Some simple things that have come from the Board, close now to four years ago, which would be before the M&O was involved, were recommendations involving human factors, engineering and system safety.

The response of the DOE was to agree that these programs needed to be put in place. And I am wondering tracing four years, almost four years, why there isn't a program in place. We asked about a program planning document, which would be part of these requirements.

And I notice that, where this program has been going on for much more than four years, you are still talking about requirements documents.

And the human factors program plan is something that I think could be written in a matter of weeks. And even given tracing up and down a hierarchy, or people, making their comments, should still be able to be forthcoming in a fairly short period of time.

The last we were given to understand on where that plan was, and a systems safety plan, I think we were to hear about that last September.

We haven't heard from them yet, as to where it is, them being whoever is supposed to be producing this. And somehow, things that should be relatively, straightforward, to be accomplished -- we are not writing the Constitution, or declaring the Articles of Independence -- actually, the reason I am citing these documents, they are fairly flexible documents.

They are necessary to be in place, but they are documents which should be capable of being iterated and changed -- should be relatively flexible because technology changes for one thing.

And why it should take four years to be able to come forward with some of these -- and surely, some of those of you in the DOE must be frustrated, because certainly, we are frustrated.

When it comes to finally seeing some kind of product, and a roadmap presentation such as this, I would hate to depend upon reading this roadmap, as presented to us here, to get from point A to point B, because there just isn't anything in it. It is very, very superficial.

MR. LEMESHEWSKY: Is it safe to assume then, there are no questions regarding the roadmap?

DR. NORTH: Yes. That is a safe assumption.

DR. CANTLON: Other comments from the Board?

[No response.]

DR. CANTLON: All right. Let's proceed then. Now that we have got the roster warmed up for you.

[Laughter.]

[Slide.]

MR. GERTZ: It makes me feel like some of my recent basketball officiating experiences this past three weeks. As a matter of fact, every game I did, it seemed to

But, let me tell you what I would like to try to discuss with you today, and you asked us to tell you about the Mission 2001. We have certainly provided that to your staff.

We have the 400 activity network on the back wall for you all, and there is a lot of backup that goes with this Mission 2001. So the text in here is rather limited,

Then I would like to update you about the progress we have made since the last time you have been to Yucca Mountain.

I have a five minute video and a couple of view graphs to show you how we are moving in the ESF. And then I will answer whatever questions you might have, including where we might be heading on thermal loading or whatever. But, let's talk about Mission 2001 first.

[Slide.]

MR. GERTZ: I am going to talk to you a little bit about the objectives of this study, the assumptions that went into it at the time, the baseline, technical, the strategy, the approach, the organization results, and the following activities.

I am going to spend some time on the following activities because they are probably more important than the study itself, in today's time frame.

[Slide.]

MR. GERTZ: Our objective was to validate the scope, cost and schedule required to submit a license application by 2001 -- to see if we could still do it, in order to meet an MGDS disposal system, which meets all of the requirements.

Now why do we do it now. Well, first of all I want to point out, it is not the first time it was done. Back in 1988, under Sam Russo's direction, we went through an exercise to look at the cost and schedule of the program.

At that time, we determined we needed to extend our license application date six years, from 1995-2001,

So, we did that in 1988. We thought it is prudent at this time to relook at that, based on new data, new funding requirements, more than we have learned in gathered data. So, that's why we went through this 2001.

[Slide.]

MR. GERTZ: When we started this, about eight months ago, we used some assumptions. These assumptions do

We thought we were going to get about $318 million in our '93 budget for the Yucca Mountain project. You all saw, the last time I talked to you, we were at $245 million, and if you ask me today what my budget is, it is a little bit over $240, so I have already lost 4 million, and that was due to other program priorities, including some of the

But, for this study, we used $318. We made an assumption that the state permitting process would not cause us any delays. And that is still a good assumption. The state professional agencies have been very professional and timely in the incidental permits that we need to move forward.

We did make an assumption that the project would not be resource limited after 1993. That may or may not be a good assumption in the federal budgeting process. You had heard Dr. Bartlett talk about our constraints there.

And we did challenge the scope of all tasks. Who challenged it? Well, the M&O was a new team coming on.

They didn't participate in the SCP preparation, in the

So, using their entire resources, they got the participants together, and challenged what was in the baseline plan.

[Slide.]

MR. GERTZ: We didn't change at this time the technical baseline. It still remained the site characterization program baseline, which has specific boreholes, specific trenches, specific analysis, topical reports, and dates, and it also included a design of a repository and a design of the waste package.

We did change the SCP design for this study to include what we are doing now and ESF, the two ramp approach. But that was our technical baseline, for this Mission 2001.

[Slide.]

MR. GERTZ: Our strategy was to put something in place that we had a starting point, so we could determine what changes really met. So we developed high level milestones, using those assumptions, we included all the participants. They did bottoms up approaches, as to how much manpower and schedules it would take. We challenged the work scopes, but we maintained the technical baseline. That is the point I was trying to make.

And, we developed a fully integrated plan. So, if you needed a topical report before you needed a modeling exercise or performance assessment exercise, you could find that on our chart, on our network.

[Slide.]

MR. GERTZ: That strategy, in effect, came down to this approach, it is a bottoms up prospective, not tops

The work scopes and budgets were reviewed by management, by the DOE team, after the initial reviews by the M&O.

Participant schedules were integrated into a master schedule, summarized in the 400 activity schedule, but in a computer with 6,000 activities.

Meetings were held over a two-week period to verify that there was a schedule logic that made sense,

We developed some work grounds to see if it was reasonable to pull the schedule back to 2001. Everybody did accept those work grounds.

[Slide.]

MR. GERTZ: And in essence, our results were that we do have a fully integrated schedule, across the board, for a license application by 2001 of Yucca Mountain site characterization activity.

It increased our confidence, in that we knew what the scope of work was, we knew what the logic was, and we knew what our budget and schedule is to do that scope of work, and that resulted in a total estimated cost, including costs in the past, to 6.1 billion dollars.

[Slide.]

MR. GERTZ: Let me just go over this on this chart very briefly. The details are in there. But, in effect, our prior years were almost 1.2 billion, adding something for this year of about 240 million, leaves us about 4 less financial, in technical assistance, leaves us about 4 billion dollars worth of activities left to complete.

DR. NORTH: Carl, I just -- Warner North --

MR. GERTZ: Yes.

DR. NORTH: I just want to clarify. So the FY '93 number at the bottom -- what you have really got is 240, right?

MR. GERTZ: That's correct.

DR. NORTH: And you were going to 685 as the assumption for FY '94?

MR. GERTZ: That was, no. 685 was the assumption if we had 321. Okay. This exercise, you had to start somewhere and we put on some assumptions.

DR. NORTH: Okay.

MR. GERTZ: So that 685 was the assumption if we had

321.

DR. NORTH: Okay. But this is an extremely rapid ramp-up.

MR. GERTZ: That is correct.

DR. NORTH: A doubling and more.

MR. GERTZ: That is correct. And we did an analysis to see if we could live with that. What did it mean. It meant drill rigs around the clock. Could we hire people, could we buy LM-300's? Yes, you have to have money in the pot to buy those kinds of equipment.

DR. NORTH: Do you have in your current plan, ramp-up so that you are essentially poised to be able to do this, because expanding the program by this factor of two plus is going to be a very challenging enterprise.

MR. GERTZ: No doubt about it. Let me get on to the current plan, because that was this exercise. And we thought with $321 here, we had plans that we could come close to $685. If not exactly get there, at least have the commitment that we could order equipment, and we would be heading that way. But that was our thought at this time.

That was based on the presumption that it was still important to get to 2001. And if it was important to get to 2001, what did you need to do it, that was achievable, and one of our notes -- not on this one, but in the 2001 study, is that there is a risk in this ramp-up. It is well-noted. We didn't try to ignore it. It is in the study.

It is based upon completion of the current work scope. We have said, for funding about $240, we still

It includes some reductions that we didn't specifically take, and that is the cost to complete 4 billion dollars.

DR. LANGMUIR: Carl?

MR. GERTZ: Yes.

DR. LANGMUIR: Do you currently have on board sufficient staff, without hiring a whole bunch of more people, to deal with the ramp-up that you have proposed

MR. GERTZ: I want to let you know, that is not my proposed ramp-up. This was the ramp-up in the study. We do not have an aggressive ramp-up, depending on what kind of funding we get, and we will have staff to do that. A lot of it comes, you heard, strictly in the craft area, and strictly in capital equipment purchase, purchasing electrical equipment for our lead, purchasing three drill rigs, purchasing additional TBMs if we are going to have another one or two TBMs.

This was based on a four TBM approach too. If we are not going to buy four TBMs, you wouldn't need that at that time.

[Slide.]

MR. GERTZ: We had to start with the assumptions in February, just to put it into prospective, the -- from the cost wise, this was what we presented to the Secretary of Energy Acquisition Board in January of '92. We had updated that one. The M&O came on. They looked over the estimates. They thought we were underestimated in some areas, mainly in repository design.

We then did an independent cost estimate exercise with Gilbert Commonwealth who also is the independent cost estimator for the super conducting super collider. They come up with some estimates.

We started the 2001. That had a first shot of 6.8 billion dollars after some scrubbing. After making sure we had down to what we thought was the minimum required, we came up with about 6.1 billion dollars.

That is an evolution of how the cost estimates relate to one another that you have heard. Once again though, this is based upon a profile that is no longer true today.

[Slide.]

MR. GERTZ: But, to put that in perspective, if you want to graphically picture how some of the monies are spread, this is the yearly funding profile, the ramp-up course is very evident in this kind of a chart. Then we kind of start ramping down.

Most of this is buying equipment. When you talk about man loading. Yeah, do we have craft in the area. We have lots of craft in the area. You could get a thousand craft within a month, if not within two weeks, to do construction type work.

But this just puts in prospective about scientific tests, about ESF, and ESF support, the waste package, and repository design, state payments for oversight, and potential benefits. And that just gives you a graphic portion of how the program is spread over the years.

[Slide.]

MR. GERTZ: Let me talk now about follow on activities, we had to have a baseline to start somewhere. To say, here is out starting point. Now what is happening in the future?

Well, first of all, we need to convert it to our 15 element work breakdown structure, instead of the 10 element one, and we have done that.

And then, hearing the Board, hearing Congress, hearing the utilities, we wanted to look at a cost reduction effort. Is there a way we can bring down the 6.1 billion dollars. A realistic, meaningful way that we can do that. That is underway, and I will talk more about that.

And then, certainly this plan will be updated to reflect what our real '93 funding is. What we think our '94 funding will be, and what cost reductions that we think we can take, without changing a baseline, because the technical baseline, because to change our technical baseline, we need regulatory NRC buy-in.

And then we will baseline that, and that will be our new plan to move forward with.

[Slide.]

MR. GERTZ: Graphically, you can put it this way. We had an ESAB baseline a year ago. We developed the Mission 2001. Now we are going to have to modify that with baseline, until it changes again, by whatever mechanism it may change.

Most significantly right now, that would be changes in scope we would propose, or changes in resources.

[Slide.]

MR. GERTZ: We were asked the same question that Dr. North almost asked, or partially asked is, well what -- based on your real funding this year, and a more realistic ramp-up, what do you think would happen?

This is in the handout and it says at $245 or $240 or so, we were predicting $366 in the next year. I hope you all have the handouts. It should be a brown covered book, and we have handouts in the back. Most of them on recycled paper too, by the way.

[Laughter.]

MR. GERTZ: What would you do with the realistic intermediary ramp-up, but still trying to get it done, as fast as possible? So, we came up with that kind of a ramp-up in about a one-year slip, and a $6.8 billion total cost.

I want you to know, it is not approved by our programmer change control boards. This is just a planning exercise to show you, what if -- if you got that kind of funding in '94, what would happen to the program. That is essentially a one year slip and some cost increases, with that scope of work.

[Slide.]

MR. GERTZ: Just another comparison about the different work breakdown structures and the bottom line comparison between Mission 2001 profile, what the independent cost estimating team believed was an appropriate funding profile, and what our inner-proposed baseline or interim baseline might look like against those same numbers -- just out there to let you know how we think in our planning process, and right now of course, we put budgets together.

We don't know what the '94 budget will be. I hope it will be at least something in this range. If someone wants us to go faster, we would try to ramp-up faster and do something.

[Slide.]

MR. GERTZ: But, the important thing, I think, to point out is, we are moving at a next step, and that is what we call a cost evaluation study.

On September 22, I conducted an off-site that I brought my staff together, and I said, gee -- with the estimate to complete, I think it ought to be realistic,

At that time, Max Blanchard offered some specific ideas. Now that we are doing 14 miles of tunnels in an ESF, perhaps we can reduce the drilling program, and some areas like that.

And, Dale Foust, who headed up this whole study, from the M&O, went over his industry experience and that I concur with, when you do a bottoms up estimate, there is always some conservative built in to it, and perhaps you can look at that conservatism in the future activities.

As a result, we established seven cost teams, headed by M&O personnel, to look at specific areas for cost reduction. And let me just tell you about the status of that.

[Slide.]

MR. GERTZ: We gave him some guidance and will go over the schedule status, the evaluation status and where the report stands.

It is a further refinement of Mission 2001. Cost reductions as a percent of the remaining budget are not the same in every work breakdown structure. They won't be the same. Some may even increase.

We recognize that it is still a limited time activity. We have coordinated with all the groups across the project --

[Slide.]

MR. GERTZ: -- the study groups for each of those seven areas, and we will have a coordination committee that ties it all together, to make sure that it makes sense, once again headed by Dale and his team.

[Slide.]

MR. GERTZ: Some of the items that we considered in our cost reduction activities are less conservative interpretation of regulations. Not only NRC regulations, but RCRA regulations.

We just had to dig up a spill, 1984-'85 oil spill. We went out for fixed prices to dispose of it, in the neighborhood of $300,000 to clean up one oil spill, to bring it to a hazardous waste materials person.

Are we being too conservative in an interpretation of all regulations, or is that the correct way? But at least let's look at it.

If we have DOE orders and NRC regulations, and if they overlap, NRC should take precedence, and maybe we can get some relief from the DOE orders.

If we have requirements that we are implementing, but really aren't applicable, can we reduce that? Can we streamline our approach to doing business? Do we have to have as much paperwork and documentation as is necessary.

In some views of the IG and the GAO, we might need more of that, but, is there a balance? And then we want to make sure that we looked at all our CARs, where we could increase efficiency, corrective action reports. We have a process of turning on work, we call it a technical direction letter. Can we streamline that? And are there alternate approaches to accomplishing the work?

Can you get information from the Callico Hills without going to the Callico Hills with tunnelling? So that was our thoughts.

[Slide.]

MR. GERTZ: The format that these study groups brought back were, what was their methodology and assumption to evaluation the elements in their area, description of the sub-element, and a conclusion regarding cost reduction, rationale for cost reduction, approvals needed, because sometimes you just can't make the reduction without someone agreeing to it, be it a DOE entity or an outside entity, and an estimate of our savings.

[Slide.]

MR. GERTZ: Very briefly, we had a schedule for all that. We are in the process of the bottom of this schedule right now of the working groups concurrence on evaluation reports, and my office, next week, should be receiving the final report on the 12th of it.

But I do have some preliminary, and they are marked preliminary, which is for sake of discussion, so you know where you are going. I thought it would be fair to put these out.

[Slide.]

MR. GERTZ: One of the groups was design construction and operation. They had nine candidate areas,

That is either interpretation or an effective way of doing business. And that would be 3.4 estimate to complete savings. Testing program, working group -- looked at some -- test consolidation, scope reductions, elimination of -- and that is a scope reduction within the baseline.

So, you still get the same information, but you can do it a different way, and elimination of tests with high construction costs, and perhaps not giving you any

DR. NORTH: Carl, excuse me.

MR. GERTZ: Yes.

DR. NORTH: What is the estimate to complete?

MR. GERTZ: Okay. The estimate to complete is about 4 billion dollars, and this would be the reduction in

DR. NORTH: Okay. So, that is ---

MR. GERTZ: In case you didn't want to look at the real numbers.

DR. NORTH: So, this is total cost in billions --

MR. GERTZ: Yes.

DR. NORTH: -- for that column?

MR. GERTZ: Percent. I am sorry. Percent.

DR. NORTH: Oh, percent. All right.

MR. GERTZ: This is the cost, and that is 3.4 percent of the estimate to complete.

DR. NORTH: Okay.

MR. GERTZ: That is just thrown out for relative importance, I guess, if you would want to say.

[Slide.]

MR. GERTZ: The infrastructure, which is the procedures and other things -- working group -- also came up with some things, not as heavy as some of the others.

I also have in parallel, Larry Hayes, heading up a group to look at this infrastructure, to see if there are ways that could be reduced. But there was 80, in this area, discrete suggestions, not generalities, but suggestions, specific suggestions.

[Slide.]

MR. GERTZ: Some other areas are still under development, financial and technical assistance. Performance assessment and regulatory had some thoughts. Some in Category I and some in Category 2. In the report on the 12th, we will have the details of all that.

Environmental work group was still under development at the time we put these together, and early decision work groups said, gee whiz, if you made some early decisions, there is some Category I and Category 2 decisions that you could make.

DR. NORTH: Now those are large numbers. Can you tell us more about what they are?

MR. GERTZ: Sure. One of them is what we just talking about. If we can make an early decision about thermal loading, then we don't have to carry two or three designs on advanced conceptual design.

We can say it is going to be hot or --

DR. NORTH: So we can save hundreds of millions of dollars by getting organized on systems engineering. May I underscore my earlier lecture?

[Laughter.]

MR. GERTZ: I was almost going to pull this chart after. That's exactly right. Early decisions for us at the project management level means let's make a decision and move forward. You may not satisfy everybody, but it is a good, solid solution at this time.

DR. NORTH: Let me state it in another way. We are costing hundreds of millions of dollars by not having done the homework. Let's really get this. I mean, those of you in the room with the management responsibility, please take my comments personally. They are intended that way.

[Slide.]

MR. GERTZ: Summaries are, within the current program, either strategy or changing interpretations on conservatism, we think there is about that much savings.

Outside the current program, Category 2, there may be that much savings. Total estimated savings is about a billion, or 24 percent of the cost to complete.

And there are some areas that still may come into play, that I didn't have the first time.

DR. NORTH: You have got to keep going, Carl. Could you tell us what that 800 million dollar number is, in detail?

MR. GERTZ: That is a summary of all the stuff you got before.

DR. NORTH: Okay.

MR. GERTZ: I am sorry. That's the summary of -- what I gave you before was the seven groups, this just summaries it.

DR. NORTH: Okay. Well, if I added up quickly 623 of that 794 -- was the candidate areas?

MR. GERTZ: No. They are one and two. 511 of this and 112 of this. Do you and I agree on arithmetic on that?

DR. NORTH: Yes.

MR. GERTZ: Okay. Thanks.

[Slide.]

MR. GERTZ: I would like to now point out where we stand -- the full reports went to coordinate groups, just before Christmas. They were looking it over to make sure it is consistent, that no one got out of bounds.

Any discrepancies will be referred back. The final report is due to my office from Dale's group on January 12th, and we will then review it at that time.

Before I take questions on this, I would like to show you a little bit of progress that we made at Yucca Mountain, including the video, and before I do the video, I will just show you one view graph, to let you know where we stand.

[Slide.]

MR. GERTZ: This is our overall schedule we are using for this year, at 4 ESF. We did start site prep on the 30th. You will see that on film. We did let out our RFP for the tunnel boring machines. We expect those proposals due to us on February 9th. We will then evaluate delivery date will be, depending up the vendor, depending upon whether it is remanufactured orr not.

In the area of construction, we are 90 percent complete with our topsoil pad and road drainage. We are 10 percent complete on the north portal and the first 50 foot slot that will eventually coverup.

We are working on the rock storage pile, and then we will be starting the starter tunnel about April 2nd. We hope, using the D-11 caterpillar, we may not have to drill in the last part of this area. We may be able to rip the side of the hill off, and that will save us some time, or probably save us not having to go double shift in that area.

So, I will show you this quick video that summarizes our year in work, in five minutes only. And then I will show you a couple of view graphs of where we stand right now. This was also shown at the NRC.

Whereupon,

a video presentation follows:

[Slide.]

MR. GERTZ: With that film, let me update you on some pictures taken just about four weeks ago. This is the north portal. We can see the top soil has been removed. We are getting ready for building the pad up to about this area, where the tunnel will go in. That's the view from Fran Ridge.

[Slide.]

MR. GERTZ: This is a little closer view from Midway Valley. Once again, lots of activity and the entrance will be about right in here. We are going to have to build that pad up. That is what we are currently doing.

[Slide.]

MR. GERTZ: I will go back to this a second, back to Mission 2001. That we are seriously looking at these things. Now, are these optimistic estimates? We don't know. We are going to have to look at them. But they certainly gave us a menu to look, and to start our cost reduction process, and I am really pleased with the start of that.

And, we have been trying to drive home across the project that it is a concern of everyone the project -- let's find a way to do this better. It has been a concern raised by you, by Congress and affected parties.

We are trying to pay more than lip service to it. We are trying to find a way to do it better. Some of it will require changes in the baseline.

[Slide.]

But, while we are doing this, we continue to work on the mountain, and this is a quote that I am passing on the project is that, while lots of things are going on, we are working on the mountain, and it is a 1700 or 1800 quote, that great things are done when men and mountains meet. And we continue to try to make progress in the area.

Now, I will try to answer questions you might have about anything.

DR. CANTLON: Well let me start off -- you mentioned earlier that changes in the technical baseline would require NRC buy-in. What is underway as such things as going to the larger canisters, and in drift emplacement,

MR. GERTZ: Eventually, we have to decide that we are going to do that, modify our SCP through our semi-annual progress report, or a special topical report, and get NRC's comments on it.

And after we have addressed their comments, we would then incorporate it into the baseline. So what is being is, some of the things you saw today.

We are starting the multi-purpose canister. If we decide that is the way to go, then we have to tell the NRC our emplacement mode has changed, from emplacement in drill holes, to in drift emplacement, with multi-purpose canisters -- here is the test we need to do, or change to our site characterization plan, or maybe we don't need to change any tests.

We just need to tell them, our mode is changed and we don't need change and tests. They may say, oh, we think you need a lot more tests, or you need a lot less tests.

DR. CANTLON: But, nobody really thinks you are going to put thin walled canisters of very low capacity in that mountain, do they?

MR. GERTZ: I don't think that that is true anymore. That's right. But we have not changed our baseline yet, Dr. Cantlon, and you have to -- that is still

DR. CANTLON: But here again, getting back to Warner's start, if one could begin to prioritize those particular decisions that have big money payoff, and get on with that negotiation, and so on, it would seem to me there would be some opportunity here to get this moving.

[Slide.]

MR. GERTZ: Those are the areas that we are looking at when you talk about early decisions. If we don't have to carry some of these multiple designs, multiple approaches, it saves money it repository design, it saves money in waste package design.

But you still have to have a rationale documented for making that decision. Because the regulations require that alternatives be looked at, and we just can't pick one without an alternative. We have to have an alternative for waste isolation.

That is part of the requirements, and they have to be analyzed in some detail. So we have to look at alternatives, and we have to have a rationale on why we chose the approach we did. Because they all affect waste isolation.

DR. CANTLON: But, with the 1992 Energy Policy Act, even the regulations themselves are in two years of limbo.

MR. GERTZ: Certainly that is true. We have thought about that a little bit, and it may be more than two years. It may be three years --

DR. CANTLON: Indeed.

MR. GERTZ: -- before we see something. However, we think our near term activities, that is, getting a five mile loop at the ESF, understanding the basic hydrology and geology of the mountain, probably are going to be needed, no matter what the regulations may finally end up.

So we don't think our near term activities will be so much affected by the regulations. Our long term analysis, and maybe some of our longer term regional studies, things like that, may be affected.

DR. CANTLON: Patrick?

DR. DOMENICO: Domenico, Board. Carl, you mentioned you may say something about the thermal loading decisions. Did you plan to say that later, or this is a time for questions?

MR. GERTZ: No, it is a good time. I think the M&O has been tasked under our guidance to put together a white paper about coming up with the thermal loading decision in a couple of months.

While you expressed your concern that that might be optimistic, we have had a lot of data on thermal loading. And we have looked at it for a long time.

And I believe it is just time to make a management decision on it -- that all strategies may be successful, and we ought to pick one that we think is our best in our mind right now, and move forward with it. And I think we can do that in a couple of months, myself.

DR. NORTH: Well, one of my concerns here is that I think for a decision of this importance, with the various issues -- that it really needs to see a lot of public scrutiny in the process. Not just management made a decision.

Some colleagues of mine in the risk analysis community say about DOE's decision-making is to decide, announce defend. And I think we have already heard from the representatives of Nevada that that doesn't seem to work.

That is likely to lead, I think, to a very serious problem, that the program can avoid, by presenting the basis for the decision, inviting the stakeholders to come in and comment. And then making your decision.

And once that discussion has been held in the open, you also need to relate it to study plans. The issue of what do you need to know about thermal loading for repository design is quite a critical one.

The last time I talked to Tom Buschek and the Livermore people, maybe somebody can update me on that, there was no study plan on the heater experiment.

There are a lot of other study plans, but that critical item didn't seem to be covered, to the extent that there is something where you can even describe, or see what it is you are proposed to do, and why.

MR. GERTZ: You will be happy to know, today I think the staff is at Livermore working on the plans for that study plan with Buschek and some other people.

DR. NORTH: Good. I urged him in the strongest terms myself -- get something done and don't wait to make it perfect with all the detail. Get something out there will serve as a current iteration for strategic planning.

And you can then improve it from there, because that issue is going to be quite critical.

MR. GERTZ: In fact, I will just expand a little bit more to share with you. Some of our preliminary thinking was to do some heater blocks and bring them to Livermore. We now think we can do those heater block tests right at Yucca Mountain in Fran Ridge, which will save us time and money, and may even be more representative of in situ test. We may do some additional, small block tests, but --

DR. NORTH: Well, then there is the issue of the inner action of that with the containers. How important is diameter? How important is this issue of centerline temperatures and the change from UO2 to U307?

It might be that you need some demonstration, that what you were doing with fuel of various ages and various burnups, that in fact, you will be able to satisfy all the requirements that we will not have a serious problem.

You need to give NRC an opportunity to think about the basis for your decisions in this area, so that they can

You can't do these things overnight, and expect to have credibility. So, I would urge that you get it out and

MR. GERTZ: I agree with everything you say. First, we have to get it out ourselves, so we can give someone else an opportunity to comment on it at that time.

And certainly we did have over 4,000 comments on the SCP, and that included a thermal loading of above boiling, and other things, so it is not that there is not a history of comments in the program, but I agree with you.

DR. CANTLON: Don Langmuir:

MR. LANGMUIR: I have not seen any work statements of what you propose to do in the thermal loading experiments. If you are going to make a management decision on the choice of thermal loading in the next few weeks of months, what is the point of the thermal loading four-year studies on those blocks? What do they accomplish for you, if you have already decided?

MR. GERTZ: Let me ask Mr. Benton, if he is here, or Diane, if she is here. I think it is to validate models, myself.

MS. HARRISON: Hi, Diane Harrison, Department of Energy. And Carl is right. Really, those tests -- hopefully, one of the reasons why we are starting the large block tests this year, is to get some answers early to resolve some of the modeling questions, the hypothesis that

Also, the tests to be done in the ESF, we would like to be started early, since we are getting underground early, and it would also be to support model validation and some of the decisions that have been made, based on testing, laboratory scale testing, and the large block testing that we have going on now.

MR. GERTZ: But Diane, I have to say, we are going to have make some of these decisions, based on limited data, hypothetical models that are going to have to be reinforced by some kind of validation, some kind of test effort.

And if the test effort indicates the model is not right, then we have to rethink that decision when the time comes. But, in the meantime, we are moving forward on some path.

MR. LANGMUIR: It is a little frustrating -- if all of these activities had been carried along in parallel, instead of in series, we would be in a position with knowledge of the consequences of thermal loading choices to make management decisions, based on some information, rather than going backwards here.

We have already -- my assumption was the thermal loading test would give us information to allow us to make an intelligent decision of whether they are high or low thermal load, instead of us accepting high load, and then going backwards and saying, well, this is the consequence of it.

MR. GERTZ: That is the risk you take when you move forward, I think. And, I wish, like you, that we had had efforts going on in parallel. I think John, Dr. Bartlett articulated pretty well, and Ed, you know, talked to me a little bit about repository, and why, I guess I

[Slide.]

MR. GERTZ: But in '93, which is here, repository design, we are only spending 4 million. Two of that is in rock mechanics, so we are not doing much hard design on how we design a repository, I will tell you that.

On waste package, we were spending four years ago, when I first came on the program, 20 million, and had some nice studies going. We had to make some decisions to cut it back. I agree with you. But in the meantime, we needed to move forward in some areas, and we did. And that are some choices that we made, but.

DR. CANTLON: Ed, did you have a question

DR. CORDING: Yes. Carl, you had indicated -- Ed Cording -- you had indicated that -- I think at one of our recent meetings a few months ago, perhaps the fall, you had indicated that this was the last chance to meet the Mission 2001 Program.

In other words, if the funds were not wrapped up again next year for fiscal '94, that 2001 would be impossible. Is that still your position?

[Slide.]

MR. GERTZ: Yes. This, I think, represents that. If that is the kind of funding we might propose in '94, then it is 2002 for a license application.

DR. CORDING: Okay.

MR. GERTZ: It is a one year -- that funding profile represents a one year slip which, I think, consistent with what I said to you a couple of months ago.

[Slide.]

MR. GERTZ: If the high number, although it be very challenged to achieve that kind of a ramp-up, then maybe 2001 would still be achievable, but we have some challenges to get there, even with that.

DR. CANTLON: Before that take that off Carl, --

MR. GERTZ: Yes.

DR. CANTLON: As one looks at the waste fund, you are not the only person feeding off of that trough.

MR. GERTZ: That is correct. Dr. Bartlett has to make decisions about the stuff you heard earlier today, transportation, MRS, and other programs.

DR. CANTLON: Indeed. And, if you recognize that the annual income is in the 600 million dollar range for the total annual income to the waste fund, then you are not likely to get those kinds of numbers, are you?

MR. GERTZ: That is right. That is why we looked at the cost reduction, can we bring some of those numbers down through our cost reduction program, and I see John

DR. BARTLETT: Carl could you please put that one back up again?

MR. GERTZ: Sure.

[Slide.]

DR. BARTLETT: It provides a great opportunity to talk about some things. Yesterday in my opening remarks I spoke about the secretary's intense commitment to the goals he had set when he came on board.

He began his watch by saying we want to begin spent fuel receipt in 1998 and disposal in 2010, and I can tell you that we have been following that goal ever since.

The numbers here illustrate something about what we have been dealing with and let me also relate it to the comments I made just before noon about going off budget, etc.

As Carl indicated, several years ago, the baseline resource requirements to complete the Yucca Mountain characterization, were evaluated, and we are still fundamentally working toward that, in what will be a changed process dealing with that.

And they indicated that $6.3 billion dollar figure. I point out to you that the total money that would have to be spent, prior to ever putting waste in the ground under current procedures, is in fact on the order of $9 billion dollars. $6 billion for characterization and another $3 billion for licensing and construction.

And that money would be invested over a period of about 30 years, and there are not results until the very end of that. No assurances you are going to have a licensable facility under current strategies.

That is one of the things that is leading to consideration of alternative strategies and Bob Williams mentioned that concept earlier today.

But now let me talk about these numbers a little bit. A ramp-up from $332 to $685. As you might imagine, that gets a little bit of attention.

There are, just in case you were not aware of it, 24 steps in the federal appropriation process. And when that kind of a thing pops up, at any point and time, that does get some attention.

So let me simply tell you that the capacity to do that kind of ramp was thoroughly vested in the first place, that. It was accepted, as Carl indicated, that it is tough, but it is doable, fundamentally.

But it indicates something really more fundamental, which is what I wanted to get at. And that is, I mentioned earlier the fact that the resources have been significantly less than required to meet the secretary's goals, and also significantly less than the funds available tradeoff process.

But what this indicates here, the numbers that you see on the bottom line there, is the commitment to 2001. So you say, this is the answer, now prove it. And now you back up and say, these are the resources required to maintain that schedule. If you don't get the resources, you won't make the schedule. It is as simple as that.

Now, Carl has shown you that an assessment has been made of the potential to reduce resource requirements to hit the objective by potentially as much as 1.2 billion dollars in round numbers.

Now I invite you to essentially divide that much money evenly over that time period in the reduction in cost for the entire program.

We have been listening for the last day and half about great opportunities and needs to increase the resources going into alternative canister systems, etc.

There just ain't been that kind of resources available.

And a lot of the things you properly criticize the program for, are in large measure, the result of not having sufficient resources, and having to make difficult choices about how to put on the resources, how to apply the resources to maintain activities at various levels.

Frankly, I see this as a continuing problem, without the initiative and accomplishment of the initiative to go off budget.

To go off budget, if that is accomplished and if then Congress will appropriate it at the end of this 24 step process, funds of the same level as are the revenues to the program annually, there is a chance that this kind of process can be made.

Absent that result, it simply won't be there. And I assure you this kind of dialogue about why don't you, between the Board and others, and the reasons we don't, will, in fact, have to continue, because simply the program lacks resources.

The name of the game then becomes optimal allocation of quite unsatisfactory resources to the goals of the program. Thank you.

DR. CANTLON: Ed, you had a question.

DR. CORDING: Yes. I am wondering in some of the testing in particular, in the ESF, the ability to -- with the program you see there on the board, the ability to be able to accomplish the test, get the results, evaluate them, analyze them, feed them into it, and prepare for licensing -- I am wondering if already, we are at a point where it is not going to be possible to do the type of scientific work and testing, and evaluate it to the degree that the DOE and others will feel satisfactory.

MR. GERTZ: I think we are right at the limits right now. Particularly with some of our heater tests and waste package tests -- that if we can get our loop down in two and a half years from now or three years from now, and be able then to move into the core test area with our test, we then may have four or five years of tests, that will go on as the license application is being reviewed, and that is probably the minimal amount.

Certainly there was a debate, and Dale or Paul you are predicting over 10,000 years, maybe four or five, to six or seven or eight, isn't that big of a swing, if you can learn what is necessary in four or five.

So, right now, the scientific investigators have bought into this schedule, although some reluctance and

MR. CORDING: I think the heater tests are certainly one -- the item that comes to mind most dramatically, because so much is beginning to focus on that, as the mechanism, driving mechanism, in terms of any flows.

MR. GERTZ: Yes. Let me ask Dale or Paul if there were other that were drivers for the schedule, in your discussions with the scientific investigators?

MR. FOUST: That was the primary one.

MR. GERTZ: Dale, go to the microphone.

MR. FOUST: Dale Foust of the M&O. The heater test was the one that was the long pole on the tent. That was the one that had the most concern.

But I did want to say, it was a byproduct of this exercise in which many of the PIs took a careful look at their own proposed testing programs, and were able to find efficiencies in time as well as money, and that continues today.

And I think that sort of thing has been one of the, maybe one of the real long-term payoffs that will, in the final analysis, be one of the better payoffs of this exercise. And we are certainly taking advantage of it in the Phase II cost studies that we are doing now.

MR. GERTZ: One of the other areas is do we need core from every hole, full depth core from every hole.

DR. DOMENICO: Domenico. You are making a decision on thermal loading, maybe a couple of decision?

MR. GERTZ: A planning decision, I think, is what it is called.

DR. DOMENICO: Of course, it is reversible.

MR. GERTZ: Of course.

DR. DOMENICO: But not without costs, probably, in time.

MR. GERTZ: That is correct. But, if you don't make a decision, you keep incurring costs and incurring time too.

DR. DOMENICO: Is there any decision with the ramp-up, your ideas to go to three big rigs, 24 hour drilling out there on the service base program, is that incorporated?

MR. GERTZ: That is incorporated, and it would be four rigs total.

DR. DOMENICO: Four rigs.

MR. GERTZ: Four rigs, big rigs, and two or three or four smaller ones operating. So when you operate four rigs, you really have five drill crews, four or five drill crews, so that is 25 drill crews.

DR. DOMENICO: Even though I have just heard that the, some of the people at core demands have been reexamined, and perhaps, some of the PIs have determined that they really don't need as much as core than has been originally requested.

MR. GERTZ: Then we probably just ream the hole. Certainly that has to be reevaluated. If all those holes don't require full depth coring, then maybe it is only two or three drill rigs. This was based upon before we took the estimates.

DR. DOMENICO: I think -- we have looked at the service base program a few times, and I think it is deserving of another good look, especially with regard to the core requirements and what they are to be. I really think it deserves another good look.

MR. GERTZ: I think Larry Hayes and the scientific investigators have taken the initiative. They are saying, maybe five years ago we thought we needed all this core, but perhaps now, we don'.t

DR. DOMENICO: Well, five years, we probably didn't know what a repository was too well, so it is probably true.

DR. CANTLON: Carl, looking at your figures where --

MR. GERTZ: Yes, excuse me. I just want to make one thing clear with that.

DR. CANTLON: Yes.

MR. GERTZ: This does not include any of the reductions I talked about. It is this exercise that generated the reductions that I portrayed in the next spot.

Our next plan is to take those reductions in place and do we need two or three or four drill rigs. I am sorry.

DR. CANTLON: Following up on your cost reductions, which is the next exercise. One of the areas where you had relatively modest savings was in the administrative site of things, and having administered university budgets for 25 years myself, I would tell you that trying to scientific programs to curtail back, you

It didn't seem to me, and I don't have the numbers in my head, so it may be misperception.

MR. GERTZ: No, it is the right perception.

DR. CANTLON: That you didn't get equivalent cuts out of the administrative overload on this operation.

[Slide.]

MR. GERTZ: We did not get equivalent cuts in the administrative aspect of the program. Let me tell you. This was looked at very closely, because the scientists, Larry Hayes and Les Shephard from Sandia, said if you are going to cut the science program, we have got to look at this administration. Well, I have set up a separate task force that is looking at just that, led by the scientist, because it is the same scientist, a while ago, that challenged the QA program, and said it is over kill, it is too much.

They got together with the QA professionals and they came to a workable program that everyone seems to think is reasonable right now.

Well, I am offering the same challenge right now on the administrative side. But, I want to point out. Some of this administrative side includes the environmental program -- you know, when you use the word administrative or infrastructure, depends on what is included.

It includes the environmental program, it includes running the sample management facility, it includes some other things that may not be pure administrative.

But, they were all looked at, and here is the detail that was looked at. There is 80 discrete suggestions. But it only comes to $10 million dollars.

Dale, do you care to comment, or Paul, because you have been on the details of this?

MR. PIMENTEL: I am Paul Pimentel with the M&O. On this cost reduction, I wasn't working on that specific part, but I think that one thing to keep in mind also, is that these seven working groups were working primarily independent of each other coming up with ideas, kind of brainstorming ideas.

And so the infrastructure working group really wasn't aware of the magnitude of reductions that were coming in some of the areas. So, it is kind of hard to look at percent versus percent.

So I think there is going to be another round, and I would suspect that there would be additional reductions in that area. Yes.

MR. GERTZ: But, Dr. Cantlon, let me point out that, I think you are well aware, we do operate in a fishbowl in this project. Next week I have nine members of

DR. CANTLON: I understand.

MR. GERTZ: We just had a report from the DOE people saying, gee, we need more schedules and more detail.

DR. CANTLON: The best argument you have is that you have really gone through a major budget cut in order to get the damn program done.

MR. GERTZ: That's true. In order to some --

DR. CANTLON: You can never satisfy the bureaucrats, so.

DR. CORDING: I have a question on what the total on that infrastructure item is. What percentage of the 4 billion is the total infrastructure?

[Slide.]

MR. GERTZ: The cost were 2.1 savings, but of the total infrastructure, once again, it depends on how you want to add it up.

You know, I have done the firm foundation chart with you all before, and this is not the firm foundation chart. But project management is a part of infrastructure. But up in here in site, we have run into sample management facility. I consider that perhaps, a part of infrastructure.

In regulatory, we had the environmental program. I consider that part of infrastructure. So, it just depends on how you want to define it, and we have defined it a lot of ways for you.

DR. CORDING: So, it is perhaps 50 percent of the total?

MR. GERTZ: It depends on how we define it. I think it is 25 percent. It depends on what you put in or put

Some people say sample management facility shouldn't be an infrastructure. The environmental program should not be an infrastructure, because that is all part of existing law. It should be just project management and administrative and procurement and personnel. And it depends on what you put in and what out -- what you want to

We can compute that percentage. We just need the definition. The reason I am being a little bit uncertain on that is the GAO wants it computed one way, with this end and one out.

Some of the IG people want to compute it another way. I just use my work breakdown structure, and let the numbers fall where they may. But different people want to compute it different ways for their particular purposes.

DR. CORDING: One question on the -- I also had in regard to the ramp-up. For several years, you have been working with a plan for the next year to be doing a ramp-up, and in order to be able to ramp up in the next fiscal year, you have to be prepared for that, and that costs

In addition to the inefficiencies that will occur in the period of the ramp-up in the acceleration, you are spending money now for those sorts of things.

If you were in a situation where you knew right now that you had to spend something on the order of $300 million or whatever it is, that is close to what you have been getting, would you be able to cut back in certain

For example, on some of the infrastructure are certain things that you could divert money to, or take money from, some of the things that are being now used to prepare for this acceleration.

MR. GERTZ: Let me ask -- have Dale maybe answer that a little bit too, but let me give you my thoughts.

Many of our things, like environmental studies, we have a base program, that no matter what we are doing, we have to do, and then we do pre-activities surveys.

So, we only fund that to what is on the agenda. If we have to do 200 percent more pre-activity surveys next year, we will get more people next year to do it. We don't bring them on this year.

That's the same with our drilling crews. We only have one drilling crew on the LM-300. If we had to have four or five, we would bring them on next year.

On the other hand, we have to have systems in place like the project control system that can take $600 million dollars worth of yearly activity, or $300 million. We have maybe 20 people operating that now, would you need 30 -- you might need 30 to go to $600 million. You wouldn't have to double it to 40. So, I don't think there are too many areas like that, but there may be some. Dale?

MR. FOUST: Let me address a little bit, the process we went through to make that evaluation. I believe Carl said earlier, a big percentage of the ramp that we are looking at is in equipment buys.

We have the big -- almost one year buy of additional rigs in four TBMs in this number. And there is a large amount of trade employees, who could be brought on board.

And we did a survey of the trades pool for the entire southwestern United States and found that that is essentially a non-problem.

Then we looked carefully at all the participants ability to bring on skilled people. We discussed that explicitly with all of the labs and within the M&O, for example, where we have to bring on designers. And that is done, in this case, to a large extent, in Fluor Daniel and M-K. We looked at those companies abilities as well as our

And so, we looked carefully at what the increase would be on a participant basis by skill type and convinced ourselves that it wasn't easy, but it was doable.

Now, I don't know if I have totally answered your question, but that is the process we went through.

DR. CORDING: The other question is, if you were operating and knew you were going to be operating in the next four or five years the $300 million dollar program, would you be able to make changes that you cannot make at this point, with the anticipation that you are going to be going to not just in the first year, but in the second year and third year, $600 million dollar program?

MR. FOUST: We think that is doable. And one of the reasons --

MR. GERTZ: I think Ed's question is though is --

DR. CORDING: Is the other side.

MR. GERTZ: Do we have people on board now that are simply on board because we might have a three or four or $500 million program, or are they on board to maintain a $245 million program?

DR. CORDING: People, infrastructure, you have a sample storage facility that is capable of handling a lot more than is being produced now, those sorts of things?

MR. FOUST: I think in all honesty, there is a small percentage that might very well fall in to that category. You have to sort of anticipate what next year's budget is going to be, and sometimes you anticipate incorrectly.

I know in the M&O, I have been caught with a skill mix problem. I had staffed the wrong guys, anticipating what was going to happen the next year. I know some of the other participants have had that same problem.

But I don't think it is a pervasive problem. I think it is a relatively small problem, and it is not really something significant to the program.

MR. GERTZ: I guess I can only share with you the budget discussions I had with my division directors and the TPOs, Dale included, and our integration, and I don't think too many of them are over-staffed, betting on the other to come for big numbers.

I think most of them are saying, I don't have enough to do this year's work. You want to get ESF done, you want to have three drill rigs going. I need more people to do environmental surveys, radcon surveys, project control, QA audits, self-assessments, all the other things, and many other things that go on and on.

DR. CANTLON: While Dale is here, let me ask this question to both Carl and Dale.

The prior speakers commented that there has been a lag in putting the system study together, the roadmap and so on. And I noticed that the amount you had in the earlier slide you had up there, the amount for systems is substantially below where you had expected it to be, and the question, do you have really enough invested in the systems area to lay out this planning information to make the operation, perhaps a little bit more expedient down the road?

[Slide.]

MR. GERTZ: Let me point out that the systems area that I have up here is not the overall systems for the program.

DR. CANTLON: You have only --

MR. GERTZ: That is funded by John Roberts and Bill Lemeshewsky. This is for the systems activity that we do at the project level, tradeoff studies, after you make the big systems.

DR. CANTLON: Do we have somebody in the audience who would answer the former question? Anybody here? Robbie is gone. John is gone. Okay.

MR. FOUST: I was just going to say, I think system engineering, at the system level, has been one of those areas where the funding has been a little bit thin, especially the last couple of years, and we are seeing the price we pay.

And I would reiterate, this is sub-system system engineering, if you will, that we are talking about here, so -- and I think we have enough there to do the sub-system part of it.

MR. GERTZ: But, in deference to John Roberts and the other people, when John Bartlett was splitting up the budget, John Roberts says, I am not getting enough money to do systems engineering, or systems trade-off studies.

And of course, I said, I am not getting enough money to do the things I need to do to characterize Yucca Mountain.

And Ron Milner said I am not getting enough money to do a meaningful MRS and transportation study.

MR. ROBERTS: Our figure is about half of Carl's.

DR. CANTLON: Well, that is -- one of the joys of administration is that you are trying to equitably distribute any inadequate budgets, and nobody is ever happy.

The real question, though, I think from the upper management, and I guess now John is back to ask the question, and that is, addressing Warner's concern about whether or not you really are putting the systems effort under the planning to move that part, and to have the hard planning material in hand, have you been under investing in your own bailer wick here in order to keep the whole in the mountain going.

DR. BARTLETT: To some extent. In fact we have. But I had also observed that the effort to integrate the systems effort is an evolving one, and it is relatively recent, as some of the things to take shape, both with regard to the activities of Yucca Mountain, and their linkage to the rest of the system.

The M&O just got QA qualified in this area relatively recently. So what you are really seeing is the beginnings of an integrated effort of the systems application across the board.

So, that is part of the reason why we are simply not there yet, and your comments are well founded, but it is really just getting together at this stage, and an inadequacies of resources.

As you well know -- significant urging to emphasize progress at Yucca Mountain, and that is the kind of results we don't, on our volition, necessarily control the allocations within the program. I mentioned 24 steps. There are lots of bites at the apple. There is not much apple left by the time it is done either.

DR. CANTLON: Before you get away, let me take advantage to the fact that I understand you are a short termer, and get to you to comment on the language in the appropriation act in which they explicitly identify the M&O as an unnecessary cost, or I have forgotten the language there -- but is that a misunderstanding of getting a good systems foundation under this very complicated prototype operation?

DR. BARTLETT: To some extent, I believe it is. There are difficulties in communicating at the operation level with the Congress and its strategic approaches to things.

When the Congress is emphasizing effort at Yucca Mountain and they see a significant level of effort in Washington, they want to know why. And they are critical of that, and understandably so, given their prerogatives and priorities.

We simply try to allocate, as you mentioned, you have been there too, as I know, the resources as well as we can, in accordance with good judgment for effective management in the program overall, respecting the wishes of those who are giving overall guidance to the program. Try and do the best we can.

DR. CANTLON: Thank you.

[Slide.]

MR. GERTZ: John, just one bookkeeping aspect. When you see systems here, that is in our ten element work breakdown structure, and that included PA and data. It isn't a fact that we reduced 23 million to 5 million systems. We distributed it into our 15 element work breakdown structure.

So, you have to be careful when you compare these things, please, because we have gone from a 10 to a 15, and some numbers are in, and some are not in the same categories. And we can provide you all the details, but off the top it might look like there was a huge reduction. There was so though. I will tell you that.

MR. FOUST: I would like to make one more comment. I know I am blocking everybody's view here, but there is one thing that -- we were talking about infrastructure a while ago, and I think it is important to note that, I don't know if it's 30 or 35 percent, or whatever percentage the program we are talking about is infrastructure, it was a specific collection of WBS elements.

But, there is a significant amount of that included in those large numbers that had to do with early decisions.

The infrastructure savings are in there. So, if you went back and looked at those numbers and then pulled out the same cost components, you would find there is some significant infrastructure savings there. I just wanted to make sure that that was clear and how it interpreted that number.

DR. CANTLON: Any further questions, comments?

[No response.]

DR. CANTLON: Thank you.

MR. GERTZ: Our goal is still to be 200 feet in the mountain by September. Thanks.

DR. CANTLON: And with the plan that tells you where you are going?

MR. GERTZ: Oh, yes. You have seen our plan. It is the U shaped plan. For a matter of record, right now, our plan is the U shaped excavation that takes two and a half years, and we gave you some milestones, I think, last time I was with you, on when we expect to be at each of the turns in the U.

DR. CANTLON: On behalf of the Board, we thank all of the participants, and the audience. I think this has been a very information-rich set of days, and we appreciate everything that you have done for us.

[Whereupon, at 3:47 p.m., the meeting was adjourned.]

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