UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

SPRING BOARD MEETING

May 9, 2006

Hilton Tysons Corner
7920 Jones Branch Drive
McLean, Virginia 22101

NWTRB BOARD MEMBERS PRESENT

Dr. Mark Abkowitz
Dr. William Howard Arnold
Dr. Thure Cerling
Dr. David Duquette
Dr. B. John Garrick, Chairman, NWTRB
Dr. George M. Hornberger
Dr. Andrew Kadak
Dr. Ronald Latanision
Dr. Ali Mosleh
Dr. Henry Petroski
Dr. William M. Murphy

SENIOR PROFESSIONAL STAFF

Dr. Carlos A.W. Di Bella
Dr. Daniel Fehringer
Dr. Daniel Metlay
Dr. David Diodato
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I N D E X

P R O C E E D I N G S

8:00 a.m.

GARRICK: It's been suggested that I point out that there's a table in the back of the room, if those of you who have laptop computers, if you prefer to have a table over your lap. So, we have a facility to accommodate that.

Good morning. Good morning, and welcome. My name is John Garrick. I'm Chairman of the Nuclear Waste Technical Review Board. And, on behalf of the Board, I'd like to say we're very pleased to be in Washington, and we like to have at least one of our meetings per year in Washington to allow policymakers and others interested in the national ramifications of the Yucca Mountain Project, the proposed Yucca Mountain Project, to attend and participate in our meeting.

As you know, at each of our meetings, we introduce the Board members, and I think I want to do that first.

In my case, I am in the role of a consultant these days, primarily in the application of the risk sciences to a variety of industries, such as transportation, space, nuclear, chemical, and so on. And, my background and areas of interest are risk assessment and nuclear science and

engineering.

Now, as I introduce the Board members, I'm going to ask them to raise their hands when their names are called. And, I'd like to start with the newest member of the Board, namely William Murphy. As most of you know, for nearly a year, we have had a vacancy on the Board due to the resignation of former member Daryle Busch. He replacement, Dr. Murphy, was appointed to the Board on March 20th of this year, by President Bush. Dr. Murphy is Associate Professor in the Department of Geological and Environmental Sciences at California State University, Chico. His research focuses on geochemistry, including the interactions of nuclear waste and geological media.

Now, let me introduce the rest of the Board. First is Mark Abkowitz. Mark is Professor of Civil Engineering at Vanderbilt University, and Director of the Vanderbilt Center for Environmental Management Studies. His areas of expertise include transportation of hazardous materials, risk management, and innovative uses of information technology. He chairs the Board's Panel on the Waste Management System, and as a result, will be leading much of the discussion today.

Howard Arnold. Howard is a consultant to the nuclear industry, having previously served in a number of senior management positions, including Vice-President of the

Westinghouse Hanford Company, and President of Louisiana Energy Services.

Thure Cerling. Thure is a Distinguished Professor of Geology and Geophysics and a Distinguished Professor of Biology at the University of Utah. He is a geochemist, with particular expertise in applying geochemistry to a wide range of geological, climatological and anthropological studies

David Duquette. David is Department Head and Professor of Materials Engineering at Rensselaer Polytechnic Institute in Troy, New York. His areas of expertise include physical, chemical, and mechanical properties of metals and alloys, with special emphasis on environmental interactions. His current research interests include studies of cyclic deformation behavior as affected by environment and temperatures, basic corrosion studies, and stress-corrosion cracking.

George Hornberger. George is the Ernest H. Ern Professor of Environmental Sciences and Associate Dean for Sciences at the University of Virginia. His research interests include catchment hydrology, hydrochemistry, and transportation of colloids in geological media. He chairs the Board's Panel on the Natural System.

Andrew Kadak. Andy is Professor of the Practice in the Nuclear Engineering Department of the Massachusetts Institute of Technology. His research interests include the

development of advanced reactors, space nuclear power systems, improved technology-neutral licensing standards for advanced reactors, and operations and management issues associated with existing nuclear power plants.

Ron Latanision. Ron is an Emeritus Professor at MIT and a Principal and Director of Mechanics and Materials with the engineering and scientific consulting firm, Exponent. His areas of expertise include materials processing and corrosion of metals and other materials in different aqueous environments. Ron chairs the Board's Panel on the Engineered System.

Ali Mosleh. Ali is the Nicole J. Kim Professor of Engineering and Director of the Center for Risk and Reliability at the University of Maryland. He has performed risk and safety assessments, reliability analyses, and decision analyses for the nuclear, chemical and aerospace industries. He chairs the Board's Panel on the Repository System Performance and Integration.

Henry Petroski. Henry is the Aleksander S. Vesic Professor of Civil Engineering and Professor of History at Duke University. His current interests are in the areas of failure analysis and design theory. Ongoing projects include the use of case histories to understand the role of human error and failure in engineering design, as well as models for invention and evolution in the design process.

At the beginning of each meeting, there are a few routine things that we do. One is to read the following statement for the record, so that everybody is very clear about our behavior as Board members and our method of operation.

Board meetings are spontaneous by design, and Board members are encouraged to express themselves freely. However, I want to make clear that when the Board members speak extemporaneously, it is important to realize that we are speaking on our own behalf, not on behalf of the Board. When a Board position is articulated, for example, in a letter or a report, we will do our best to make clear that it is a position of the entire Board, and not the opinion of an individual member.

Before I go over the agenda for today's meeting, let me give you a preview of the Board's annual report for 2005. We expect that that report will be printed and distributed within the next few weeks. Among the Board's findings and conclusions, are some of the following.

First, let me address the issue of natural barriers.

The Board believes that the Project has made great strides over the last few years in developing a sound understanding of the magnitude and rates of mountain-scale groundwater flow in the unsaturated and saturated zones under

ambient conditions. Further, the Board considers the Project's findings with regard to chemistry of the water in the unsaturated and saturated zone under ambient conditions to be broadly consistent with a large body of empirical data and experience. Although the Project should continue to evaluate new data as it becomes available to refine its conceptual models as warranted, the Board does not believe that significant investments in further research in these areas should be a high priority for the Project at this time.

The Board believes, however, that additional work on radionuclide transport is warranted. In particular, research on secondary mineralization, matrix diffusion, colloid-facilitated transport, or other processes that might significantly affect the rate at which dose-significant radionuclides are transported. These could yield very important results, particularly with selected radionuclides, such as Neptunium 237 and Plutonium 242.

The report includes serious concerns about technical issues underlying the Project's thermal-management strategy, a topic that's been commanding a lot of attention from the Board of late.

First, the rationale for the Project's choice of thermal criteria is, at best, unclear and may possibly be inadequate. For example, the 11.8 kilowatts per waste package limit appears to have a somewhat arbitrary basis.

Second, the implications for thermal management of the Project's provisional decision to implement the canister-based system do not seem to have been fully evaluated. In particular, given the relatively limited amount of spent fuel blending that can be carried out at a utility site and given the trend toward higher burn-up fuel, a canister-based system may increase the difficulty of achieving compliance with thermal management criteria.

Third, the Board is not persuaded that the thermal-hydrological models being used to predict postclosure temperature and relative humidity within the drifts have a strong technical basis. For example, the thermal conductivity of the rock at Yucca Mountain is important for predicting thermohydrological conditions in the proposed repository, but few measurements of this parameter have been made.

Also, consider what our report says about the near-field environments.

The alloy 22 outer barrier of the waste package will not corrode significantly unless liquid water is present on the waste package.

The Project maintains that potential localized corrosion of alloy 22 at elevated temperatures can be excluded from its Total System Performance Assessment calculations. The Board believes that the technical basis

for this exclusion is not compelling.

Because aqueous conditions can exist at elevated temperature, future performance assessments should either include general and localized corrosion at elevated temperatures or present a clear and compelling technical basis for not doing so.

There is considerable uncertainty about the source term incorporated in the Performance Assessment. The Board is pleased that the Project is seeking to improve its understanding of the source term through research sponsored by its Science and Technology Program.

Let's talk a little bit about postclosure risk.

The Board remains concerned that by adopting a conservative compliance-based approach for projecting postclosure risk, the Project discounts the importance of letting policymakers, the public, and the broader technical and scientific community know what the Project's experts believe are the intrinsic capabilities of the proposed repository at Yucca Mountain. Having more definitive information on the adequacy of the natural system and the levels of conservatism involved, for example, may well provide all interested and affected parties with important and relevant information.

The issue here is not that the Board thinks that the Performance Assessment is conservative. The issue here

is that the Project has maintained it to be a considerably conservative analysis, although they use the term "reasonable conservative." But, at the same time, have dedicated an entire appendix in the Performance Assessment to conservatism, and on looking at that, one has to ask, well, what do the experts really think is the performance capability of the repository. It seems that the answer to that question is something that we're all entitled to have.

The Board believes, therefore, that the Project should carry out a realistic performance assessment, perhaps in parallel with its efforts to develop the compliance case, to establish a "baseline" for measuring how "conservative" or "non-conservative" the Project's licensing case might be.

Another means for increasing the confidence in the conclusions coming from the Performance Assessment that the Project is now conducting would appear to prepare full and realistic process models that account for the transport of the two radionuclides that appear to be the major contributors to peak dose over the long period, over the one million year period, namely Neptunium and Plutonium.

I should point out that in just recent days, the Board has received a response from the Department on many of these issues, and we have not had an opportunity as a Board to evaluate that response. So, on that evaluation, we might be modifying some of these observations.

Now, continuing with the report and what it says, what does it say about the design and operation of surface and subsurface components and facilities?

Well, the Board looks favorably on the Office of Civilian Radioactive Waste Management's provisional decision to implement the transportation, aging, and disposal concept, the so-called TAD concept. It believes that such an approach holds potential for minimizing the handling of the spent nuclear fuel assemblies, for simplifying the design of surface facilities, and for reducing occupational exposures.

The Board remains concerned that the Project has not fully evaluated the range and consequences associated with the implementation of the TAD system. Exploration of these consequences is a major goal of today's meeting.

The Board believes that the Project needs to refine further its drip shield design and implementation approach.

One more comment about what's in our report, and it's about the waste management system.

The Board is pleased that the Project has begun development of the Total System Model, which has significant potential as a tool for understanding the performance of the waste management system.

We recommend that the Project enhance the Total System Model in a number of ways to increase the model's utility in evaluating the waste management system. Specifics

are covered in the report.

The Project also should evaluate phased approaches to developing the waste management system. For example, it should consider handling "normal" spent nuclear fuel first, and exceptional fuel types at a later date. It should consider early shipments that are easy to load, use a single transport mode, travel a relatively short distance, and follow routes used previously in shipping radioactive materials.

Those are some of the highlights of the report. And, there's a lot more detail, as you will be able to see, when the report is published in a few weeks.

Now, let me turn to today's meeting, and set the stage, if I may. And, one of the things we like to do is kind of remind everybody of the perspective of the Board.

In evaluating the technical validity of DOE activities, the Board considers a number of factors, including, first, the relevance of the activities to the long-term performance of the total waste management system and short-term performance of the repository operating system. And, by performance, we mean safety, security, and throughput.

Second, the extent to which the activities improve or reduce integration of the total waste management and repository systems, and whether the activities improve the

fundamental understanding of the technical and scientific issues involved in managing spent fuel and high-level waste.

To repeat, the three most important factors are to evaluate the effects of the activities on performance, integration, and fundamental understanding. And, the fundamental understanding is probably, is in many respects, the most difficult challenge we have on many of these issues.

During today's meeting, we will concentrate on the issues of performance and integration as we review the upcoming decision by the DOE on possible adoption of the canister-based system for transportation, aging, and disposal. As we said, the so-called TAD concept could have the potential to improve the throughput of the repository surface facilities, reduce the potential for accidents, and reduce worker radiation exposures.

The Board has long been interested in the feasibility of the canister-based system and recommended as early, in its second report, I believe it was, in November 1990, that DOE evaluate the merits of such a system. The Board welcomes the DOE's decision to study the TAD concept.

Today's agenda leads off with an overview of the entire Civilian Radioactive Waste Management program, including the Yucca Mountain Project, by Paul Golan, the program's Acting Director. Following Paul Golan's overview, I am going to ask Board member Mark Abkowitz to introduce and

lead the discussions on several presentations on the proposal transporting, aging, and disposing system. A presentation on surface facilities will immediately follow the discussion of technical analyses supporting the TAD.

Finally, after our review of the surface facilities, we have asked for presentations on two additional topics. The first is a status report on the DOE's inquiry into the U.S. Geological Survey e-mail issues. And, after DOE has reported on its inquiry into the e-mail issues, a representative from the U.S. Geological Survey will inform us about the agency's own inquiry. And, we're looking forward to that. Our final presentation of the day will discuss a recent analysis by the Electric Power Research Institute to estimate the maximum disposal capacity for spent fuel in the Yucca Mountain repository.

And, as usual, following the presentations, we have scheduled time for public comment, which is an aspect of our meetings that is extremely important to all of us. If you would like to comment at that time, please enter your name on the sign-up sheet at the table near the entrance to the room. And, of course, written copies of any extended remarks can be submitted, and will be made part of the meeting record.

Some of you have asked about questioning during the course of the presentations. Our preference for that would be for you to write down your questions, and submit them to

Linda Coultry at the back of the room, and leave this information at the sign-in table. We will certainly cover as many questions as time will allow.

Now, before we get started with the presentations, I would like to ask all of you to turn your cell phones and pages to the silent mode to avoid distractions during our meeting. That's just to remind you of what we mean.

And, I'd like now to introduce Paul Golan to kick things off with a program overview.

Paul was designated Acting Director of the Office of Civilian Radioactive Waste Management on May 8, 2005, by the Secretary of Energy, Samuel Bodman. The office's mission is to develop a disposal system for the Nation's spent nuclear fuel and high-level radioactive waste at Yucca Mountain, Nevada, as mandated by the Nuclear Waste Policy Act of 1982. We're delighted to have Paul with us today.

GOLAN: Thank you, Dr. Garrick. Can everybody hear me in the back? Thanks for inviting me and allowing me to speak today.

My name is Paul Golan. I'm the Acting Director, and as Dr. Garrick pointed out, I've been with the Project about a year. I think yesterday was my one year anniversary of being part of the Project. But, in a lot of ways, I've been associated with this Project a lot longer. I grew up in Illinois, and Illinois right now has the largest backlog of

spent nuclear fuel in the nation, derives about 50 percent of its power from nuclear energy. And, so, I was the one who was using all the lights and everything else like that growing up.

From there, I joined the Naval Nuclear Power and Nuclear Propulsion Program, and I've seen the seas for about six years. Another aspect of what we're going to dispose of at Yucca Mountain, is the Navy Nuclear Propulsion System's reactor cores. Lastly, I came by way of the Office of Environmental Management, which is the Department's clean-up program, of which we have Savannah River, Hanford, and Idaho, which is high-level waste that was generated as a result of the strategic deterrent we developed during the cold war. The high-level waste at Hanford, Savannah River, and Idaho will also be disposed at Yucca Mountain. So, while I'm new to the program, I think I have some--going further back.

An interesting thing I learned in coming to this Project is just how important Yucca Mountain is to this country, and how it allows us to have a diverse supply of energy that's less dependent on fossil and less dependent on foreign sources. 20 percent of our nation's energy, electricity, comes from nuclear power, and the waste that generates that electricity is going to come to Yucca Mountain.

If you look at the amount of power that the waste

that's going to be disposed of at Yucca Mountain has produced, it amounts to the equivalent of about burning five billion tons of coal. And, I think that's something that we can leave our next generation, is a resource that we haven't used, and it's also eliminated the burning and the discharge of pollutants into the air. I think the number is around 700 or 800 million tons of gases and particulates that have been avoided as a result of our using nuclear power.

About a year ago, Secretary Bodman did ask me and a small team to come to the Yucca Mountain Project, and his guidance was quite simple to me. He said, "Find ways to make it simpler, safer, and more reliable." And, over the last year after understanding where we are, there's a number of things and a number of changes that we've instituted, that I would like to go through some of those today that goes along the path of safer, simpler, and more reliable.

The first item that I do like to talk about, though, is the item that's in front of Congress, is our 2007 fiscal year budget. And, I think folks in the room would probably know that a lot of the committees are actually doing their marks this week and next week before the May recess. So, if I can go ahead two slides to the 2007 budget request?

Our request in 2007 is $544.5 million. The request amounts to about $156.5 million out of the waste fund, and $388 million out of the defense fund. As everybody in the

room understands, the nuclear waste fund, there is a levy on the sale of nuclear power across the country. There is a corpus which has about $18 billion in it today. The rate payers contribute on the order of about $700 to $800 million a year for that levy. The $18 billion in the corpus actually accrues interest. The corpus is invested in government securities. In the last year, we generated about a billion dollars in interest through the corpus.

The four areas that we're going to be focusing on in 2007 are largely extensions to some of the initiatives we're undertaking this year. The first is the development of the license application with the clean canistered approach. I'm going to talk about that approach a little bit later. But, we're working right now in developing the license application.

While we're going to have to redevelop portions of the license application, both the surface portions where facilities weren't going to have to be built, we're redesigning some of those facilities. We're having to redevelop some of the subsurface portions of the license application. It is going to have some short-term cost in terms of how much time and how much money it's going to cost, but we think the benefits of going down this approach far outweigh the short-term costs that we're going to have to incur.

The second item that we're investing in this year, next year, and over the next two years, is improvements to the safety infrastructure of the site. A lot of the facilities, a lot of the infrastructure is old, and it needs to be improved. We have workers who are still working in cargo containers. We have an electricity grid that basically is not where it should be today. We frequently lose power. The communications infrastructure is not where it should be in terms of the reliability. Some of the emergency services are located up to 45 minutes away from the site. We're looking at bringing some of those services closer to the actual repository, and on the repository.

We have over 200 workers who work on the site every day. The site has thousands of visitors a year, and we want to make sure that the people who work at the site, and the people who visit the site, the regulators, all have an environment that's safe.

We're also intending, with our 2007 budget request, to invest in the transportation infrastructure. And, this is not the work that's associated with the Nevada Rail Line, which we're in the process of the Environmental Impact Statement right now. There's a lot of long lead items associated with transportation, such as the rail cars, the rolling stock, the escort cars, and things like that, all the infrastructure necessary to take the waste from where it is

today to where it needs to eventually go.

One of the things that we're looking at is trying to follow the model of the Waste Isolation Pilot Project used in developing its transportation infrastructure. I think that, largely, that is a very successful program on a number of different fronts, and we're trying to get in front of this transportation system, much like WIPP did back in the Eighties and Nineties in putting together its transportation infrastructure. There's training, there's education, there's public interaction that has to happen before we move our first shipment of radioactive waste to Yucca Mountain.

The last area of focus that we're looking at in 2007, again, follow onto 2006 improvements to the quality and culture of this organization. Gene Runkle is going to talk later on about a report on e-mails associated with infiltration work on the USGS. But, the quality and the culture of this organization is something that we're taking a hard turn on in improving and making it truly something that can be licensable by the Nuclear Regulatory Commission.

If you look at our '07 request compared to our '06 request, we actually received $495 million in 2006. About $49 1/2 million of that request, of that appropriation, actually went into an integrated spent fuel recycling project, which the money, although came to our organization, the Radioactive Waste Management Organization, that money is

actually being spent and the program is being managed by the Office of Nuclear Energy within the Department of Energy.

The clean canistered approach, which we're going to spend a lot of time today talking about, let me just give you a rationale on why we wanted to do this, again, safer, simpler, more reliable. I come from an operations background, and what I take out of my operations background is that every time we do something, every time there's an activity which involves a worker and a hazard, there is the opportunity to have an accident. What we're trying to do is take as many of these interactions out of the process, and one of the ways we're trying to do that with the clean canistered approach is basically receive the majority of the fuel in a canister where the workers are not going to have to handle the fuel, and they're not going to have to handle the fuel as many times.

Every time we take out one of those interactions, we think we make the operation more safe. If we look at the whole design of the facility compared to the design that we had before, there's a number of large facilities that we're no longer considering building today.

So, the question is where are we in that, because we announced the clean canistered design back in October. We directed our contractor back then to develop a design. One of my engineers in my organization had a good idea, and said,

"What could make this really interesting is we have competing designs." So we asked another contractor to develop a competing design for what this clean canistered approach would look like.

At the end of March, we received two designs, one from our contractor, BSC, another from another contractor, our MTS contractor, Management and Technical Support contractor. And, there's a lot of things about both designs that looked good. So, my staff right now is reviewing both designs. Our intent is, in June, to take the design packages to the Secretary of Energy Acquisition Board, and make our presentation there, and, then, to basically get two designs, not complete designs, but two designs approved by the Acquisition Board.

And, again, the question is why are you doing two designs? If we look towards managing risks, project risks, there's different ways that you can manifest managing risks. One way is to put a great deal of contingency or extra money on a part of a project that has risks, and the other is to have a backup, or a Plan B. So, for the areas of the Project where we feel that there is significant program risk, rather than just say we're going to have 100 percent contingency, we'd like to carry at least to the next step, a contingent design.

Now, the design that we eventually submit to the

Nuclear Regulatory Commission in our license application, we'll have a single design. Right now, we're at a point right now where we can't make that. So, there's going to be a number of aspects of our design that we're going to continue forward with parallel designs.

Our status and schedule right now, again, is to be in front of the Board in the June time frame, and then later this summer, after we've incorporated that into our baseline, is to promulgate an intended licensing schedule.

About a year ago, in March of 2005, we were made aware of some disturbing e-mails associated with the infiltration work that the USGS performed for us. We published a technical report, which Gene Runkle is going to walk through in more detail later on today. But one of the things that we did in preparing that technical report, we started with assuming that we had nothing, we started with independent work that was not derived by the Project. We looked at the infiltration rate estimates, a science that's independent that the Project has come up with for the three predicted climate conditions at Yucca Mountain, and we plotted those as a function of the amount of precipitation versus the amount of infiltration you expect into the mountain. And, we took the USGS work and we laid it on top of that. And, what we found for the three predicted climate conditions at Yucca Mountain is that the USGS work was

consistent with independently derived work.

Nevertheless, we're going to replace that work, because the process that USGS used to develop that work didn't meet our quality requirements. We've asked Sandia National Laboratory to redevelop the computer approach for the infiltration rate estimates. They're in the process of doing that right now. And, later this summer, we expect to have a final product from them, which after independent review, we will place before a model.

We're spending a good deal of our management time focusing on quality and culture. There's a number of work stoppages and work suspensions we've ordered over the last several months, because our work requirements weren't met. We suspended work associated with the temperature and humidity gauges, because we had issues with calibration. We suspended work associated with chemical standards, because our requirements weren't met for procurement of those chemical standards. We stopped work, actual physical work, in the--for laying a cable, because we weren't sure that the national player codes were met in terms of how that cable was marked, and we also suspended work in December when we could not verify that we had proper flow-down of requirements when we actually did design work.

We're taking hard looks at these things right now, and rather than say we're going to come back and fix it

later, we're going to fix that work now. Because, in my mind, rework is a defect, and we have to find these issues either before they happen, or right after they happen, and correct the problem on the spot. And, rather than taking months or years to find out an issue, we want to find out these issues in minutes, hours, or days. We'll take aggressive action.

We're also working on looking at how we report our Project status. When I got to the Project, we had what was called the dashboard, the red, yellow and green dashboard, which talked about--there were a hundred indicators--what we're looking at is the Project. And, what we found through a number of our reviews is that the same problems were coming up again and again, and we're doing the same kind of corrective actions, yet we weren't getting any kind of change in performance.

So, what we did is we're looking right now at retooling our performance indicator system. We're focusing right now on the effectiveness of corrective actions. Once that we can verify that we had a good corrective action program, that we can verify the effectiveness through change in performance, through improvement of performance, we're going to start to grow the things we looked at, the things we're reporting.

But, one of the things that we found was that we

were probably looking at too many things, and in some cases, not the important things. So, we want to--we're right now in the process of looking at fewer things. We're looking at them deeply. We're developing processes so we can actually measure systems without disturbing the systems. I do have a background in physics, and I do know the Heisenberg Uncertainty Principle.

We had a tendency when we measure things, to actually change the performance, and we were getting something different. Our measurements were telling us something different than it was when it was actually happening. So, again, we're focusing on measuring fewer things, measuring them more effectively, so that when we actually take an action, we can say we've now fixed the thing, and we're going to follow up, but we don't expect to have to fix this thing in the future.

Talk about the infrastructure, operate, the worker safety, operations that we're taking at the site. Scott Wade is working that right now. Again, simple things, such as taking workers out of cargo containers, putting in a more robust emergency response infrastructure, improving the communication and electrical distribution at the site. We're even looking at the road, which I think a lot of you know has been there since the early 1950's. It's a two-lane winding road, which we think poses some worker safety risks.

In January, we designated Sandia National Laboratory as our lead laboratory. Dennis Berry is here today. Again, using the WIPP model, the Waste Isolation Pilot Project model, we took advantage of one of the great national laboratories in Sandia to coordinate and organize our scientific work. We chose Sandia because of their success with the WIPP project. They were very successful in organizing and coordinating that work.

Right now, we're in the process of transitioning the work from our BSC contractor to Sandia National Laboratories, and while we're working that hard, and as you can imagine, when you're talking about the scope of work of about $100 million a year, there's issues that we're working, but we expect to complete that transition this year.

And, again, what we're trying to do is take advantage of the things that we've learned before. Everything that we're trying to implement here, not only safer, simpler, more reliable, but if we don't have to invent it, if we can use a model that's worked before, we intend to use it here.

As part of the trust and verify culture, as we're asking ourselves how do we know? We have established an independent technical review consortium. Last month, we named ORISE, the Oak Ridge Institute for Science and Education, basically to do independent technical review of

our work. And, the people say, Paul, why are you doing that? And, I said well, there's things that I just don't understand, so I would like a second opinion. It's kind of like going to the doctor. If the doctor tells me I need to get my eye removed, I'd probably get a second opinion. So, we have established ORISE to basically come in and if we have an issue or a question with the technical part of our work, ask them for review.

Now, for folks who are not familiar with ORISE, it's a consortium of about a hundred universities around the country. I think Vanderbilt is on that consortium. It's based out of Oak Ridge. Homeland Security, the Nuclear Regulatory Commission, Environmental Protection Agency uses this consortium for independent technical review. As we have done some of our work through the year, for instance our technical report on the infiltration work that USGS did, we went off and got some experts outside of the Department to review the technical work.

Gene Runkle, who is going to talk about that report today, went off and interviewed people individually to do some independent work for us, and when we did the independent technical report for the infiltration, we actually got three people who are not associated with the Department, a professor from the University of Arizona, professor from the Colorado School of Mines, and an expert from the U.S.

Department of Agriculture. We spent a lot of time getting those people assembled to do that work.

With this consortium here, we now have a hundred universities at our fingertips. And, again, trust but verify. Trust but verify, part of about changing the culture. What we're trying to ask ourselves is how do you know the data is good, and how did you verify that the data was good? We're looking forward to using Oak Ridge and moving forward.

Contract status. I'm going through a number of different things right now, some of them technical and some of them non-technical. We had a five plus five, five year plus five year, contract with BSC. The first five years of that contract expired in March of 2006 year. We executed a one year extension to that contract, to the 2007 time frame, March 2007 time frame. And, right now, we're in discussions to execute that second year of the option year of the contract with Bechtel. That's where we are on that.

Organization. I have to go to my organization slide. Yesterday, as a matter of fact, this organization became effective. When I got to the Project about a year ago, I looked at the organization and we had east and west designations to the office, and we had two deputies, and we had what I'll call more of a linear organization, some people would call it a scope type organization, where folks

necessarily didn't have to work together.

What we have done is we focused on our core function. Okay? We have basically this represents the repository itself. This line represents the waste, which is going to go to the repository. And, this bottom line of the organization represents the support that we all need to do our work. Up here, I have the office of Quality Assurance, which is a direct report to my office. That's a change from where we were a year ago. And, the other thing that I'll point out, right in this office here, not as a separate box, but we have the Office of Employee Concerns, which again reports directly to me.

One of the things we have done over the last year is we now have that office, and the safety conscious work environment, the Office of Worker Concerns, is a single program for the entire Office of Civilian Radioactive Waste Management.

Another reason why we changed it, because I was asked a question, and I said, "Who is responsible for this," and, you know, a lot of people would just sit on their hands, so I would ask the question the next day, and I said, "Who would be responsible for this?" Well, on day one, I got nobody raising their hand. On day two I got three or four people raising their hands. And I thought there was a little bit of confusion in terms of roles and responsibilities.

So, right now, the way I like to look at this is we have the Chief Scientist, the person responsible for organizing, integrating our scientific work across the entire Project, is Russ Dyer. Russ will be here today. He will be talking. There's Russ. Everybody knows Russ.

The second part of this is we're going to have to design a repository, so we have the Office of Chief Engineer, and that will be Paul Harrington. Paul is responsible for the engineering aspect of this Project.

Mark Williams is the regulatory authority. Mark is personally responsible for developing a license application for the Department of Energy, not only the license application, but any other regulatory interaction we have, whether it be with the EPA or any other regulatory organization.

Eventually, we are going to have to do construction. In the early parts, we're going to do some safety related infrastructure construction. Scott Wade is responsible to basically develop, maintain and develop the infrastructure for this Project.

And, lastly, as we go to operations, John Arthur is the site operations manager. John is basically at Yucca Mountain.

So, as we go through the project, we go from science to design to license, to build, to operate. And, so,

as we go through this process, we've spent a lot of time on science. Right now, the major activities that were undertaken, the Department has undertaken, is the license and design of this Project. As we go through the licensing, and we get an actual construction authorization, the elements of work will move into our infrastructure. And, then, we're going to get to the point of operating, and we'll have an operations manager who is responsible for operating the repository.

The next one down here, we have to prepare, transport and dispose of the waste. Chris Kouts is basically responsible for the Waste Acceptance criteria, and getting the waste, working with industry, working with the government agencies, getting the waste ready to move.

Office of Logistic Management and Transportation. Again, the process of getting the waste from where it is to where it needs to go. And, then, last, which you notice this is vacant today, is that once the waste is at the site, how do we do in the thermal management, and how are we effectively emplacing the waste into the repository. And, as we go from preparing, to transporting, and disposing of the waste, you will see the predominance of the activities go from the left side of this chart to the right side of this chart.

At the bottom here, we have four support functions.

Project controls, that's the baseline, that's earned value, that's our configuration control board. We have a single person who is responsible for all those processes, Ken Powers.

We have actually separated off procurement in a separate organization. And, as we look forward into time, whether it's procurement of rail cars, the rail line, or the major facility, we wanted to have a separate contracting organization, because that organization is going to have a lot of business through it. Different from the Office of Government Services, which provides for CFO type of functions, the HR type of functions, and, lastly, the Office of External Affairs.

So, we tried to take the organization, which was basically linear, east and west linear, we tried to fatten it. As I tell my direct reports, you're as responsible, Russ is responsible working his interactions with Paul Harrington and Mark Williams as he is working for me as the boss. We have tried to develop an interdependent organization where these people feel and believe the need to work with one another, and unless they mutually succeed, none of them will succeed.

We implemented this organization yesterday. There's some things we're doing to fully implement the organization, such as changing procedures, and things like

that, but right now, this is the organization that is RW today, and as Dr. Garrick asked before, we like single points of accountability. Today, I think we have that. And, again, if we want to talk about that later in terms of who is responsible for this, we can.

Licensing schedules. As I mentioned earlier, right now, we're in the process of reviewing the conceptual design from the contractor. We're expected to be in front of the Board in the early part of June. Later in July, later this summer, we expect to have a schedule that we intend to live by.

Lastly, the Department did introduce legislation associated with the Yucca Mountain Project last month. There's three reasons on why we did legislation and why we did it right now. First, legislation is required by the Nuclear Waste Policy Act. In order for the Department to receive a construction authorization from the Nuclear Regulatory Commission, we need to permanently withdraw land. 147,000 acres around the repository. The only way you can do that permanent withdrawal is through legislation.

We modeled the land withdrawal for Yucca Mountain around the land withdrawal for the Waste Isolation Pilot Program in Carlsbad, New Mexico.

Second, recognized that times have changed since when the Nuclear Waste Policy Act was passed in 1982, and

when it was amended in 1987. It was first passed shortly after Three Mile Island. It was amended right after Chernoble. I don't think policymakers necessarily saw the continued growth of nuclear power through license extensions, and as we look right now to our future, the importance that nuclear energy can play in the 21st Century in the United States energy mix.

One of the things we asked for and requested in our legislation is to eliminate the administrative cap, the 70,000 ton capacity limitation that was placed in the original Act, and basically make the capacity dependent on what the mountain is technically capable of holding.

The last aspect of the legislation, we seek to provide clarity and predictability. Part of that is funding reforms. Go back to one of my first slides. The waste fund generated, you know, $800 million in receipts and a billion dollars in interest. We received less than $200 million from the waste fund in 2006. So, we're seeking funding reform in our proposed legislation. The other thing we're looking for is predictability and clarity.

There's some aspects that we would read the Nuclear Waste Policy Act, we think we have the authority. What we seek with the legislation is to ensure that when we go down a path here, it's clear to everybody that that path is consistent with the law.

So, with that, I'd just like to summarize, and then we'll get into questions and answers. We've engaged in some significant change over the last year. We think that these changes are consistent with the Secretary's direction of safer, simpler, and more reliable. We're working right now to take a lot of those changes that we introduce and make them part of our systems and make them part of our culture. Going forward, opening up the repository is vitally important to our Nation, and I'm confident that with these actions that we've taken, and the actions that we plan to take, that the Department will meet this challenge.

GARRICK: Howard?

ARNOLD: Arnold, Board.

I'm sure glad your description of the task you're giving ORISE, sounds somewhat like the charter of this Board. And, I'm curious what distinction you see in the questions you would ask them versus what you might ask us to look at?

GOLAN: That's a good question. Again, it's not meant to challenge what your Board charter is. But, for instance, when we completed our technical report on infiltration, which Gene Runkle is going to talk about later today, we asked the question does this make sense. And, so, we wanted to get some people who were independent of the Project to take a look at it, and basically provide their feedback to us. And, so, it allows us, when we have technical questions with some

of the work projects, we say does this really make sense, and if it does, let's get a second opinion.

So, I think it's meant more for some of our real time work products, and basically allowing ourselves access to a large body of experts out there who can provide--you know, this may not make sense. I don't know if we would have been able to give you our technical report and ask for a review, like we did from the three experts that we had from School of Mines and Arizona, to incorporate those comments into our report. I don't think it's counter to this. I think it's complementary. And, again, part of it is trying to engrain the trust but verify culture into our organization, so that we're critically looking at our work.

GARRICK: Thure?

CERLING: Cerling, Board.

One of the things you mentioned with respect to the USGS was that you'll be redoing some of the analyses and rewriting the computer codes, and all that sort of thing. I was just wondering if you had a notion of what time frame you'll have to complete this analysis and bring the whole thing, some sort of resolution?

GOLAN: Sure. We passed last fall Sandia National Laboratory, so we developed the computer approach. We've been working with Sandia. They've given us indications that they're going to have completed that work in the summertime

frame of this year. After that work has been looked at and peer reviewed, then it's our intention to replace the USGS work with the Sandia work in the infiltration model. So, we're looking at the summer and the fall.

GARRICK: Mark?

ABKOWITZ: Abkowitz, Board.

Paul, I've got a few questions on different topics. I'd like to start with your organizational chart. The Board for some time has been communicating to the Department of its concern that the left hand and the right hand are not connected well enough, and what I'm referring to is the connections between waste acceptance, transportation, surface facilities, design, emplacement, and postclosure. And, I looked at this, and I wonder where is the box or the Office of Project Integration? Who's responsible in this organization for making sure that all of the intricate tendencies are connected and properly connected?

GOLAN: This box right here. Office of the Director. And, let me just spend a little bit of time on this. And, I would invite you to talk to any of my direct reports, Chris Kouts, Russ Dyer, Paul Harrington. We're really working to try to behave differently in an organization. And, in some ways, the structure is less important than how people act in that structure. And, to me, it's more important that Russ Dyer, Office of the Chief Scientist, understand that there is

a critical interface between the science of the repository and the characteristics of the waste. And, my job is to make sure that Russ and Chris work together and understand that. And, I'll know my job is complete when I don't have to ask Russ or Chris have you talked to each other about making sure that this waste meets your criteria down here.

So, I would say at the outset that there's no way that you can develop an organization that is just going to automatically work together. What makes an organization work together is leadership. And, the leaders acknowledge that their individual success is dependent on their mutual success. And, again, it's a challenge. It's a leadership challenge. But, one of the things that we've, again, tried to take out, is we've tried to take out the fact that I work in the east and I work in the west. I work in the repository. I work in Washington. We're trying to take out some of those beliefs that people had, and say we have one project, we have one mission, and it's our job as leaders to work together to make that happen.

So, again, from an organization perspective, it's going to be my job to make sure that these guys, they need to work together to the point that they're working together instinctively.

ABKOWITZ: Abkowitz, Board.

So, can I presume then that the accountability for

making sure this project is seamlessly integrated rests with you?

GOLAN: Yes, sir.

ABKOWITZ: Okay. Let me move on now to the surface facility. In the work that I've seen up to now with reference to the surface facility design, I'm somewhat confused about two different amounts of waste that are being discussed to be emplaced at Yucca Mountain. There's the 70,000 number, and the 142,000 metric ton number. Can you comment on how the surface facility design work is progressing relative to those two assumptions?

GOLAN: I can. Right now, Yucca Mountain is statutorily capped at 70,000 metric tons, and that's our limit, and that's the basis that we're designing our facilities for. We have analyzed waste up to 120,000 metric tons. There's another number out there that I think was closer to the 142,000 tons, which represents all the projected waste from the current reactors to all the life extensions. So, that's what those three numbers represent in my mind.

ABKOWITZ: Abkowitz, Board.

Irrespective of that number, I wanted to indicate at least my personal appreciation that the Department has developed the total system model. I think it's one of the really bright lights in the last couple of years that have come out of the program.

And, in that context, I see that this model is a very important tool in being able to reconcile some unresolved issues at this point with regard to the surface facility design, because we're just now learning how some of the dependencies on the preclosure side as an integrated system, and in the relationship between preclosure and postclosure affect issues of throughput and safety and thermal management, and so forth. So, I would strongly encourage the Department to utilize this tool and to expand its use.

And, having said so, I have my doubts that rushing to the finish line to get a surface facility design in front of the Board in June is going to be a positive exercise. I would encourage you to study this issue much more thoroughly than in the next 30 days.

GOLAN: We will. But, again, the purpose of the critical decision one for the conceptual design is to get something so that we, as an organization, can work--it's not going to represent the completion of that design. It's going to represent going back to the executives on the project management process, before we were on this task, which was the dry fuel handling, we're now going back, we're going to give you our technical basis for why we think this task is better.

And, then, the second part about that is here's the

things that we're going to do in order to continue that design, and here's the milestones that we're going to put in place for us to be measured by by the Secretary. And, then, when we come back for our critical decision two decision, they'll have some ways to say are they going fair or they going afoul on that.

So, in my mind, the conceptual design, the meeting that we're going to have next month, represents adjusting, and basically, adjusting the baseline from where we were to where we want to go, and in no way represents a detailed design at this point.

ABKOWITZ: Let me move on to my last question, which has to do with transportation. There's two related questions.

First of all, can you apprise us of the status of the evaluation of the Nevada Rail Line? We understand there may be an alternative route being reevaluated in addition to Caliente.

GOLAN: Sure. And, I may have to get back to you with all the details after I go back and talk to my office today. But, one of the requirements of our initial Environmental Impact Statement is to come back at a time in the future and go back and look at all the routes, look at all the potential routes that would actually go to Yucca Mountain. We have made contact to basically see if there's any interest in looking at some of the routes that we hadn't looked at

before. What I'd like to do is come back after I've talked to my Transportation Manager, and let me come back this afternoon and provide you a little bit more thorough answer on that.

ABKOWITZ: Thank you. And, finally, related to transportation and routing, you mentioned the WIPP model as a successful model, and I concur that it was done very well. But, if you look back over the history of that, the stakeholder interaction at a local level, the engagement process began many, many years ahead of time, and the kick-off point for that was understanding what the routes were going to be, so you could then meet with the local stakeholders and really get it done operationally, and from an emergency response viewpoint. Do you know to date the Department has been reluctant to identify the routes that would be used, and, so, my question to you is how do you plan on implementing one of your objectives that you discussed absent having made that decision?

GOLAN: Sure. One of the things that we've done in 2007 is requested more money for transportation. I will say that every year, we request money from Congress through the Administration, and every year, we get less than requested. And, policy decisions were made through the years in terms of where those cuts were taken from. And, over the course of the last six or seven years, the Department has received

about a billion dollars less than what it's requested. So, part of our 2007 request is looking to actually make investments in the things that you're talking about, in terms of routes, in terms of separations, in terms of the community interaction here. Again, I'll know more about how successful we're going to be when we get through the 2007 budget process, though we've specifically asked for additional money in the next fiscal year to see if we can start that process.

GARRICK: Thank you. Andy, David, Bill. Andy?

KADAK: Yes. Kadak. I'm looking at this organization chart, and I'm wondering how one as a principal integrator could manage 13 direct reports? That's a very heavy burden, and having been an executive, that's a huge number if you're going to do it well. Could you explain how that's going to work for you?

GOLAN: Well, I'll just cite two examples that appeared to have worked in the past. The Naval Nuclear Propulsion Program I think has about two times as many direct reports. I could be mistaken, but I think Admiral Donald has I think about 20 direct reports. It can work. Another, if we go back about 2000 years, in terms of the number of direct reports, and that is TAD. But, this will work.

GARRICK: That didn't work very well.

GOLAN: I apologize for that. In terms of leadership, you can have layers in an organization, and the question is

can you go to the layered approach, or, let's say this box would have four direct reports, and then under each one of those direct reports, they would have four more. Or, you could look at a flatter organization, and then you have to ask yourself, again, from a personal perspective, which organization, either a cascaded organization, with flowing down direct reports, or a flatter organization with more direct reports is going to work. I would submit to you here is that if at the end of the day here, people are looking at me for direction, for feedback, for success, I will have failed. My job is to make these folks look to one another for success, say give me the feedback, I need your dependency, I need to understand what you're doing here.

And, so, rather than the situation, let's say this was tiered down, let's say this layer worked for the Chief Engineer, and this layer worked for the Regulatory Authority, I'd rather not have this person having to go through the Office of the Chief Engineer, over to this office down here, and then down to here, for interaction. Because every time I think you do that, you create a potential loss of information flow. I'd rather have this person feel a need, feel a requirement to talk to this person over here, and interact, communicate, and establish dependency.

KADAK: Well, I don't need you to defend it. I'm just saying it's an observation that you should be aware of, and

how this thing is going to work, is going to be interesting to watch. I have a couple of other questions.

Could you go back to your focus chart there? In terms of the budget request, and I'm looking at the last line which says $50 million from the waste project is going to go to another project. What's the justification for that, and is there similar cutout for '07?

GOLAN: No. This is what Congress did. Congress put in a requirement in our budget for $49.5 million in '06 to go to the Integrated Spent Fuel Recycling Project. So, we didn't request it in Fiscal Year 2006. This is what we requested. None of this $544 million would go into this project that year, based on our request. So, this was something that Congress did that was a departure from the Administration's proposal.

KADAK: Is that coming out of the Waste Fund?

GOLAN: No, this is coming out of Defense. And, in fact, if you look at the '06 budget, out of the $495 million that were appropriated, $100 million came out of the Waste Fund, which all went to Yucca Mountain. But, the balance, or $395 million, came out of Defense.

KADAK: In terms of your license application, what is the constraint that's driving the delay on submission?

GOLAN: Well, there's a number of things that we need to make sure are in the license application before we submit it

to the Nuclear Regulatory Commission. First of all, we're changing the surface design. Okay? And, as we talked about before, we're in the process of reviewing the conceptual design. In order to submit a license application that can be documented by the NRC, it needs significant more detail than we would necessarily for conceptual design. We're looking at design detail on the systems and safety for the surface design, for the surface facility.

Second aspect that we're looking at right now is the infiltration model. Again, we've made a decision to replace the infiltration model upon successful completion of that by Sandia National Laboratory. We're in the process of doing that right now.

The third aspect is EPA radiation protection standards. We have a draft standard out right now. We've provided comments on that draft. The comment period closed last November. But, we're looking for the final EPA radiation protection standard. And, again, if it changes from the draft standard, then there's going to be additional rework that we're going to need to do.

The last is we're working on improving the quality and the culture of the organization. We're going to have to demonstrate to the NRC, and before that, we're going to have to demonstrate that our quality standards have been met, and that we're operating consistent with a quality program before

we submit that license application to the NRC. And, I would submit to you we're not there yet. We're working to get to that point.

So, those are the things, the major things, that we're looking at right now in terms of the things that we're going to need to do to get to a license application.

KADAK: So, assuming that you had the TAD decision, when do you think the license application might be final?

GOLAN: Until we've looked at that, and until I've gone to the Secretary and got that approval, I'm not going to comment on that today, Andy. What I'd like to do is that once we do do that, and get that, we'll come back and we'll brief you all on that in terms of licensing schedule.

KADAK: One final question.

GARRICK: Go ahead.

KADAK: Why does it take so long for your office to respond to Board letters?

GOLAN: We're working to change that. I want to make sure that we're answering your questions. So, there's times I go back and make sure we're answering the question, we're fulling considering your recommendations and advice. But, we're working right now to try to improve our response rate back to you all, and that's something that we're going to try to improve on.

GARRICK: David?

DUQUETTE: Duquette, Board.

I guess I haven't paid much attention to where the budget has come from, but I thought you were the Director of the Official of Civilian Waste, and I see that DOD is about--well, almost three times as much as the Nuclear Waste Fund. Has that been traditional? I just haven't paid much attention to how that budget has come out.

GOLAN: From when the program started in 1984, through 1992, the program was funded exclusively through the Nuclear Waste Fund to the tune of about $3 billion. Starting in 1993, there was a defense component that ranged from $100 million to about $200 million through fiscal year 2001, which was slightly less than the Nuclear Waste Fund component. Starting in--and, in fact, I'll just give you the numbers here. In 2004, $190 million came from the Waste Fund, $390 million from Defense. In '05, we received $343 million from the Waste Fund, $229 from Defense. And, in '06, we received $99 from the Waste Fund, and $346 from Defense. Part of this is recognition that the Defense, over the first ten years of the project, didn't make a contribution, so there's a catch-up that has to be made. Because there's a ratio in terms of every generator pays their fair share, so over the course of the first ten years, Defense made no contribution. I think that Congress right now is in a little bit of a catch-up mode, and making the Defense contribution get caught up so

that it has provided the proper share.

DUQUETTE: Duquette, Board.

Is that another way of saying that it's easier to hide the money in the Defense fund than it is in the--

GOLAN: Not at all.

DUQUETTE: --the Nuclear Waste Fund.

GOLAN: Not at all.

DUQUETTE: Okay. Let's go back to your organization chart. I count 14 boxes on that chart, and by my numbers, I think that there are five acting, including your own position, two vacant positions, including the Director's position, and at least one relatively new position, Russ Dyer's position. So, more than half of this organization chart is still in flux, and I think one of the things I've been concerned about, and I think other Board members have been concerned about it, is stability in this particular Project. It's been a revolving door for managers to come and go through. What are you and/or the Secretary doing to stabilize it and to get some of these acting position into real positions rather than acting positions?

GOLAN: Well, as far as this, neither the Secretary nor I have no play on getting that filled. The President has made the nomination. The nominee is given a clearance, is-- and a hold on that person. There's a couple things that we're doing that not only look at the early part of the

Project, but in terms of the senior management part of this Project. One of the things that we're trying to do is take some examples from Naval Reactor and started an intern program, and we're actively seeking to hire about 12 college graduates with degrees in physics, mathematics, chemistry, engineering, early sciences per year. And, we're actually going after graduates from the University of Nevada, to bring people in at the start of this Project to build a technical base.

We're recruiting to fill a number of our positions today. I think one of the things you'll see here is we've given over 200 FTE's, full time equivalents, from the Office of Personnel Management, to manage this project. We're about 30 under right now in terms of the actual federal staff. The rest of the program right now is to recruit people into this project. We brought in Mark Williams, who is new to the office, but comes from a background of the Nuclear Propulsion Program, but also spent about ten years in Naval Reactors. We're trying to recruit folks, senior folks, recent retirees from Naval Reactors, from the Naval Nuclear Propulsion Program. We're actively seeking to fulfill our Office of Quality Assurance with a full-time person right now. We're re-advertising again.

But, what I will say, you know, one of the difficulties we have to bring people for this Project for a

number of reasons. First of all, Las Vegas tends to be a high cost of living area. And, there is differences, in terms of what I can pay individuals, versus what the private sector can pay individuals. We're trying to work on getting some of those authorities back here through accepted--things like that.

But, in terms of stabilization, the only thing I can say is that if we provide meaningful, challenging work and a good work environment, that's going to be one of my goals that we use in terms of providing stability to the organization. I can't stop people from leaving because they want to retire. In fact, we just had a retirement in the Government Services Office. The manager of that office was a federal employee for 35 years in the CRCS program. Thought it was a good time to leave. I couldn't stop that from happening. But, we're trying to bring new people in at the very start of the program. We're trying to develop a pipeline of experts. We're recruiting right now, and we're really trying to provide good, meaningful, important work for people, so that people want to come to this Project.

DUQUETTE: Duquette, Board.

Let me just pose a comment, and it's my last comment. There probably will be a new Director named soon. I presume that this organization chart has been vetted by the Secretary, or at least someone at his level. We're not

looking for a guarantee, but why wouldn't a new Director coming in simply want to put his own organization in place, rather than this organization?

GOLAN: There is no guarantee that--well, first of all, to answer your first question. This organization had to go to the Secretary's office, and I personally agree with the Deputy Secretary on this in terms of the rationale. But, as you said there is no guarantee. I have to ask, though, that this is the program that--the Department that we're going to operate. If we do good things, if we have logic behind our decisions, if we have a good rationale technical basis for this, for not only the organization, but the other things that we're doing, hopefully when people come in, they're going to say that's a good idea, that's just what I would have done.

But, again, at the end of the day, there's really no guarantees. We're trying, again, I ask myself this every night when I go home, does what we do make things safer, simpler and more reliable. And, whether it's organization, whether it's leadership, whether it's design, whether it's the science, and again, you can ask any one of my direct reports, always ask that question, are our decision, are our actions consistent with those principles. And, if they are, I think they stand the test of time.

DUQUETTE: Thank you.

GARRICK: All right. Bill, Ron and Ali. Bill?

MURPHY: Murphy, Board. I want to get that on the record.

You answered this question in part in response to Andy's question about scheduling. But, one of the big developments, as I see it, in the program in the last year has been the concern about million year time frame as opposed to a 10,000 year time frame. And, I wonder if you perceive or sense a change in priorities or a set of new scientific or technical issues that might need to be addressed in response to that change?

GOLAN: Well, I think if you go back to our models, our models always consider both time frames. And, again, in terms of the change in priority, I can't comment on what happened a year or two years or three years ago here. You know, my priorities, safer, simpler, more reliable. You know, one of the philosophies I have is that if it's safer, if it's safe for the worker standing next to it, it's probably safe for the neighbor, and it's probably safe for the community here.

As we look to the million year time frame in terms of the period of geologic stability here, you know, our models can go out that far. One of the things that I will just say is is that I've been reluctant to give a schedule, and Andy probably is going to twist my arm at the break here

and ask about it, because what we're really trying to focus on is let's make sure we have all the pieces together, let's make sure we have the technical basis before we can comment on what the schedule is going to be. You know, at the end of the day, schedule is very important, but let's make sure we have something that we can actually point back to and say this is the base for it.

GARRICK: Ron?

LATANISION: Paul, could we turn to the slide on the new legislation? I don't remember which number that is.

GOLAN: The last one.

LATANISION: This new legislation is required by the Policy Act? Is there a time limited mandate attached to it? I'm wondering what the timing is.

GOLAN: The timing is before we get a construction authorization from the NRC, we're going to need to have some permanent withdrawal of the land.

LATANISION: A permanent--

GOLAN: Permanent withdrawal of the land, of the 147,000 acres.

LATANISION: Yes.

GOLAN: So, in terms of the timing interaction, that's what would be the connection there.

LATANISION: What I thought you said was one of the motivations was to increase the capacity beyond 70,000 metric

tons. Is that also correct?

GOLAN: Yes, what we're looking to seek to is take the Administrative limit off, and make the capacity consistent with the technical capability of the Project.

LATANISION: The thought that I have is that there clearly is a renewed interest in nuclear electric generation, but there's also an interest in new designs in terms of reactors, new fuels, therefore, different waste forms. Is that something that will be integrated in some fashion into this new legislation, or is that too far ahead of the game?

GOLAN: I think that's too far ahead of the game right now. What we're trying to deal with is the set of circumstances that we have today. And, again, you know, the nuclear movement into the future here, we'll have better indication of what that's going to mean to the repository. After we understand that and consider it, it will be time to say what exactly will happen in terms of any type of legislation, or not.

LATANISION: Okay, thank you.

GARRICK: Ali?

MOSLEH: Mosleh, Board.

Back to your organization chart. Which one of these offices has the most direct responsibility of interacting with the utility?

GOLAN: Chris Kouts.

MOSLEH: I see. And, then, which one would be responsible for integrated analyses of the TSPA?

GOLAN: Again, the integrating analysis, you know, Russ Dyer here is going to be my point person, the Office of Chief Scientist is going to be responsible for the TSPA, so he's going to have to integrate that with our regulatory authority, Mark Williams. And, then, again, at the end of the day here, in terms of other management processes, such as configuration controls, it would have to be coordinated, if we're going to make a change, we'd want the change to be documented, and we want the change to be promulgated, and that would happen through the Office of Project Control here with Ken Powers.

GARRICK: Okay, we have a couple of people that have already asked questions wanting to ask some more, but before they do that, I'm going to get a few licks in. The privilege of the Chairman, but I'll try to be brief.

Paul, you didn't say anything about the Science and Technology Program. And of course, a good deal of the information that this Board has received to answer a lot of the questions we have come from that Program. Can you say something about it?

GOLAN: Sure. Science and Technology is a large part of this Project. And, again, in trying to keep my comments to the prescribed time this morning, I limited them. We would

be more than happy to write a mission and function statement of the entire organization for the Board. But, the Science and Technology people work for the Office of the Chief Scientist. So, the people that you've been working with before, John Rangles and company, they're working in this office right here. We want to bring the Science and Technology together here.

GARRICK: Okay. I think that we're very interested, too, in following the level of effort that has been dedicated to science and technology, particularly in the areas that you've heard us identify frequently in the letter to you and in today's opening remarks, and the meeting yesterday. We're very interested in being able to map as much as we can from the Science and Technology Program to these questions as possible. So, we're most anxious to see that Program being viable and move forward.

In that connection, you've made frequent reference to independent review and peer review, and made specific reference to independent review regarding the infiltration rate estimates that will be coming out of Sandia. Is that the kind of thing that ORISE will be doing?

GOLAN: Yes, they will.

GARRICK: Now, how is ORISE budgeted?

GOLAN: Well, in this fiscal year, we have about $2 million on that instrument. As we go through the fiscal year

2007 process, if the Department receives about what it would cost, we're looking at about $3 million for that next year.

GARRICK: About $3 million next year?

GOLAN: Yes, sir.

GARRICK: Yes. Okay, And, I'll cut off most of my other questions, because I had several, but one thing, and the only thing I'd say about the organization is that the Office of Civilian Radioactive Waste Management does more than just the Project. Has anybody challenged--and, like Andy, I have managed organizations that are under the gun from clients to get projects done, and I have been monitor in terms of the level of effort that every individual whose name is on the organization chart with respect to that project. Can you say something about the level of effort, the time commitment to the Yucca Mountain Project of that top layer, of these individuals? Because I know some of these people have other things that they have to do.

GOLAN: Are we talking about this box here, or this here?

GARRICK: No, I'm talking about the Science, Design, License, Build, Operate, that's the working, those are the offices that, as I understand it, are going to be making the Yucca Mountain Project happen.

GOLAN: And, the question is what level of--

GARRICK: The question is what's the level of effort of

these people to Yucca Mountain? What percentage of the time do they really dedicate to the Project? I think one of the concerns that the Board has is that in order for a project of this complexity and this magnitude to really happen, there needs to be a, as you've said yourself many times, an unbelievable amount of dedication and focus and commitment. And, I guess we're looking to not only achieve the Project, but to achieve what other Board members have talked about in terms of integration and all of the problem solving that goes with it.

We know that a lot of time is taken in other things, in budget meetings, in planning meetings, and managing the Science and Technology Program, that is not necessarily Yucca Mountain specific, et cetera, et cetera. So, what I'm trying to get at is where are the people that are really 100 percent motivated, dedicated, and committed to this Project?

GOLAN: Let me say a couple things. First of all, this guy's commitment is 100 percent, and I will say this, I've spent time in budget and planning meetings, but that supports our cost.

GARRICK: Right.

GOLAN: If these guys aren't 110 percent, I would be a little bit surprised here. I will say this. We as an organization spend too much time in meetings.

GARRICK: I agree.

GOLAN: Far too much time in meetings. I see people scheduled, and they're double and triple booked for ten hours a day. And, a lot of those meetings aren't to make decisions. A lot of the meetings are for information exchange. And, so, management goal is that we have the primary purpose for a meeting is to make a decision, and I am working, and, again, you could talk to any one of my direct reports here, I ask them, challenge them how much time are you spending in meetings, and, over time, I think you will find that the amount of time they're spending in those meetings, in information meetings, has gone down, but I still think we spend far too much today. Again, that's one of my challenges, and that's one of these challenges for everybody here, is effective use of their time. Less time in meetings, more time communicating, more time doing the necessary management and leadership work necessary to move this Project forward. And, you can't do it with--you know, I liken it to you can't do it if you're just talking to the same people for ten hours a day.

GARRICK: That's right. All right, we've got to wrap up in a couple of minutes here. But, Mark, you have a short question, I hope?

ABKOWITZ: A very short question, and I think it's a good seague from the last comment. Abkowitz, Board.

Given that you are accountable for integrating this project seamlessly, and given that you think you spend too much time in meetings, I was just curious if you're going to be staying with us for the rest of today's. Because the TAD Project cuts across just about every box on the diagram.

GOLAN: Yes, I am.

ABKOWITZ: Okay, we look forward to it.

GARRICK: Andy?

KADAK: Yes. Kadak, Board.

We've had a new wrinkle with this Global Nuclear Energy Partnership, and I'm wondering what contingency plans you are making regarding that project, specifically relative to waste forms. And, clearly, waste forms are a strong aspect of licensing this repository, and from what I understand from the GNEP program, that waste form is yet to be defined.

GOLAN: I'll just talk briefly about GNEP here. The Secretary asked me to run the Yucca Mountain Project, and that's what my job is, and that's what the job of this office is. The Global Nuclear Energy Partnership is an office run out of the Office of Nuclear Energy within the Department. Dennis Spurgeon is now the Assistant Secretary for that. And, while the benefit of GNEP are tremendously powerful, you look into the future, in 10, 20, 30 years from actually seeing that, that whole process be completed.

In a license application today, we contemplate reprocessed waste from West Valley, from Savannah River, from Hanford, from Idaho, and I know all about that waste here. Well, in some sense, we have already looked at what reprocessed waste looks like, and it's already incorporated into our waste acceptance criteria. But, we're proceeding along with our base case. I think it's about 13,000 tons, or so, of reprocessed waste that exists today. If you look at it, I think, under this scenario here, we're looking at about 6,500 tons of that waste actually coming to Yucca Mountain. I think that's half of that would come to Yucca Mountain. But, we're proceeding along with our base case.

Yes, if the GNEP technologies come through in the future, will we consider it? But, right now, we have to go to something, and that something is our base case, the same base case that we had in January of this year, and it didn't change with GNEP. Now, we stay close, keep an ear to the ground on what the GNEP folks are doing, but, remember, that's a longer term proposition. This is a near-term proposition that we're moving forward on.

KADAK: So, no impact, basically?

GOLAN: No.

GARRICK: Okay. Well, thanks very much, Paul. We hope the time you spend with us today is not logged as speeding time, and, in any event, that it is very much worth your

time.

So, I am now going to ask Mark to take over and introduce the next comments.

ABKOWITZ: Thank you, John. Good morning.

As Chairman Garrick noted, I chair the Panel on the Waste Management System. And, Dr. Garrick has asked me to lead discussions today on the TAD system, and I am pleased to do so.

I'd like to start this session with just a few remarks from the perspective of the Board, and then we'll get right into the presentations.

As most of you know, until recently, planned operations at the surface facilities involved removal of individual spent fuel assemblies from transportation casks, and placing them into packages for disposal, a process that could have resulted in as many as four lifts for an individual assembly. A canister-based system would substantially reduce the number of lifts needed because the entire contents of a canister can be transferred in a single lift. Reducing the number of lifts can improve facility throughput and reduce the potential for accidents during lifts.

A canister-based system also has the potential to simplify the design of the surface facilities. If individual spent fuel assemblies are to be handled at Yucca Mountain,

there could be a concern about oxidation of any assemblies that have undetected failures in the cladding. With a canister-based system, those assemblies that are sealed in canisters would not be handled in air, so concerns about oxidation would be reduced. It might not be possible to use a canister-based system for all the spent fuel destined for Yucca Mountain, so some capability to handle bare spent fuel might still be needed. However, the size of such a facility presumably would be fairly small if the bulk of the spent fuel can be handled in canisters. We understand that the DOE's current proposal involves wet handling of bare spent fuel, so the potential difficulties involving an inert atmosphere can be avoided.

The Board is aware, however, that there is no free lunch here. There is a potential for a canister-based system to increase the cost or the complexity of the overall system. For example, it might be difficult to achieve an optimal thermal blending of spent fuel assemblies, resulting in an increased need for surface aging capacity, longer-duration ventilation of the underground part of the repository, or other measures to deal with the decay heat from spent fuel. Also, by the time a canister-based system could be put into operation, which we understand could be a decade, or so, in the future, a significant amount of spent fuel will have been placed into dry storage casks that may not be compatible with

DOE's TAD system. The need to transport and dispose of that fuel, in addition to fuel initially placed into canisters, adds complexity to the overall system.

So, with that as background, the two primary objectives of today's TAD session are, first, to examine the effects of a canister-based system on the overall performance of the repository system, including waste acceptance, transportation, surface facility operations, emplacement, and long-term waste isolation.

Secondly, to help determine whether adoption of a canister-based system would improve or reduce integration of the equipment, facilities, and operations needed to move spent fuel from reactors to final disposal underground at Yucca Mountain.

Our program is structured as follows. Chris Kouts of the Department of Energy will begin this session by giving an overview of the TAD concept. While the Board has some familiarity with the TAD concept, we also recognize that this has been evolving over the last several months, and we look forward to an update on the current status of the TAD proposal.

If a canister-based system is to succeed, I think we all recognize that significant participation and acceptance of the proposal will be needed from two particular industries: the utilities who must be willing to order, load,

and seal the canisters, and the cask vendors who will design and fabricate the canisters and associated transportation and aging casks. Today, we will hear a joint presentation by representatives of these industries to get their perspectives on the TAD concept.

After lunch, Chris Kouts will come up to bat again to present an overview of the technical analyses that will support a decision to adopt, or to reject, the TAD proposal. Among other things, we hope that this presentation will tell us both the assumptions that have been made in defining the analyses, as well as analysis results and interpretations. Of particular interest is how much spent fuel can be realistically shipped and disposed of using TAD, what might happen to the spent fuel that will have been placed in dry storage before TADs become available, how TADs would affect operation of the transportation system for shipping spent fuel, and how a canister-based system might affect thermal management of the repository system, waste emplacement, and long-term performance of the repository system.

The final presentation in the TAD component of today's meeting will focus on the effect of the TAD decision on surface facility design. DOE's Paul Harrington will be offering these comments.

So, I'd like to invite Chris Kouts to come up to the podium, and begin the session.

As background, Chris has served in various management and technical positions in the Office of Civilian Radioactive Waste Management and the U.S. Department of Energy. He has been responsible for managing overall program policy-related activities, including the development of program strategic and contingency plans, interactions with Congress on policy matters, and activities for storing and transporting spent nuclear fuel and nuclear waste.

Chris?

KOUTS: Thank you, Dr. Abkowitz.

Thank you. It's a pleasure to be here in front of the Board again, and I'm going to try to give the perspective of where the Department is in terms of developing of the TAD concept, and walk through the implementation steps that the Department is going to consider.

As Paul indicated, and the Board is aware, the Department is in the process of examining the approach of a canister-based system, basically dealing with the transport, aging and disposal of spent fuel in a primarily canister-based system. This would have particular advantages and benefits that we'll talk about in a little while, and I'll discuss this afternoon. We're also in the process of considering the approach to provide incentives to the vendors to develop these systems, and also for the industry to utilize them.

If we go to the next slide, the TAD system has the unique advantage of standardizing the system of at-reactor storage, of transport, repository aging, and disposal, that potentially can allow the integration of commercial spent nuclear fuel and the whole process of the handling of these materials from the facility sites to the repository. It has the benefits of utilizing the facility packaging and handling experience at reactors to eventually the packaging that would historically have been done at the repository. And, it has the substantial benefits at the repository from the standpoint of reducing worker exposure, reducing the amount of low-level radioactive waste generation at the site. It reduces the cost and complexity of our facilities that we have to have on site in order to deal with these canisters, and it also, as the Board and Dr. Garrick indicated, can reduce a variety of technical issues that we have to deal with in the licensing of our facility.

If we can go to the next slide? Performance specifications. The task for the Department is to once we have approval, as Paul indicated, from the Secretary's office to proceed with the canister-based approach, is to issue a performance-based standard from which the vendor, at the utility site right now, will develop various designs related to that specification. There are actually about seven different areas that we would expect that the vendors would

have to deal with. The first is the TAD canister itself. It would have to deal with that canister would have to meet the requirements of Part 71, Part 72, and also meet our disposal specifications, and our use in the repository.

The vendors also would need to develop a transportation overpack that takes the canister from the utility site, the canister would be placed in the transportation overpack, and moved over the rail lines of this Nation to the repository site. Also, a transportation skid would be necessary in order to handle that.

There are four additional aspects of that specification that would deal with handling on site at the repository that has to do with the type of lifting devices that we would use with these materials, a shielded transfer cask that we would use on site at the repository, an aging overpack in case we would need to age that canister. We would need a long-term thermal goal, and also an on-site transporter. Now, these are specific to our needs at the repository. Any needs that the utilities might have, the vendors would work directly with the utilities to develop whatever equipment is needed on site at the utilities to handle these materials on site, there are similar devices to lift these materials, lift the canisters off of similar devices for on-site transport and for transport casks to move them into transportation casks.

Let's go to the next slide. The performance specifications that are currently being developed, we have not received this, we have asked Bechtel to develop that for us. We have not received that yet from Bechtel, but our expectations are that these requirements will look at, will have to be consistent with our long-term TSPA. In other words, whatever designs these canisters, or the vendors come up with, those designs have to meet our long-term performance goals, have to be consistent with our TSPA, and should effectively mirror what our current waste package design configurations are.

I should say also that we're leaving it up to the vendors to determine what waste fuels they will cover, the ones that they're most comfortable with in terms of what facilities they deal with, what other reactor sites they deal with. They will be looking specifically on those, and we'll have to make sure that we get coverage for all the fuel types, and we will be monitoring that very carefully. But, basically, that's going to be something that the private industry will drive.

We will also have to, in the performance specifications, identify any needs that we might have for handling these materials on site. And, of course, any operational requirements, in terms of how you might require the utilities to verify that they have loaded and provided

these canisters in a manner that we can accept them into the repository site for aging and disposal.

Our licensing approach, if I can go to the next slide, is essentially to issue this, the performance specification, and the vendors will be responsible to work directly with the Nuclear Regulatory Commission in terms of getting certification for Part 71, which is for transport, and for Part 72, which is on-site storage at utility sites. Part 63 will be the responsibility of the Department, and our intent is to have the performance specifications as part of the license application, such that the TSPA that we have will be consistent with the performance specification that we issue hopefully later this year.

Now, the Department will be intimately involved with the vendors at every step along the way. Once they develop a conceptual design, the Department will have to review that, and determine whether or not it meets our long-term disposal needs, and also meets our on-site handling needs. As they go through the certification process with the NRC for both 72 and 71, if there are any changes that happen during that licensing process, they will have to come back to the Department and, again, we will have to determine whether or not that canister design is still in concert and essentially consistent with and meets our performance specifications.

So, although the Department will issue the specifications, we will be involved at every step along the way should there be any changes. I'll also talk about this later. But, if there are any changes as we go through the licensing process, after we go through NRC review with the repository, if there are changes associated with the performance specs that occur, then we will have to make sure that the vendors are aware of that, and can accommodate any changes in order to make this compatible with our long-term disposal.

If we can go to the next slide? As I said earlier, we're planning to, assuming we can work out the details, after we receive it and review it and are comfortable with it, we will issue that to the public, the performance specifications to the public, and essentially, we will solicit TAD concept design. At that point in time, after those designs are developed, we will review them again to make sure that they are consistent with our specifications. And, upon DOE approval of those designs, at that point, the vendors will make representations to the NRC for certification of the specific design.

I think I've covered basically Slide 8. If there are any modifications, again, in the development of the designs, the NRC reviews. Again, the Department has to again review those modifications to make sure that it's still

consistent with our disposal specifications.

Slide 9. Once we receive, or the vendors receive Part 71 and 72 certification, we will develop essentially a list of those systems that are compatible and are acceptable, and if that list changes as we go through various evolutions of the TAD design, we will update that list as appropriate.

Go to Slide 10. Once we get through certification, the cask vendors will begin to fabricate, and the utilities will begin to deploy this.

I will talk about, for a moment, the decision on the part of the utilities to use these for at-reactor storage on their sites will be a utility decision. It will not be a Departmental decision. The Department, according to the Nuclear Waste Policy Act, and I think it's been upheld by the courts, can in no way provide any funding to utilities for storage of their materials on site. That's the responsibility of the utility industry. However, should they intend to do that, as the fabrication occurs and as we've heard before at utility sites, we have to be assured that they meet our disposal specifications at each step along the way. And, any modifications that might arise from the fabrication of these materials, again, the Department will have to be involved in that process, and make sure, again, that any modifications that have been made in no way affect the ability of the Department to demonstrate compliance with

the long-term disposal needs of the repository.

Similarly, if we go to Slide 11, if utility sites load the materials, and load spent fuel into these canisters, we have to also make sure that they do it in compliance with procedures, according to an NRC approved QA program. And, before we would take them from the utility sites, we would have to make sure that the utilities would certify that they have followed basically all our verification requirements in order to satisfy the Department that, again, at every step along the way, these materials and these canisters can be disposed of.

We would also want to emphasize the fact that DOE asserts no regulatory control over utility sites. That is the purview of the utilities. They are private businesses, and the Department has no regulatory authority over any of their operations on their site.

When we get to waste acceptance operations, Slide 12, assuming that the utility begins to move fuel from the pool, we will provide a TAD canister and a TAD overpack, which the utilities essentially will load the canister, according to our needs and specifications, place it in the transportation overpack, and then we will receive, assuming all the paperwork is appropriate and done and has been certified by the utility, then we will accept that at the reactor gate. If the utility site has secured these and used

them on-site, then we won't provide them, obviously, another canister. We'll basically give them an overpack, which they will load their canister into, and we will, again, take title to it at the reactor gate.

Now, if you go to Slide 13, assuming that the utilities have loaded appropriately, and have certified to the Department that they followed our verification requirement, at that point in time, we transport it, and there are no off-normal events, essentially, the Department will review those canisters suitable for on-site aging at the repository, or disposal directly underground and be placed inside of an emplacement drift.

If there is an off-normal event after we have taken possession of the TAD, then the Department would have to analyze whether or not that off-normal event would have affected the ability of the canister in order to meet our long-term disposal requirements. And if we do make that determination, then we'll have to remediate that, and potentially repackage it, again, in the case of an off-normal event that occurs either over the road or occurs at the repository site.

In conclusion, we feel that TAD systems will enhance the management and disposal operations. As I mentioned earlier, the benefits associated with this can be substantial to the Department. Our expectation and our

intent is that the TAD performance specifications will comprise part of the license application. We're going to rely on the commercial industry to design and engineer TAD system components, which is consistent with the Nuclear Waste Policy Act. That basically directs the Department to use private industry to the maximum extent feasible in the transportation arena.

The final slide, the Department will be involved at every step along the way, from the development of the design, to the licensing process with the NRC, to the fabrication process, to the loading process, every step along the way in making sure that these canisters are handled, developed and designed, licensed, fabricated and loaded according to our specific needs at the repository. And the final oversight in our list at the NRC, they have regulatory authority for Part 71, and 72, and 63.

And, with that, I'll be happy to answer any questions that the Board might have.

ABKOWITZ: Okay. Let's start with Dr. Latanision, then Dr. Petroski, Kadak, and Garrick.

LATANISION: Latanision, Board.

Chris, I know we're going to hear from industry representatives later today, but I'd just like to get your take at this point. Do you sense that the vendors and utilities would buy into this concept, or are close to buying

in? What is your sense of their reaction to this?

KOUTS: Well, I think they'll speak for themselves, but we have had several meetings with the vendors and with the utility industry on this. I think they are supportive of the approach, especially the concept that we're going to rely on industry to develop these. I think we have had some very good discussions on technical issues associated with the implementation of this, and what aspects of the performance specifications would effectively create issues for the vendors in order to get 71 and 72 certification. And, there's been a good give and take.

I think the utility industry, from my interactions with them, and Mr. McCullum will be talking later, but I think they're supportive. I think that they feel that this can help the implementation of the repository, and get to the point I think where the industry wants to be, which is to get the fuel off their sites. That's not to say there aren't technical issues that we're going to have to work through, and I think we have had some good discussions about those, but I don't see any insurmountable issues at this point. If there are issues that we've had to go back and look at what potential impacts on our TSPA might be, carbon in the waste package has been an issue. We're looking at that.

The vendors have a substantial problem with that, and we're looking at how we might deal with that. Carbon is

important, Russ can certainly explain why we need carbon in the waste package, because it does have the ability to retard radionuclide transport. But, we'll have to basically get to a trade-off process and make some decisions as to how best to go forward. But, I think my impression, and I've been at all the meetings, and we're going to hold more meetings, has been fairly positive, a very positive dialogue, and I think the industry is supportive.

LATANISION: Thank you.

ABKOWITZ: Henry?

PETROSKI: Petroski, Board.

Maybe you could clarify something for me. We heard Paul Golan talk about two designs for clean canisters, and they were going to be compared, the better one chosen, I assume. How does that fit in with what you've just described, where the utilities or the vendors are going to effectively design the canisters. Are we talking about a conceptual design versus detailed design?

KOUTS: I think what Paul was referring to is that the contractors had competing designs for the surface facilities at the repository site. This would all be handled in the same canisters to meet the same performance specs. So to the extent that--as we go forward with the industry, yes, they will have designs. We have, our specification will have specific weight limits, will have specific length and size

requirements associated with it. And, the facility designs will all be compatible with that, regardless of which approach, design approach, we take for surface facilities.

So, the integral part that these individual facilities will be handling will be the same. And, I think the approach that we're taking using private industry to deal with that, I think is the right one, and I think there's been a similar concept in the past, back in the Nineties, and I think that trying to go with one design, there's a major roadblock to its implementation, and I think that having competing designs within the development of a canister, I think is really the best way to go, and I think it's been endorsed by the vendors and also by the utility industry. You can ask them that when they have their opportunity to speak.

ABKOWITZ: Andy?

KADAK: Yes, Kadak, Board.

I'm trying to get a grasp of the logistics here. It's clear that the industry can design transport canisters and storage canisters for Part 71 and Part 72. What isn't clear is if you can dispose of those canisters, which you won't find out until after the licensing procedure is over, so, I'm wondering how this fits. Would you try to explain that for me, please?

KOUTS: Well, you're correct, Dr. Kadak, that the

existing dry storage technology has been around at reactor sites right now, in the Department's mind, so our disposal concept requires criticality controls that do not exist in those canisters. But, those canisters, in many cases, are larger and don't fit our thermal goals, and so forth. So, the concept here is that we want to proceed with a design of the canisters based on what we know now. And, one of the issues we're going to have to deal with is the risk that as we move forward, that those specifications may change as we go through the licensing process for the repository, and that's an issue we're working on now, and it's something that we're going to have to deal with. The utility industry has made that comment to us, about if they move down the path of implementing this based on a design that is developed based on a specification that we issue this year, how is the Department going to help the utilities with that risk. And, that's an issue that we're working on, and we plan to address that in the implementation of this as we move forward.

KADAK: You haven't really answered my question. If the final determination relative to disposability of these canisters will not be made until let's just say seven years from now, and you're now asking cask vendors to design TADs to what you think the specifications will have to be, and suppose they--would you expect them to start building these things now, or not?

KOUTS: Well, let's talk a little bit about the time frame involved. Assuming that we issue a specification later this year, sometime later this summer after we make a decision to build. If it's likely that the vendors probably could not be before the NRC for another two to three years with 72 and 71 designs, they will probably go forward with on-site storage designs first, and then probably go through certification of that later, then, you'd have to go through the NRC licensing process. So, I guess what I'm trying to imply to you is that as we move forward, if we see changes, then we'll have to adjust to that. And, if there are changes, then, obviously, the implementation of this will be deferred.

I think this is going to be something that we're going to have to deal with. I agree with you from the standpoint it will not be a disposable canister until the repository receives a construction authorization from the NRC and we get final approval of the performance specification from the NRC. However, the Department has taken this approach now. We feel we can potentially deal with that risk. We know a lot more today than we did ten to twelve years ago when we went down this path.

Back then, we didn't have an EPA standard. Our concept of the repository disposal strategy was substantially different than it is now, and I think it comes down to the

level of confidence that the Department has in its approach. And, I think we are much more confident in our approach for disposal today than we were ten years ago. I will fully concede your point that the ultimate arbiter of this will be the NRC, and we won't know for sure until it's licensed. However, if we want to get these systems out to the utility sites in the near-term, we need to start working on that now, and we can adjust the process as we move forward.

KADAK: Just one other question. It gets to the technical specification, the performance specifications. It appears that the TSPA is going to be the criteria on which these TADs will be developed, and we've been looking at this for some time now relative to the maximum kilowatt loading, and heat transfer characteristics, and temperature requirements, and so forth, for the repository. That's a fairly inflexible criteria, and one of the things that you heard Dr. Garrick mention was that we have some questions about the bases for those criteria.

What flexibility are you going to have or give to the vendors to allow them to maximize the value of this TAD relative to the repository, and their needs, which is storing as much spent fuel as possible in their dry cask storage systems?

KOUTS: I think we're talking about a couple of issues when we discussed that approach. First of all the design of

the TAD itself, basically it has to do with a range of fuel types, a range of fuel types, and a range of burn-ups, and a range of ages, basically at least a five year cool. So the design ability of that canister to handle spent fuel will be across a range of parameters of fuel. So, that's one issue.

The next issue is, and I think what you're getting to, is how do you operate the system effectively and efficiently to meet our thermal goals, and how much aging will we have on site, and the ability of the utilities to come close to our thermal goals so the system operates efficiently and effectively. We don't have to have a lot of storage on site. The facilities basically can move their fuel when they need to. And, I think in many of the analyses that we have done in the total systems model, and I'll speak to that this afternoon. I think that's a workable issue.

Remember, the 11.8 kilowatt per package is the thermal goal that we need to meet for emplacement purposes. That doesn't necessarily apply for when we begin to accept these from reactor sites. Utilities, I think will work with us to try to meet our thermal goals. If they can't, then they will bring the canisters on site, and we will age them until we're ready to emplace them.

So, again, the design needs to be able to handle a wide range of fuel types and burn-ups and ages. The actual implementation of it and the optimization of how the system

works, I think will evolve and we will have to do the best we can based on when we begin to pick up what the utilities have on site, and their ability to work with us on those types of issues.

KADAK: When can we see the performance spec?

KOUTS: The performance spec? Right now, the Department doesn't have it from Bechtel. So, I can't provide that to you. We hope to get that in the near term. At that point, the Board has access to all our documents, certainly we can make that available to you.

ABKOWITZ: John?

GARRICK: Garrick, Board.

I would assume, Chris, that success of this operation is somewhat akin to the success of any operation that involves materials handling and throughput. Given that the utilities are pretty much able to send stuff whenever and how much and in whatever volumes they please, essentially at any time, and given the pressure that's kind of on the Project to not have any more than a certain level of on-site storage, what are your thoughts about how you're going to manage the waste streams to the repository?

We hear a lot about you having to have flexibility, a lot of flexibility, but we also hear that it doesn't seem to apply as much to the originators, that is, the matter of flexibility. How are you going to manage that?

KOUTS: Well, I think the best way to answer that question is that the Department does have a contractual arrangement with the utilities, and we have a contract under which we will have to operate. And, there are certain requirements to that contract. However, in all my discussions with the utility industry, my expectation, and I think their expectation, is that they will work with the Department to try to meet our needs at the repository as well as their needs at their sites. So, I don't look at it as if the waste generators are not going to be supportive of the process, and are not going to try to work with the Department to try to make the system operate efficiently. And, I think we should ask that question also to the industry representatives which you're going to have following me.

But, I think we have to design the system such that we can handle all the fuel types and deal with the anomalies, if you will. But, I think when we get to the actual operation, my expectation will be that, again, that if the generators will work with us, try to meet our thermal goals. If they can't, then hopefully, they'll be close so our aging on site will be limited, and we can move forward with the system in a reasonably optimized fashion.

GARRICK: One of the other things that I was curious about is were other alternatives considered to the vendors having to license their canisters?

KOUTS: We certainly thought about other alternatives. I think, however, I guess my response to that would be that the vendors have much more experience than the Department does in terms of dealing with the certification of canisters and transportation systems associated with the TAD, and they would be far more effective in moving that issue forward than the Department will, or requiring that expertise. I think that the history of the implementation of this program, and when I headed the transportation program back in the late Eighties when we were developing our own casks, and we were doing it under DOE contract, we were still using private industry at every step along the way to deal with those interactions.

And, I think it's the Department's view, and I think it's the right view, that we need to use the experience of the vendors, and their expertise in terms of how to get these things done, licensed, certified, if you will, and, also, since they have to essentially be used at utility sites, they work with the utility sites every day in terms of the implementation of dry storage systems, so they would have the most information available. What we want to do is to tap that expertise in order to move this initiative forward.

GARRICK: Okay, thank you.

ABKOWITZ: Howard?

ARNOLD: Arnold, Board.

I just had the same question as Henry Petroski, but I didn't understand the answer. I heard Paul Golan say that he has two competing designs going--I don't suppose either of those--are these installed into facility designs, or what?

KOUTS: I think what Paul Golan was talking about was different facility designs, not canister designs, different facility designs, and, Paul, do you want to--

GOLAN: Yes. The design is for the facilities at Yucca Mountain. And, for instance, when we looked at the design, it was based on the fact that this is the way we're going to manage the project risks. When we got our design back, we had one design that had the fuel shielded at all times. You could basically walk up to that waste package without being (inaudible) of the shield. Another aspect of the design, where instead of moving the fuel through the facility, (inaudible) as we got into waste package disposal. All the implements across the waste package, the waste package basically stayed (inaudible). When we saw that kind of innovation with the key design, again, we're looking innovation, we learned a lot of good things by having two people, two organizations, come with their best ideas.

So, as we moved to the next step in the critical decision process, the critical decision going to conceptual design (inaudible) down select. From the project management perspective, and he (inaudible) to see the design, and what

we did is we took the design, facility design on the table, and they were, for instance, you know, looking at one system that's, for lack of a better word, more trolley based, and the other is more based on the fact that the waste package stays (inaudible), We had to see which one (inaudible). and which one could get a license, and, so, we're keeping those and at some point before we go to, you know, the detailed design that we're going to submit to the NRC, we're going to take one of those, but right now, we want to keep that information going. Again, what we do is we provide specifications that your facilities have to be able to accommodate this kind of waste. And, the two vendors, the two contractors right now, are giving us their ideas on how we can best, from a facility perspective, accommodate those waste packages.

ARNOLD: Thank you.

ABKOWITZ: Thure?

CERLING: Cerling, Board.

You spoke very eloquently about how this TAD has great benefits to the DOE, but you didn't really mention the benefits to the industry. So, I was just wondering, you know, what is it, given their existing inventories and other problems that you feel will make it, or the DOE could do to make it a benefit to the industry?

KOUTS: Well, that's an excellent question, and I think,

without getting into some of the measures the Department is considering in relation to how we might reduce the risk for the utility industry in the implementation of this concept, I think what it does provide the industry with is if they decide to, or obviously, if they need to go to additional dry storage as they move into the future, they will have a device that they know the Department will accept without having to repackage, without having to do anything else with it, which is something I think that the industry would very much like.

So, in that sense, it can help standardize on-site storage at utility sites, and it also helps standardize the entire system. We're dealing with essentially the same types of casks throughout. The utilities will get used to dealing with those same types of casks. It will help with their operations. So, when we go down to a standard approach, it helps a great deal, I think, in terms of providing certainty about how these materials are going to be handled at the utility sites, and also how they will be handled within the waste management system.

ABKOWITZ: Ali?

MOSLEH: Mosleh, Board.

I'm very interested in the process that you are taking to develop the performance requirements, and ultimately, the best performance requirement would be within a kind of iterative process, optimization. What are your

overriding constraints, things that were your anchor points that you're starting with?

KOUTS: I think our approach to this has been not to perturb, at least in the initial generation path, is not to perturb our current long-term approach to performance assessment. We want to have the specifications nearer our concept of the waste package that the Department wants to proceed with. This means that the capacity of that TAD, initial capacity would be 21 pwr's, for the reactor assemblies. I think that's a constraint that we want to start with at this point.

In addition to that, we want to make sure that our criticality needs in the underground, what we're going to have to demonstrate to the NRC about criticality over the long term, of emplacement, those have to be met. I think those things are probably paramount in our minds in terms of the development of the performance specification, and they need to be consistent with our performance assessment. Also, the material properties that we need in the waste package in order to demonstrate long-term performance, all those are factored into the performance spec as we see it, and those are reasonably--obviously, those should be the ones. We want to make sure that the canisters meet Part 71 and 72. The challenge here, if you will, is our long-term disposal, will be driven by our total system performance assessment, with

the other requirements that you need for 71 and 72, provide that in the specification, and have the vendors take our disposal needs, and try to make the 71 requirements and the 72 requirements work.

ABKOWITZ: Okay, thanks, Chris. Abkowitz, Board.

I'm going to ask a few questions, and then we have some staff questions, and some Board members that want to ask additional questions.

First of all, what is the realistic schedule for having TADs available for use? And, just how many years from now?

KOUTS: I would say that we've asked the same questions to the vendors, and once we've issued the performance spec, how long before we would expect to have a system operating, and I would say potentially five or six years.

ABKOWITZ: This includes approval from the NRC? I mean, you're saying six years from this date, it's realistic to assume that TADs will be delivered to the front doorstep of the utility, and they're going to use it?

KOUTS: I would put it this way. I would say it's five to six years, and I can't comment whether or not we'd be through the licensing process, I think we would have designs that would meet our performance specifications that we would issue this year. If we were done with the licensing process at that point, then I would say yes, but that's certainly

difficult to handle until the licensing process is finished, we wouldn't know for sure. But, assuming that the utilities are willing to assume a certain amount of risk, we could potentially have them at reactor sites within five or six years.

ABKOWITZ: And, if the TADs are used for on-site storage, my understanding is that they would be more expensive per kilowatt hour, per kilowatt than the traditional storage. So, to use it for on-site storage without knowing for sure whether they will be taken to the mountain that way would have to be a DOE initiative?

KOUTS: That's what I referred to earlier, is that the Department is looking at ways that we can address the risk that the utilities might incur by having these on-site, and then if for some reason they turn out not be--I mean, we're looking at that issue, and we have the standard, we appreciate it, and we--but, I'm not prepared at this point to discuss how we might do that.

ABKOWITZ: Okay. On a parallel track, and please verify this for me. I think we've had this discussion before, but I want to make sure I have it straight. The entire TADs concept requires a rail spur to Yucca Mountain. In other words, delaying the rail spur or no rail spur has direct and complete implications on the TAD concept; is that correct?

KOUTS: I would certainly agree. It's much easier to

move these systems by rail than it would by heavy haul, and our expectation would be that a rail spur would be needed in order to move these.

ABKOWITZ: Let me rephrase the question? Is there any point in going on right now that assumes that--that does not assume a rail spur is in place for moving TADs?

KOUTS: Well, the ability of the Department to receive waste by truck is something that we are looking at. But, we would not anticipate that we would move TADs by truck, if you will. We would need a rail spur to do that.

ABKOWITZ: So, again, to get back to my original point, any TAD that's going to move to Yucca Mountain has to be moved to Yucca Mountain by rail; correct?

KOUTS: I would agree with that.

ABKOWITZ: Thank you. Okay, the next thing I wanted to ask you about is that I was curious about the meetings with the utilities and the manufacturers, but you haven't mentioned anything about having a meeting with NRC. It would strike me that if those are the people that are going to pass, you know, if you have to pass the litmus test with, it would make sense to me that I'd want to engage them early and frequently. Could you tell me what your relationship is in that regard?

KOUTS: The Department certainly respects the regulators' view about the implementation of this concept.

We have had discussions with the NRC in relation to the development of a technical exchange that we will have later this summer after we issue the performance spec. The discussions with the NRC, it was their desire that they not have a technical exchange until after the performance spec was issued. But, we have had discussions with them about the concept in the context of developing that plan for that technical exchange, and they're certainly aware of it. NRC officials--

ABKOWITZ: So, if I understand you correctly, the Department has approached the NRC about getting engaged and the NRC said we'd rather defer on those discussions until you have a specification to present to us?

KOUTS: That's one of the views. And, also, that the NRC's view that they have meaningful exchanges with the Program, they'd like to do it in the public, and the technical exchange, in their mind, would be most beneficial after we have had the performance specifications on the street, hopefully as soon as possible.

ABKOWITZ: Okay. And, then, one final question. If we could go to Slide 13, please?

The first bullet, I take, my interpretation of that bullet is that if someone has stamped certified on the shipment when it leaves the utility, the reactor site, unless there's been some upset in transportation, there's no need to

verify that things were done correctly. So, we have 70 to 80 different locations that are stamping certified, and as long as there wasn't an accident during transportation, there's no need to look at these canisters again. And, I was wondering if there's been any discussion about having some kind of sampling strategy in place so that when these canisters arrive at Yucca, that at least some percentage of them are opened up for purposes of verifying that the quality control in 80 different locations is correct?

KOUTS: Well, I would submit to you, first of all, that reactor sites where these will be loaded, and these will be handled--operate now under NRC qualified QA programs, just as the Department operates under NRC qualified QA programs. The certification that we will request the utilities, in our plan, at least, is to make sure that it's loaded properly, is something that I don't-- I think the Department needs to be assured that the canister, when it was fabricated, met the specifics of the design, it was certified by the NRC, it was loaded in accordance with the needs of the--the Department's needs for disposal, that it was properly inerted, that it was properly dried, inerted and properly sealed. I would submit to you that if the Department has to go through a process where, after we take the canister from the utility site, and we have to open it up in order to determine whether or not it was properly sealed and whether or not it was properly

loaded, I think that defeats the purpose of this concept.

The idea was to move away from the handling of bare spent fuel, and the idea that, again, we're going to have to go through a sampling, or a sample size or whatever, again defeats the purpose, and again will defeat the concept of trying to--my thought here is that once it is properly loaded and sealed, unless the Department has a reason to believe that something has happened to that canister from that point forward, that there is no reason why we could not use it in aging and put it in the ground. Again, that's the concept. I'm sure we will have some comments and some thoughts from the NRC in relation to that, but I would also submit that, again, we're going from one NRC licensed facility to another NRC licensed facility, so hopefully there will be some uniformity of treatment in terms of the quality of how these materials were originally packaged.

ABKOWITZ: Dr. Duquette?

DUQUETTE: Duquette, Board.

My question really, or comment, is really on the same subject. It seems to me that there are at least two aspects to the process. One is going to be the transfer of currently stored waste into TADs. And, the second part of this is going to be once that presumably is all transferred into TADs and ready for shipment, there would be another process that would occur for newly generated waste that was

going directly into TADs rather than into interim storage and into TADs. Do you envision on-site supervision of any kind by the Department other than just licensing the facility?

KOUTS: I'm not quite sure of your question. Are you talking about at the utility sites?

DUQUETTE: Yes, that's correct. At the utility sites. You're going to have to transfer the waste that's already in storage at many of the sites. And, that's going to have to be transferred into TADs before it can be shipped, I presume. And, then, I presume that the concept is that in the future, you wouldn't have the same kind of interim storage at the site, that the transfer would be directly into TADs from the reactor when waste was generated. And, that means that you're going to have a large amount of activity initially with the transfer of the current waste that's already stored on many of the sites, with, I presume, somewhat of a slower process after that some years down the line. You mentioned, I think, just a minute ago, that it would be going from a licensed facility to another licensed facility. And, I guess my question is do you envision the Department having to provide supervisory staff at the sites to make sure everything is done properly?

KOUTS: Well, I'll go back to the bullet I had at the bottom of one of those slides. The Department has no regulatory authority whatsoever on the utility sites. Our

expectation is that we will have verification requirements, and the individual utility sites will have to verify that they met those. The NRC on-site inspectors at those facilities, they would be overseeing those operations on a day to day basis, just as they would be at our facilities. So, my sense is that there will be plenty of NRC oversight on all the activities.

The Department, again, has no regulatory authority over what happens there. We certainly have an interest and we want to make sure that it meets our needs, and we will do that through the proper verification plan. But, right now, we have no plans or intentions of having personnel on site to inspect or to deal with that. We really look at that as responsibility of the utility sites, and I think that's a fair question to ask the utility representatives that you're going to have later, whether or not they want DOE on their sites potentially overseeing their activities.

DUQUETTE: Thank you.

ABKOWITZ: Andy?

KADAK: Kadak, Board.

I'm still a little bit struggling to try to understand. You apparently have refusal rights to accept spent fuel from the sites. And, the TAD clearly, if it is licensed and acceptable, is an acceptable waste form you will take.

KOUTS: That's correct.

KADAK: And, the expectation is even if it can't be disposed, you have some obligation to take it, because you had incented the industry to go in this direction in some way?

KOUTS: Yes.

KADAK: However, there's a lot of spent fuels at the sites now, which is licensed for transport to storage, but not disposal. Are you saying you will not accept that spent fuel for shipment to Yucca Mountain until they transfer it to a TAD?

KOUTS: Let me answer that this way, and I'll answer it legalistically. For over 15 years, the Department has taken the position that dry storage systems that exist at reactor sites are not covered by the standard contract. And, I will submit to you reading March 31 of this year, the Smut case against the Department, where this issue was (inaudible) by Judge Braden, who I testified in front of, she agreed with the government's position that those materials are not covered by the standard contract. Now, I will say this, that the Department has remained open to discussions about how to address this issue, and is willing to meet with the utilities should they desire to meet with us. None of them have come forward to meet with us as of yet. Also, our surface facility designs will have the capability of dealing with

those systems should the contractual issues be addressed.

KADAK: To follow up--

ABKOWITZ: Okay, go ahead, and be quick.

KADAK: So, you're saying that you will accept their fuels, no matter what?

KOUTS: That's correct.

KADAK: And, how is this going to work? How is this really going to work for the Department if that's the only criteria that you now have?

KOUTS: Well, as I indicated--

KADAK: In other words, you cannot accept TADs, because you say bare fuel in the contract.

KOUTS: That's correct. The Department's view is that if we provide the designs to the utilities, which is disposable, that those would be acceptable into the system. Again, this is an issue that we're going to be working with the utilities on. Nonetheless, we will be providing all the equipment, if you will, for the utilities to load the material. And, I should say also that this is primarily a canister approach. If there are utilities who cannot handle a TAD, for whatever reason, they're not capable, or for other reasons, we will still have some bare fuel handling capability on-site to address that.

ABKOWITZ: Carl DiBella, you have the last question.

DI BELLA: Thank you. Carl DiBella, Board Staff.

My question is it seems to me that this strategy for the TAD depends on many things, among which is the willingness of NRC to accept a license application that includes performance specifications for the TAD as opposed to a mechanical design. Can you say why you believe the NRC is willing to accept this?

KOUTS: Well, let me give you a view on that. Our total system performance assessment takes an individual waste package, and that individual waste package is an average, it's an average of radionuclide content, it's an average of chemical content, it's an average of everything. And, I would submit to you that if you have a waste package that meets those averages, there is no reason why that canister in compliance with specification could not be (inaudible), as long as the Department can demonstrate that whatever it's going to place in Yucca Mountain is consistent with that specification, and that specification essentially balances the impact, if you will, of the emplacement materials over the long term. So, I think that this is an area that we're going to have to assess further.

I would also submit to you that there's been numerous comments made over the years by various NRC Commissioners about the--something like this approach should be pursued in order to help standardize the handling of materials both at the reactor sites and at the repository.

So, my expectation is, at least with the Commissioner level, that from an NRC perspective, that this is an approach that will potentially work, that it's up to the Department to demonstrate in its application, in its license application, and certainly for the vendors to demonstrate that they can design this to the specific needs of the Department. But, nonetheless, I think the approach can work, and only time will tell if it will.

ABKOWITZ: Chris, thank you. You have been very patient about answering a number of questions. You can tell, I think, the Board is thinking pretty deeply about the whole TAD concept.

We're going to take a short break now. We'll recess for ten minutes, and reconvene at 11 o'clock.

(Whereupon, a brief recess was taken.)

ABKOWITZ: We are ready to resume our program.

Our next presentation in the TAD session is going to be a tag team presentation entitled Industry Perspectives on TAD.

During the DOE's discussion earlier today, they made reference to the engagement and constructive discussions with the utilities and the cask manufacturers, and speaking on behalf of those two parties today, we have Rod McCullum representing the Nuclear Energy Institute, and David Blee representing the U.S. Transport Council.

Rod has been working on used fuel management issues at NEI since 1998, currently serving as NEI's Director of the Yucca Mountain Project. He has over 20 years of nuclear engineering, licensing and regulatory policy experience. In his current role, he advances industry-wide efforts to reduce business risks associated with used nuclear fuel disposal by working with industry leaders and DOE managers, as well as scientists and regulators, to develop a more effective disposal system.

David Blee serves as Executive Director of the U.S. Transport Council, which is a national coalition for policy, business and public education issues affecting nuclear materials transporters, suppliers and customers. He is also the Managing Director of the Forrestal Group, a Washington, DC-based strategic management firm that specializes in policy and business strategy for the energy and national security markets.

I don't know who is going to do what first, but if the two of you can make your way up here, one or the other, or both, the floor is yours.

MC CULLUM: Good morning. It really is a pleasure to be here this morning, and address what is really an exciting and elite opportunity, as presented by this DOE TAD initiative.

We, in industry, consider it an exciting opportunity because it's something that has the potential to

really move the Yucca Mountain Project forward, and we consider it a unique opportunity as well as a challenge, because it is something that requires a level of integration across the entire waste management system in almost unprecedented levels in terms of both DOE, NRC, the utilities, the cask peddlers, the transporters, and that's why you'll be hearing from two of us today. Because even though USTC and NEI have considerably overlapping membership. In fact, most people that come to all of our meetings are members of both.

Every now and then, David and I have to remind each other to invite the one guy who is not in one or the other's organization, but we really are with both USTC and NEI capturing the entire industry that's concerned here, and even though this is a very unique challenge of integrating across the system, the good news is, and we'll talk about it today, is that we are doing that. There's a tremendous amount of interest. We've had several meetings with DOE that we will discussed. And, if ever I put out a call to one of these meetings across the industry, and David with his membership as well, we get almost unanimous response that everybody wants to be there. So, there's just tremendous amount of support and a tremendous amount of interest in this.

If we could go to the first slide? I'll talk a little bit about how we're going to break things up and

discuss this today. David will be coming and joining me at the podium about midway here. I'm going to talk about why Yucca Mountain is important to the national interest. And, I think we would talk about some of the--there were some questions about risks before, and why we should take on some of those risks and do some of the things we're doing.

I think it's important to see in the context of why this is important to the national interest, and also to see why the TAD initiative itself is pivotal to ensuring that we do get the progress at Yucca Mountain. I want to emphasize the word "progress" here. It truly is, you know, it's not the absolute date that the first stick of fuel moves, but the fact that we are continuing to make progress, and the TAD is probably the best near-term opportunity we have to make real progress at Yucca Mountain.

So, I'm going to talk about those two aspects, and then David Blee is going to come up here, and he's going to talk about the specific process that we're going through between industry and DOE to achieve this, and then back to the end, I'll talk a little more of some of the things the Board might be specifically interested in in terms of some of the details of the issues we've been discussing within that process.

If we can go onto the next slide? Here is one of the key reasons why it's important, especially when we look

at the world situation today, and three dollar gas at the pump, this almost becomes quite a frightening graphic, because not only do you see a fairly notable increase, and this is for the Energy Information Administration, the U.S. consumption, you see the gap between our ability to meet that with domestic production actually growing in the future years. And, another thing, this is against a backdrop where the curves of consumption growth are much steeper in places in the world like China and India, very large countries, so the need to produce more energy, is definitely, you know, a strong reason for moving forward.

If we can go onto the next slide? Just keeping up with that production curve, you know, the production curve that I think most of us would say is inadequate, because it does not at all begin to close the gap, and certainly made me recognize the overall global situation. But, even within overall energy, we're looking at a 45 percent increase in electricity demands in the United States by 2030. That's a pretty incredible increase in what's now about a quarter of a century. And, to maintain this, we're going to have to build, you know, there's a lot of energy choices and I want to talk about that for a second. We're going to have to build 50 nuclear reactors, 261 coal-fired plants, 279 natural gas plants, and 93 renewable facilities of 100 megawatts or more there.

So, what really is in play here is energy choices, and Yucca Mountain and the progress in Yucca Mountain is one of the things that affects these energy choices, just as progress in coal sequestration technology might affect how many of those coal plants we really build, or how price spikes might affect how many of those natural gas plants we build. Progress on nuclear waste disposal is a key component of this, and will weigh on any choices.

I will submit to you that no matter how slow or fast Yucca Mountain proceeds, we will build more nuclear plants in this country, and we will get to that in a second. The question of how many and how well we will keep pace and with what energy mix, and the real important thing is that we have the appropriate mix of energy sources. This is something that plays into that, and the TAD specifically is something that is, again, our best near-term opportunity to weigh in.

If we go to the next slide, we've been maintaining our market share in the nuclear industry, and I like what the Secretary of Energy told Mr. Golan at the very beginning with these, the notion of safer and more reliable operations. That is, indeed, how we can--a safer, simpler and more reliable operation. That is, indeed, how we have been accomplishing maintaining the market share in nuclear, even though we have not built any nuclear plants since the last one went on line in 1991. And, yet with shorter outages,

more efficient outages, power upgrades, life extension, efficiencies, becoming safer and simpler and more reliable in everything we do, we have to date maintained our market share.

And, if you can go onto the next slide, the public is very much okay with that. And, then, this truly is something I want to--it's remarkable that you look back where, you know, the Three Mile Island, and you can see the two curves cross around the time of Chernoble. But, since then, it's been sustained improvements in public conception. When you look at the energy choices we might make in the future, there's very strong public support for saying nuclear should be one of those choices.

And, so, going onto the next slide, the same public that is supportive of nuclear overall, Skip Wellman calls this the "yeah, but what about waste?" And, this is the situation we are currently faced with. And, I think this will be an important record perhaps to come back to when we start to get into the discussion part here. It puts the numbers to some of the concerns I heard being expressed earlier. You know, 53,000 metric tons, maybe closer to 54 by now. Right now, almost 9,000 of that is in dry storage. That's material that's in containers other than a TAD at this point.

We can see some of those details of how many casks

that is and where they are. We are estimating that by 2010, if we talk about five to six years to get this deployed, you know, we'll almost double that to 15,000 MTU's, and we will be adding, I think the most important figure on the chart is the one at the bottom, we will be adding about 1,000 metric tons per year. So, there's a tremendous incentive here on everybody involved with the TAD initiative to get it on line as quickly as possible. The sooner in the scheme we have TADs, the less non-TAD fuel we'll have to address.

And, I think that's why we have noted that the DOE has been looking at this with a very big sense of urgency. We're working with a good sense of urgency. We want to do it right. We've got a lot of basic experience, having licensed almost 800 casks now, there's a tremendous amount of experience, and we want to make sure that that experience is fully factored into everything we do going forward.

If we can go to the next slide? So, you know, kind of to get away from the nuclear commercial here, and a little more back into this, to summarize that aspect of it, there was some discussion about GNEP. The nuclear industry very much endorsed GNEP initiative, a very bold vision into the future. It's a future we would like to see. It's something that is going to take a number of years to deploy, and we feel strongly that no matter what you do, nothing magically makes every one of the radioactive types that we're concerned

about disappear. And, we also feel strongly that in order to build that public confidence in the GNEP version, in order to build the confidence that we can achieve the waste disposal system in the future, we have to demonstrate we can manage the waste disposal fuel system--the waste disposal system in the present. So, Yucca Mountain supports all possible scenarios, we believe.

We believe that Yucca Mountain can serve as a scientifically sound repository. We thank the Board for its continued diligence and efforts to guide improvements in the science. A decision was made back in 2002, based on what we believe is a very conservative safety case, and I hear Dr. Garrick asking for more understanding of what the scientists really believe, and I think that will help us as we go forward to the next step, which is, of course, licensing, which we thoroughly believe will, you know, there's the question of is Yucca the site, and now the question of can you license a repository at that site. And, we feel that the licensing process is very rigorous and will answer that question, and protect public health and safety.

So, all these things, and I talk about advanced technology, it's very important that we remain committed to Yucca Mountain, and the efforts we're seeing in front of the Department of Energy and of the industry is evidence of that commitment.

So, kind of trying to connect the nuclear commercial, if you will, with the TAD, and I think it's important for the Board to consider these points. Yes, it is true that the TADs will greatly simplify the Yucca Mountain design. Will every stick of fuel currently in every one of those casks go into a TAD? No. But, the vast majority of the fuel that will produce over, whether it's 70,000 or 120,000 or 140,000, or even more later on, certainly might be able to go into a TAD, at least over the next several decades, before we get to the point where it's something other than fuel.

So, clearly, we've simplified the repository design. We absolutely believe, and, again, we look at the curve and the success we've had in industry, the simpler being more licensable. We've demonstrated that. We've had to simplify our operations, and we improved our ability to be efficient.

Now, really the key point in linking the nuclear message to the TAD message is this, and there were some questions on this earlier. What's in if for industry? Obviously, there's going to be a need for incentives. There's going to be a need for equitable distribution of risk, however, the companies that are building the new nuclear plants, and I though I had a slide in here on the number of companies that were doing nuclear plants, but, you

know, they see some real advantages, and that's really what it goes to, from our standpoint. We want to maintain our market share. And, in terms of maintaining market share, there are real advantages to the TAD. Granted, as in the bottom sub-bullet here I mentioned there are things like, you know, the small canisters, there are things that make our business more complicated. But, we do see disposal and waste acceptance uncertainty. It will be a canister that will be, the DOE will say is ship to Yucca Mountain care of Chris Kouts, postage prepaid, you know, I hope it would say postage prepaid on the side of it. That reduces a lot of uncertainty in our business, and helps us when we are trying to convince the larger world, that public that 70 percent believe in nuclear, you know, that we should build more plants, that we should be able to maintain, or even increase, our market share. Increasing stakeholder confidence. that's a very important plan with us. You know, when we put dry cask storage on your site, and you have to go out and explain that to your neighbors when they see it from the road. And, the explanation now is we can talk about how safe it is, and all that great stuff, and that's a good explanation, and it's always worked, even in states where it was challenging at first.

However, you are now giving your neighbors a different message with the TAD. You're saying here's a cask

that will be here for 20 years. Okay, maybe 40, and maybe we're not quite sure about when it will--you know, again, you're saying this is a disposable cask, you understand, on your site, and it's got that, you know, postage prepaid care of Chris Kouts message right on the side there, so they can go to him instead of us. But, you know, it really does, I think, help us with our, you know, interacting with our stakeholders. And, again, it's helping to create the environment in which we can build more nuclear plants. It's about how the TAD's link to energy choices we can make. And, when you start to look at all the risks and all the benefits, and, again, just like you told people, look at what types of clean air technology we'll be deploying, and the natural gas people, look at the international market forecast. This is one of the things we have to look at. This is one of the things we have to get done now in order to continue to create that environment in which our public support will continue to increase, and, more importantly, investor support, which means a lot to public support in our business.

If we go onto the next slide? So, I want to dwell on this a little bit, and I think one of the things I want to point out about this slide is this is a graphic, and there's been a lot of coordination on technical issues that we'll talk about in a second, but this says graphically I think the same thing Chris said in the words on his slide about how we

intend to move forward, how we get things to fit together.

You know, what we have here is DOE's preparing here, that's this slide. Now, I used to be able to show these kind of charts with dates on them and, I'm hoping DOE will give me the ability to do that again in the future, the very near future. But, DOE will issue the performance requirement, and we feel that will be coming this summer, and we'll be able to pace our interactions with DOE, we think that can happen. That's what goes into the license application, and this is a very important concept here. The level of information which will be put into those performance requirements has to be of the same type of level that will go into, that did go into initial license applications you expect at nuclear facilities.

But, it's important that we go forward with an application based on that performance spec, and allow the market with the TADs to develop, similar to the market we have now, I think to insist on one final TAD design before you move forward. But, first of all, that pushes everything way out, and really, you know, the greatest risk, we talked about risk, the greatest risk is to try to find zero risk, you know, that would be not doing anything at all, kind of what you'd get if you wait for all the questions to be answered before you do anything. And, there needs to be equitable ways of sharing risks as we go down this path.

Certainly, we think that a preponderance of the risks should fall upon the entity that was supposed to be getting the deal in 1998 now that it's 2006. But, we're not going to get into that because we're about the technical issues and we're committed to resolving those first. So, you go with the performance specs which feed this process down here that you're all familiar with, the license application.

Meanwhile, you've got vendors designing the TAD, and maybe one of the most important features here is the double arrow that exists between the NRC review and the vendor design process, and right now we're establishing the foundation for that kind of interaction and it's going very well. And, realize that in order to get our process to a certain point, and we're going to start bringing in the NRC more.

In fact, there's a meeting down in Florida, the NRC is getting together in Florida, and I'll be shortly heading to the airport to get to it. So, we're starting to have some discussions today and over the next few days about that, and we'll continue to do go over these processes.

The important thing here is there's three stars here, and it could be five, it's important that we have choices here. It's important for the different utilities with different needs, different vendors with different capabilities that we have now in this competitive

marketplace, I think for this to be successful, and, again, you get to the sense of urgency going back to the numbers of casks, for this to move at the speed at which you'd have fewer non-TAD casks to deal with, it's important we have an incentive for competition. One of these stars is going to want to be first, and that will drive progress.

Also, you will get better designs, and designs that will be able to cover the range of needs. You have 103 nuclear plants out there, where different utilities are used to dealing with different vendors. They deal with different vendors for different reasons. That needs to be kept intact.

And, then, also, you notice here the new designs will continue to be on line. There's not one day this process stops and, you know, sorry, you can't get into the market, the market is closed. That would be almost as bad as having no competition at all, is to not let the market continue to improve the design, particularly when you look at things like GNEP coming on line, where you may actually have different waste forms. But, you know, you need to accommodate different types of fuels as industries on the front end change.

So, this is how, you know, we see this thing together. And, again, when I go back to Chris's slides, I see the process he was describing in words. He was describing this arrow with the way he described interactions

and the need for a competitive marketplace. So, at this point, you know, that's the--well, I guess I'd say the philosophy of this. I'll ask David to come up here and join me and talk a little bit about the interactions we've been having, and then I'll come back and get into a few of the details and answer questions.

BLEE: Before we get into this slide, I'd just like to say that we certainly welcome the Nuclear Waste Technical Review Board's focus on the TAD, and the transportation issues generally. It's been very, very helpful. And, we welcome that.

We've heard a lot about potential today. We agree that this issue has tremendous potential if properly managed. It really is crosscutting, as has been noted, in terms of the linkage to the license application, the linkage to simplifying the surface facilities, which is, of course, related to that; safety, in terms of driving transportation, driving the integration and innovation that Mark Golan talked about, and discouraging stove piping, and really showing demonstrable progress. It's very possible that this TAD could be deployed before you see a license application approved by the NRC, and what we are looking for, of course, is progress on the Yucca Mountain Program. This is a key driver to a lot of these things.

We do believe that, as Dr. Kadak noted, the private

sector has shown it can license and design canisters very successfully, and the utilities, along with the so-called cask vendors, have shown that they can deploy these systems. 800 systems have been deployed safely at 34 sites, and I think that record speaks for itself, and it's been done in tandem with NRC oversight regulations. So, we are certainly adding that one additional element to this, that we are guardily optimistic about this achieving its objectives.

With respect to the--I think, again, this is not total altruism, but we think maximum reliance on the private sector is a key ingredient. I think Chris Kouts talked about past lessons learned from the Nineties, in terms of the approach to mandating development. And, we do that the competitive process, the flow of competition, we do believe there are some things that need to be done to jump start some of that. But, for the moment, I know that the commercial companies have much at stake here, their commercial and competitive interests and the interests in trying to further this thing. So, I think we're encouraged by what the dialogue with the Department, and certainly the results so far with we're looking at a mid summer result.

This is a statement we put together with working very, very closely obviously with NEI and the utilities, in terms of--sorry about that. We obviously have a vested interested, as you heard. It has great potential, and the

utilization of the private sector is critical to its success. And we have convened a group of experts to provide technical input to the DOE. I'll talk to you about that in some detail.

So, next slide? The goals of our interaction with DOE have been to provide DOE with technical input for the TAD development. We have, again, through our group of experts, had a number of technical exchanges, and I think that has been very helpful to providing the kind of input into the Department's programs that is really necessary in all elements.

We have encouraged and facilitated the resolution of technical issues, and Rod will get into that in some detail in a few moments--pertaining to TADs in a timely manner, such that DOE can be in a position to issue performance requirements in mid 2006. We appear to be on course for this collectively, and we are encouraged that since its announcement in October, that we may see the first fruits of this labor very, very shortly.

We are also working to ensure these performance requirements are reasonable and adequate to support the timely development and straightforward storage in transport licensing of TAD designs by the private sector. That goes without saying.

We've been maintaining the focus on TAD performance

issues, not withstanding commercial or contractual issues, which we believe can be addressed once the technical performance requirements have been issued this summer. There's no sense in getting into standard contracts, getting into the other commercial and competitive issues. We wanted to focus really simply on goal one, which was job one, the developing the performance spec.

We have also provided technical input related to the design of the surface facilities at Yucca Mountain, in terms of TAD handling and whatever fuel is shipped to the site with respect to other types of containers.

Key challenges that we are addressing are, again, managing the time line that you saw that Rod put up there in terms of some of the time line that we've sort of put out in a pro forma way. I think Chris Kouts talked about up to five to six years is a possibility, and I think while we didn't have dates on there, that's certainly something that's within the realm of possibility.

Managing the performance requirement and content. We have tried to keep very focused and very laser focused really on developing the performance spec, and not let it get into other issues that I've mentioned before.

Material selection, criticality control is something that Rod will talk about. And, avoidance of over conservative design inputs. Again, the experience, the

hands-on experience of the canister manufacturers and vendors and utilities has been instrumental to that. And, then, achieving appropriate scales of test inputs. Again, another key input by our group. And, we have also stressed the emphasis on solving local issues locally. We don't want the TAD to solve all the issues associated with the DOE Yucca Mountain Program. We've tried to, whenever an issue came up that maybe could be solved by the surface facility, we've encouraged them to take that back and see if they couldn't solve it by the surface facility, rather than the designing the TAD to accommodate--to solve that problem.

In terms of looking ahead a little bit, in terms of our crystal ball, while TAD commercialization has been on the back burner, we believe this issue is critical to the ultimate success of the TAD. We believe that the TAD performance spec is only a first step towards realizing the full potential of the clean canistered approach to the repository, and it's our opinion that market forces alone will not trigger the design, licensing, and fabrication of TAD canisters. I think the DOE recognizes this, and I think to this end, they have issued a notice of program interests on April 26th to identify qualified companies for the next phase of the TAD development.

The next step should be establishment of contractual mechanisms to design,license, fabricate

"generation one" TADs, at least until such time the market is ready to be able to drive the development and sales of future generations of TADs.

As I mentioned, we had a number of technical information exchanges on this issue. We've met on four separate occasions, and had exchanges, in some cases, day long sessions. We believe the questions are being answered and the issues are being resolved, and progress is being made. So, again, we are laser focused on driving towards the issuance of a performance spec this summer. And, again, we are optimistic that we are on course, that DOE is on course for that.

While this is still a work in progress at this point, we have additional interactions planned between now and, depending on your definition of summer, but we hope it's mid summer, when the TAD specification is issued. So, that's really about the process. and now Rod is going to talk a little bit about some of the technical issues which are of great interest to you.

MC CULLUM: Yes. And, I know the Board likes to spend about half the time on presentation and half the time on questions, so, we will quickly introduce these. And, I figure they might be a topic of discussion. If we could go to the next slide?

This is going to be a two page list, just so you

all know that it's not just us getting together with DOE and singing Cumbaya, there's real meaty technical discussion going on here.

This is a summary list of the issues we are in fact discussing. Chris mentioned carbon steel. You know, we have a lot of experience with our pools, and the word unacceptable, bare carbon steel doesn't work in our pools. DOE I think has received that message. There really are two solution paths. One is coatings, and we've provided some information on coatings. Perhaps the more preferred and more likely path would be for DOE to find that it has enough carbon and stainless steel to meet its postclosure needs. And, you know, certainly our EPRI analysis would indicate that that would be the case. You know, there's two paths, one of which we think has a strong probability of success.

Shielding requirements. Again, this is where you want to look at a facility that builds a layer into its own design, you want to look at realistically, what the radiation doses are going to be, and also building in the facility as to not encumber the TAD with more shielding than needs to be built into it, and making it less wieldy for transportation and storage and handling.

Criticality and reactivity control. We've had a lot of discussions about a wide range of topics in this. And, I would submit to you probably the one topic when we say

it's a work in progress that needs the most additional discussion is this issue of Gadolinium. Again, we see a potential solution for that here, but we in the industry provided some information. It's not that we don't think Gadolinium would perform the function that DOE does. It's the question of do they have enough information on the Gadolinium in the form they're going to be using it to support a licensing process, and maybe they do want to for a Part 63 perspective, but they might not for a Part 71 perspective, and maybe that's okay. Maybe it's an issue where for Part 71 and Part 72 perspective, the Gadolinium coils don't do anything other than take up more space than warranted. Whereas, in Part 63, they do perform a function.

But, we're going to continue to discuss this issue. I think that's particularly not as much everything criticality, but the issue of the role of Gadolinium.

Thermal requirements. You know, DOE I think I want to compliment them here. They have been very understanding. I think this is one of the issues where they've moved their position to align with our position. The role of aging at the repository, DOE is going to be willing to, they're not imposing repository performance requirements on the TAD. They're going to load TADs to greater than 11.4 kilowatts, and age them to 11.4 kilowatts. We have shared some information with them on how long this might be, and, you

know, we're talking decades in a couple of cases, in many cases. But, it's not an unreasonable period of time, given the aging facility we've seen in DOE's plans to date.

Canister handling. Again, solve local problems locally. These issues have been fairly straightforward.

Go to the next slide. Aging pad seismic requirements. We've designed casks in places like California. As long as we had the seismic envelope, we don't see this as being a problem.

Overpacks and transfer casks. Again, you saw from Chris's presentation, we're looking at the whole system, and I think we are providing the information we need to credibly do that.

The same thing with package closure and seal integrity. Regulatory interfaces, that's the key point, that's where there's some risks, you know, making sure that risk is addressed in terms of the contractual and commercial issues. But not taking the risk, not going ahead and developing TADs for Part 71 and 72 in parallel with Part 63 licensing process. But to think about how it impacts the energy choices we make in the future. Not a good idea.

ASME Code compliance. DOE seems to know what it wants to do there, and we don't disagree.

Transportation issues, again, the overall system is being looked at. These things, in a way, they helped us in

transportation, because right now, these big dual purpose casks that we have on our sites, some of them are licensed for storage only because of the higher--you know, some of the fuels we now have, without more burnup credit, we're having challenges licensing them for transportation. So, in a way, the TADs will be even more transportable by being smaller.

So, you know, these are the issues. Going onto the concluding slide there, you know, we really believe that the TAD is an important initiative and it's reflected by the fact that all the members of both David's organization and my organization are approaching it with a great sense of urgency, as is DOE. And, that's the commitment.

We're addressing the technical challenges, and as David has mentioned, you know, one of the things we wanted to do from the outset was let's not let the commercial become a barrier to resolving the technical issues. Let's resolve the technical issues first, and once we know what the TAD is going to do technically, what the performance requirements will be technically, then we can talk about the commercial and contractual issues.

You know, if you press us on questions, probably David and I will politely "no comment," they're just discussions that have to occur. Folks have contract rights, and commercial interests, and I'm not one to give any of those up. But, DOE has indicated a willingness to do this.

And, if DOE goes forward as forthrightly in this area as they have in the technical area, we see no reason to believe it can't succeed.

So, with that, David here will answer all the questions.

ABKOWITZ: Questions, Andy?

KADAK: Yes, Kadak.

I had a couple of questions that I asked Chris earlier that maybe you can help me answer. Do you expect to have the utilities repackage their spent fuel at the--at your sites for TAD loading?

MC CULLUM: The current expectation--the short answer to that would be no. However, that gets into, you know, contractual negotiations. Clearly, there's some cases where they can't, and I'm sure you are familiar with places like Maine Yankee and Trojan where there's no more pool.

You know, DOE has I think done a very good job of saying we're going to provide a limited bare fuel handling capability, and we're going to try and get these TADs on line as quickly as possible, so we don't have to over-rely on that limited capability. The question of will any utility ever agree to repackage an existing canister? And, again, that's a contractual question, and it depends on how that negotiation comes out.

I think right now, we need to work on minimizing

the number of cases in which we will face that dilemma.

KADAK: One of the assumptions in the total system model is that roughly 90 percent of the fuel, spent fuel in existence, would be TAD-ed. Do you think that's a reasonable assumption, given your answer?

MC CULLUM: I think it might very well be. If you go back to the whatever, I think it's Slide 8, which is the slide that has the numbers on it, yes, that slide there, I mean, right now, you're at a little bit over 10 percent. You know, you might get up to 20 percent. Now, can, over time, DOE actually handle more if they had to age it longer, if they had to--you know, there's a throughput question, you know, will they have to amend the license at some point if they're going to hire more than 10 if they're not successful in the negotiations.

Again, I'm not going to presuppose if there are going to be any such negotiations, or how they will conclude. But, you know, in a world where orders of magnitude start to become important, if we move in the next five or six years, and I'm speaking on behalf of my utility members, we would like to see it even faster.

If we move smartly forward with the TADs, we're not going to be far off that 10 percent. It's not going to be that great of a challenge when you look at the overall system.

KADAK: So, you think the utilities can blend to the DOE requirements, whatever they are?

MC CULLUM: Well, I wasn't answering that--I will clarify. I wasn't answering that question from the standpoint of blending, I was answering the question from the standpoint of accepting existing dual purpose.

As far as blending goes, everything we talked about, as long as we can load it to meet transportation and storage heat loads and criticality requirements, and all that, DOE has seemed to indicate that they would then age it on their sites until it meets their thermal requirements. We're not anticipating any blending for thermal reasons on our sites.

KADAK: And, one last question relative to burnup credit. Clearly, it's an important criteria. From what you have heard from the Nuclear Regulatory Commission, do you think that criteria should be applied to performance specifications for the TAD?

MC CULLUM: Yes. And, we think that more burnup credit is in order. We're working to get that on existing packages, and--

KADAK: Did you say more or full?

MC CULLUM: Full would be good with me, as close as we can get to it.

KADAK: Thank you.

ABKOWITZ: John?

GARRICK: Yes, you've done a very nice job of giving us a glimpse of the large number of parties who are involved in this, and the components, and even some indication of some of the technical problems that are involved, such as some of the materials and materials compatibility.

Given that there are such a large number of parties, are you satisfied that if everybody that's involved in this has the level of appreciation for the complexity of the Project that is necessary in order for them to really appreciate the goal that they have to serve to make it successful?

And, putting it another way, one of the things that is very useful for a project of this complexity is a road map, and the road map that is sufficiently detailed that it's clear to every institution, every organization, every company that is involved, exactly where they fit in this grand scheme of things. Do you envision such a road map evolving, or being developed, or having it early enough where it really does enhance the communication and integration that this Board has a very genuine concern about?

MC CULLUM: Yes, we do. Let me answer the first part of that question by saying yes, I do feel everybody appreciates the complexities. And, also, that's why everybody wants to--they all understand the role they play in it.

If we could go to Slide 11, which is the graphic I put up, absolutely I anticipate there being a road map. This is very notional, I understand that's not a road map. I really look forward to DOE coming forward later this year in the schedule for the licensing process, so that we can start to evolve from this. I mean we need to preserve all the notions that are in there, and we need to stick to some of our commitments about the structure of the licensing process. That we start with performance specs, moving forward in parallel, and we have that very critical double arrow there, but that double arrow certainly needs to be much more well-defined. I mean, it's not nearly that simple in terms of making sure that everybody up here knows what's going on here, and everybody down here knows what's going on up here. That needs to be structured and, we at NEI, and I'm sure, David would say at USTC, are committed to working together with DOE to begin, once they have a path forward for themselves to make sure they give it that structure.

BLEE: I wouldn't want to say that every member feels exactly the same way. These are the consensus views. But, in terms of-- the key is reliance on the private sector, and there are a variety of ways that DOE can incentivize the private sector and create demand for utilities or create demand for these TADs. And, I think we don't want to have, in terms of this is the process, we don't want to have a

command and control micro-management of how the private sector goes about it.

Again, they have proven over the last 15 years, they are extremely capable of getting the job done, the utilities, working in partnership with utilities, are extremely capable of doing it safely and successfully. And, I know that Paul Golan, for instance, is using off the shelf, proven experience to the maximum extent possible--did I say that right? No.

So, I think, again, we have accomplished--and, I think the only new element to this is the Part 63. It's not a new element, but it is an element that has to be managed. But, if you look at the process to date, we are encouraged by what we have seen so far in terms of DOE's approach to it, decision making, all of those are good harbingers we believe.

ABKOWITZ: Thank you. Bill?

MURPHY: Murphy, Board.

You mentioned in the discussion of materials, that carbon steel would be unacceptable, and that the possibility would arise for coatings, but the most likely path would be to reassess carbon steel for repository performance. In that case, I presume there would be some other materials that you would use or propose. Could you talk about that?

MC CULLUM: Yes, we would be looking at stainless steel, and our expectation is that you would be able to find enough

of the iron that you need in--I may have said carbon before, I apologize--in the stainless steel to meet the postclosure. Again, this gets into, you know, peeling away some of the conservatisms in the analysis, and finding out what's really there. If you can do it with stainless, there's no need for carbon. We're okay with stainless. It works a lot better than trying to engineer a coating that, you know, is sure to last in one case, and not last in another case.

ABKOWITZ: Thank you. Rod, I had a question for you. You mentioned you're leaving to go to Florida to attend meetings involving DOE and NRC; is that correct?

MC CULLUM: Yes, I'll be more clear on what that is. It's the annual Industry Dry Storage Forum, and this is something that was planned even before we knew about this Board meeting. That was my slight on Heisenberg's and your measuring our momentum there.

NRC attends that, you know, the media attends that. It's an open forum. This year, we have expanded it from two days--it's normally two days every year--we've expanded it to three days, specifically because of the TAD initiative, because there is so much interest in that. And, this will be the first, you know, time we'll be really interacting with the NRC on this initiative, as well as DOE.

And, we have taken a position that we want to, before DOE gets too far down its road with NRC, and I think

Chris answered the question with NRC appropriately, it's appropriate that both the folks that are going to be providing the performance requirements, as well as the folks that are going to be providing the fuel that goes into this, have agreed it will work before we start to generate too much of a regulatory path forward, and we're getting to that point.

ABKOWITZ: Okay. This leaves me very confused. DOE and NRC, you expect, will be engaged in discussions on TAD in Florida over the next couple of days? We were told a short while ago that DOE has been wanting to get together with NRC for a long time to talk about TAD design and specification, but had been told by the NRC don't show up at our doorstep until you have a spec. So, help me out, please.

MC CULLUM: I'll let Chris clarify that.

KOUTS: You may have misinterpreted my remarks. I think that the industry conference that Rod's referring to is one-- we plan to give essentially the same presentation there that we gave here. I want to say that in terms of interactions with the NRC, I think that the Department needs to remain respectful of the NRC's role as a regulator, as I mentioned in my discussion, the NRC actually wants that interaction,that public interaction to be done in a manner where we have some technical information in front of the public in the form of a performance specification, and I

think the NRC's view and the Department's view is that until we have a specification out, discussions with the NRC would essentially not be as productive as they might be with that.

So, I don't think there's been a reluctance to meet with the NRC. I think there is a lack of substance upon which we can have meaningful public discussions, and we hope to have that public discussion after the performance specification is received.

ABKOWITZ: Okay, thank you. I now want to move to the issues that you raised where you said if we ask questions, you'll probably have to say "no comment." And, Dr. Kadak asked you the first of those, which was are the utilities willing to place spent fuel in dry storage back into the pools? I gather that was a no comment?

MC CULLUM: Yeah. That is a no comment.

ABKOWITZ: Okay. Now, I'll go and ask the question are utilities willing to trade within the waste acceptance gueue in order to make TAD workable? Is that also a no comment?

MC CULLUM: I will go as far as to point out that the queue slots are fungible, that they could be traded. However, when it gets too expensive, the willingness of anybody to actually do that, I'll have to say no comment.

ABKOWITZ: Okay. And, then, my final question, which I'm expecting a no comment from, is are the utilities willing to purchase more expensive TADs without assurances that the

waste will be moved, using them for storage, without assurances that they will be moved?

MC CULLUM: You know, again, there's a bit of a no comment in there because that gets into the whole idea of how is DOE going to incentivize the purchase of the cask for the TAD. But, I will say, as I pointed out, that--and, whatever happened to that one slide that showed all the companies planning on building reactors? There's about a dozen companies that are involved right now, spending real money and we may be seeing--we should be seeing in the mid to latter stages of this decade, license applications for new reactors. Yeah, if you can go to it in the handout there, you will see that.

But, the Chief Nuclear Officers and Chief Executive Officers of those companies do see a value in the TAD, which they are weighing against the increased costs of the TAD. Now, again, DOE is going to have to take on the appropriate amount of risk. You know, this just shows you how substantial the efforts are at building new reactors. And, when you look at creating a business environment in which these new reactors will be able to build them, as I said, we will build some, regardless of what happens at Yucca, there are some places where their needs are so great, will we build 50, like I showed on the other slide? Will we build 100? Who knows? But, creating the best possible business

environment, the TAD helps that. So, you know, maybe I can give up a little bit of negotiation there, but it is true that there is value in the TAD, and as long as it's properly incentivized, where I can't comment at this point, yes.

ABKOWITZ: Okay. I want to take those answers and reflect back on Dr. Garrick's reference to a road map, and Paul Golan's insistence that the program will be integrated and he will be accountable for that. The inter-dependencies of what's happening here, if you study them, and I know you have, is that how much can be actually put into TADs has dramatic implications on both the safety and the throughput and the thermal management issues at the mountain. And, it's very difficult to sit here and understand how a surface facility can be designed, and what kind of emplacement strategy is sensible, without knowing whether you can really put 90 percent, or 80 percent, or 70 percent, or whatever the number is.

So, it strikes me that you have a very serious chicken and egg problem here, and I have a very difficult time understanding how a license application and a TSPA can be submitted without resolving a number of these issues.

So, you made a comment that the DOE and utilities are approaching this problem with a great sense of urgency. My suggestion is the road map that is on the critical path of a great sense of urgency is getting rid of the litigation

problem you have, because I don't really believe that anyone believes that you guys can jump into bed and really solve this problem as long as you are competing with each other on these issues.

MC CULLUM: Well, yeah, again, I can't comment on the results of the legislation. But, I would agree if we haven't been jumping into bed already in terms of going through the technical issues and resolving the technical issues, I don't know what more we could do. It is--there have been substantial meetings, substantial discussions, substantial show of support. You know, it is true that in most business lines in America, you know, we're in a hotel, I'm sure there are-- Hilton is suing somebody, somebody is suing Hilton, suppliers, whatever. But companies that are suing each other do business together, and there are ways to do that. There are ways to structure this that you don't have to say, well, we can't do anything until everybody settles their lawsuit.

And, we have been working. Believe me, lawyers approve everything we do. Lawyers do approve everything we say. But, it goes back to, again, risk management. We cannot, and I'm not talking safety risk here, I'm talking business risk, financial risk, licensing risk, you cannot create a zero risk environment. We need to make sure that the risks are equitably distributed. We need to make sure that we do have a road map, I think was an excellent way to

put it, that allows us to move forward in the face of those risks, as we think the parallel path approach does that.

The greatest risk of all is zero risk, because then nothing happens, and we start to make energy choices. And, I hate to do that.

ABKOWITZ: Dr. Duquette, do you have a question?

DUQUETTE: Duquette, Board.

I can't let Dr. Abkowitz off the hook with finishing his session on time.

But, a more technical question, and getting off philosophy into a technical area, did I understand you properly that you think carbon steel is not good for TADs. That stainless steel will be okay, and that we're looking at overkill by even looking at Alloy 22?

MC CULLUM: We're talking about the internals. We fully support Alloy 22.

DUQUETTE: Thank you.

ABKOWITZ: Before we adjourn--oh, okay, Dr. Kadak, do you have one quick question?

KADAK: I'm trying to clarify in my mind what you mean by incentivize. Do you expect the DOE to pay each of the cask vendors to develop these designs? Because from my understanding, they're not likely to invest in a technology that may not be used. And, when do you think that if they do this, when do you think that these TADs would be available

for purchase, I guess is the way to call it now? Two questions.

MC CULLUM: Yes. Well, I think on the first question, DOE has said they're going to incentivize, and we're going to react to whatever proposal, the vendors are going to react to whatever proposal, and then I have to go back in the no comment space.

On the second question, I mean, we have talked about a period of years here. I think that if we get past that first question, if you get a good answer, and that's a very good question, obviously, that's why we're getting right to that crux now, if we get a good answer to that question, it might happen faster than the five to six years we talked about. I think that, you know, our companies that are interested in creating the environment, the new plants would like to see it happen faster than that. So, I hope that answers your question.

Before we adjourn, can I answer one question that Chris got that I haven't gotten yet?

ABKOWITZ: I'm sorry, what's that again?

MC CULLUM: One question that Chris got that I wanted to--and I forgot to mention it in the talk that I answered. Can I ask myself a question?

ABKOWITZ: Sure, as long as you also answer one that's been submitted to me.

MC CULLUM: Okay, I'll do that first.

ABKOWITZ: And, I don't know if this is you or Chris, but the question was will DOE specification require that all materials be put into a TAD--that all material that's put into a TAD be intact, in other words, no damaged fuel? I don't know if that's a question you or Chris should answer for us.

MC CULLUM: You know, they have to accept all the fuel. You know, there are provisions for things being different, for what was originally defined as canistered fuel. What is the definition of damaged fuel? The answer was that if they have to--we have to have a system that can accept all fuel, whether that's something they choose to accept in the TAD, or whether that's something that they're going to handle in some other way, I don't want to presuppose that at this point.

ABKOWITZ: Okay. Did you have a question you wanted to ask yourself?

MC CULLUM: Yes. The question that was put to Chris was about a sampling program, getting into the casks and looking at what's really there. I did want to point out that in our vast experience with Part 71 and Part 72 licensing, reactor records, records that were developed in an NRC license environment that was very rigorous are always considered acceptable, and we would expect that in the environment of the TAD, that we would continue the same regulatory process,

that we're expected to know what goes into the casks before we put it in there with high certainty, and that does not have to be questioned in the future. We would expect what's been good traditionally for decades in Part 71 and 72 licensing, would also be good, even with the extension of Part 63 licensing.

ABKOWITZ: Okay, thank you, and thank you, Rod and David, for your time and patience.

We're going to adjourn now, and reconvene at 1 o'clock.

(Whereupon, the lunch recess was taken.)

AFTERNOON SESSION

ABKOWITZ: Our first presentation, we'll have Chris Kouts back up here again to talk about the total system model analyses supporting the TAD concept, and then he will be followed by Paul Harrington, who will talk about the effect of the TAD decision on surface facility design. Then, we'll take a break, and I will hand the baton back to Chairman Garrick at that time.

So, I would like to invite Chris to come back up here and start us off.

KOUTS: Can everyone hear me? Okay, I don't see any nos. Thank you, Dr. Abkowitz.

Before I begin my presentation, I would like to clarify something I said earlier, and I was reminded by a member of my staff that when we did announce the TAD concept back last October, the NRC did request that we meet them early on to discuss how we might implement it. However, it was the Department's view at that time, and my view at that time also, that until we had more technical work done, until we had something substantial to discuss, that we didn't think that those interactions would be meaningful.

Subsequently, we have discussed a technical exchange with the NRC, as I said earlier today, and we do plan on having that. However, I did want to clarify that. The NRC did want to meet, and the Department was reluctant to do that until we had a more defined approach, and more technical work done on the TAD system. So, I don't think I have any other mea culpas at this moment.

I do want to, as we get into the total system model, I'll just say this, that I am somewhat of a student of history, and for those of you who know something about Arthur Wellsley, who was the first Duke of Wellington, and a great British statesman and great military commander, and you probably remember that he defeated Napoleon at the Battle of Waterloo, but he did a lot of other great things in his military career before that in India and in the Peninsula campaign, then later became the first Prime Minister. And, at the end of his life, he was asked by one of his great grandchildren if he had any regrets, and he said essentially, one comment, and he was a very terse individual, he said, "I should have given more credit." And, by that, many of the men and the units who served under him, whenever he wrote his dispatches at the end of battles, he was very terse, he did not cover all the bases, so to speak, and he bruised a lot of feelings, especially when people's lives were of concern.

So, trying to learn from the Duke's mistakes, I do

want to give credit for a lot of the development in the total system model to Don Kim, who is a member of my staff, who I know has briefed the Board on numerous occasions, occasions where I couldn't be there, both members of staff, and I do want to give Don the credit to which he is due for the work on this model.

Now, moving to the presentation, if we can go to the next slide, I'll talk a little bit about the model overview, and I will talk about essentially the study that we did prior to the time that the Department made the decision to go to TAD. This was a study that we commissioned back in, I believe, March of last year, and we made a variety of assumptions, and we'll walk through some of the results of those studies that helped inform the Department's decision about going to TAD.

If we can go to the next slide? As the Board is aware, we continue, the Department continues to develop an integrated solution to the overall waste management system. There are a lot of diverse issues associated with trying to develop that solution. And, the development of the total system model, which has occurred over the past several years, is one tool that I think helps us analyze the system. It helps us analyze alternatives. It helps us analyze policy implications, or going different areas and the policy shifts, and different programmatic paths that we might take.

So, from that perspective, it's been a very useful tool. It's not the only tool we use. Nonetheless, it's gotten the interest of the Board, and I certainly appreciate the comments made earlier.

Let's go to the next slide. I've gone over some of this material in the past, and I'll do it briefly, but we'll talk a little bit about the architecture associated with what the total system model is.

On the left of your screen here, where you see we have a preprocessor essentially where we develop the logistics, the actual pickup parameters that we would want to go through to pick up fuel from utility sites and defense facilities. That feeds into SimCAD, which is a trademark model that we use that's been essentially used by a variety of organizations around the country, more and more used by the pharmaceutical industry. Many industrial process lines use it to try to hone in on that, how they can operate more effectively and efficiently.

It's essentially an object directed, or an object oriented code such that basically one section of the code asks if it needs something, it calls for something from another section. In other words, if the repository needs a waste package, or if it needs a transportation cask, that trigger essentially goes back to the system and pulls that through it.

So, the driving force behind the implementation, or what makes the code, what is the forcing function essentially, has to do with our baseline requirements, our acceptance schedules, and so forth, that we have in our baseline documents.

The TSM creates, one of its advantages is that one thing, it has a graphical user interface, which I will get to in a moment, where the operator can look at how the system is operating, and you can see whether or not there's a choke point in the system. The operator can address that. You can also learn from the operation of this system in terms of where those choke points are and where we need to work on certain aspects.

And, another advantage of it is report generation. It gives us incredible amounts of data every step along the way about how an individual package, or a bundle of fuel, if you will, moves through the system. You know, it's pad through the system, transportation routes, so forth and so on. So, it's very, very informative. It's a work in progress, and we will continue to make it better as we get additional data, and as our facilities get more refined and our designs get a little bit more further along.

I will talk a little bit about the inputs to the code. On the left, we have a variety of things, including spent nuclear fuel characteristics, DOE high-level waste,

spent nuclear fuel characteristics. We look at dry storage parameters, just about anything you can think of from a utility perspective we can model.

From a transport perspective, we essentially take the routes that we used in our EIS we published in 2002, and we use that routing mechanism, both for rail and for truck. We use transit times based on understanding of how these would move through the transportation system. We can do a variety of truck and rail options and look at, as I said earlier, it allows you the flexibility to look at alternatives, and understand how the system can operate under a variety of different conditions.

As far as the repository is concerned, one of the drivers in terms of putting packages underground obviously are thermal limits. So, that trickles back to the system in terms of what we pick up from the utilities, what we have to age on site, and also what we can put underground and the amount of that aging. And, we will talk about that when we get to some of the results a little later.

And, I think we've talked about most of the things I want to talk about on this slide. Those are the inputs.

The outputs, again, we get amount of truck/rail or shipping schedules, a variety of inputs, or outputs, if you will, as to how the materials move through the system. We can get dose, not only at DOE facilities, we can get it along

the transportation routes, we can get it at utility sites. Life cycle cost, it's certainly helpful in that perspective, not so much as an absolute, but in terms of a relativistic view of how one option, system option will look to another.

We can, as I mentioned earlier, get a read-out as to how much aging we have to have on site based on the type and the amount of fuel that we picked up. And, what's very important to us is that we can understand whether or not we're meeting our apparent requirements that the Director wants in terms of whether or not we're moving the fuel through the system in the amounts that we expect to move it, and it helps inform us as to the capability of our designs as we move forward. And, it also gives us a perspective of uncertainties and sensitivities with the system.

And, the other interesting part of the code is for those of you who have seen it operate, is it does provide a synergistic understanding of how the system works, how one element of the system can trickle back and affect another one, or how you can adjust various aspects of the system in order to accommodate uncertainties.

Let's talk a little bit about the graphical user interface on the next page. This is just one very broad screen that you can pull up, essentially the top of the screen shows you utility sites themselves, and those utility sites are broken down to the amount of fuel that sits within

a spent fuel core, or that resides in storage. We use industry data. The last call we had for industry data was, I believe, in 2003 in terms of where they were with dry storage. That actually reflects 2002 information. Nonetheless, we regularly go out to the industry, ask them to update our information. So, we are using the latest information that industry has to provide us.

Transportation routes, as I mentioned earlier, the next two sets, we have rail and we have truck. Basically, we are using the routes that were identified, routes that were identified in our EIS in terms of how we move across the system. Barging options are also considered, you know, heavy haul to a barging option is also considered. We look at all those alternatives.

And then, of course, when we get to the geologic repository operations area, the lower area, that effectively essentially models what we expect to have in terms of surface facilities on site, and also, again, the amount of dry storage we'll have on site, or aging on site, in order to meet our thermal needs. It's a very powerful tool, and for those of you who watched it operate, it's very, very helpful.

Let's talk a little bit now about the system study that we started in March of last year. That was essentially to evaluate the feasibility of the TAD concept using essentially commercial spent fuel. Right now, our baseline

assumption for DOE materials, including spent fuel and for vitrified materials, are that they will come canistered to the facilities, as well as the Navy spent fuel that will be canistered when we receive it.

So, what we had to do at that point was do some kind of internal adjustments to the model, not really based on design information, but based on what we would anticipate that canister handling facilities could do on site. We looked at about 70 combinations of parameters, some of which I will talk about in a minute, came up with about 40 alternative scenarios. And, again, our intent when we did this study was not so much to try to determine how the system would be optimized, or optimally operate, but, rather, to understand the bounds of the operations, and the upper bounds and the lower bounds, if you will, of how we would operate between that. Because we could get the extremes down, we knew that the answer would ultimately be somewhere in between.

And, when I start to talk about things, let's go to the next page for a moment. The first couple of slides that you will see will be, when I show you some of the results, will be based on what I would consider to be the old system, the old system meaning the bare fuel handling system. And, we will show you essentially how we viewed that in operation. And, then, when you overlay the concept of a canister

system, not going to a bare fuel system, and you can look at the effects of what that does to the system.

Let's talk for a moment about the different parameters that went into it, and I think this bears some discussion, so I think the Board understands exactly how the model operates and how we use it to understand the different parameters and the outer bounds of the operation.

Let's take the first example, in terms of accepting spent fuel from utilities. We have two items there, YFF10/YFF5, and there are actually variations, two variations of each of those. And, what do we mean by YFF10 and YFF5? That's youngest fuel first, 10 year cool. So, essentially, we'll take the youngest fuel that the utility has on site, and we can also adjust whether or not it's in the pool, or whether or not we're taking it from the dry storage site. And, we can do a very strict interpretation of that, or we can do a not so strict interpretation.

A strict interpretation means if the utility can't meet YFF10, or YFF5, we skip it. We don't pick up any material from that site. Or, if you take a little bit more of a less strict view, you essentially look at what you can load the cask with, bring it to the site, and then we have to determine how much aging would have to be done. So, we look, for each of these parameters, we look at the outer bounds, if you will, a strict implementation of it, or a not so strict

implementation of it. Again, this gives us an understanding of the bounds under which this system will operate.

Similar for, let's see, other things here, the same thing with heat load. We can do at 11.8, which is our current design basis in terms of what the heat load is for each individual waste package. We can do that on a strict basis, meaning we'll load a TAD at a reactor site, and it will either meet 11.8, or we don't accept it, and we'll just skip that, or we can look at the closest they can get to that 11.8, and then bring it on site and age it to the necessary amount.

And, we looked at three different heat loads in that study. We looked at a very cold heat load, a cold heat load, at 7.5 kilowatts. We looked at a higher heat load at 18 kilowatts, and we looked at strict and non-strict versions of each of those.

In addition to that, we looked at different sized TADs. We looked at the baseline case for our waste package right now, which, as I mentioned this morning, was a 21 PWR, or 44 BWR. We looked at a 32/68, 32 PWR, 68 BWR. We looked at the various heat ranges associated with that. And, we also looked at going to a smaller TAD. So, we tried to cover in this study as many different scenarios as we possibly could in order to understand, again, how the system potentially can operate.

And, let's see, is there anything else I want to cover here? The other thing I think is important to note is that we had a base case a few years ago in terms of our transportation capability, or the transportation infrastructure capability at the utility sites. Those assumptions were based on, essentially, that there was more capability to handle heavier devices at the utility sites than actually exist today. About two years ago, we went out and did another survey, if you will, and we found that some of those assumptions needed to be adjusted, and I will show you some of the effects of that as we move forward. And, I think that's pretty much all I wanted to cover on that page, and now we will go to some of the results.

Let's take the baseline scenario, what we call Case 0A. And, this is, let's go back in history a little bit, this is when we had an FHF, which was an initial dry handling facility. We had a CHF, a canister handling facility for defense materials, and we had two large dry transfer facilities, DTFs, that were for handling bare fuel on site. And, when we modeled that, with certain assumptions, and that's, as you can see here, we're moving things mostly in rail. The shutdown sites dump to pool, which means that the shutdown sites don't get rid of their pools. They basically put all their material in their pools, and take the material from the pools. YFF10, I think we have already talked about,

and 11.8 kilowatts.

And, what we are looking at here in the upper left is what our capability is at the repository site, with that older system, to process. And, effectively, this dip that you see here, or valley curve, as some of our analysts like to call it, is essentially reflective of the fact that our heavier production facilities come on line later than the initial operation of the facility, therefore, in terms of meeting our waste acceptance baseline, which is 400 metric tons the first year, 600 the next, 12 the next, 2000 the fourth, and 3000 thereafter, that we had a deficit of about-- that we work off in the first 30 to 40 years. And, the total amount of the deficit in any one year, the greatest amount is approximately 11,000, 11,000 behind, 11,000 tons behind in taking the amount of fuel that we want to from the utilities.

Again, this informed us of what the capabilities of that were, of that system were. And, when we look at the amount of aging on site that we would need, that's roughly about 2000 site-specific aging canisters, if you will, that we would use on site in order to cool the fuel down to what we needed. That's roughly about 9 metric tons per canister, so that's roughly about 18,000 metric tons. So, that, again, gives us an idea of what our system was prior to the time that we decided to go to a canister approach.

I'm also going to show you the impacts, on the next

slide, of going to essentially the new infrastructure data that we developed from the utilities. Now, you see we have a very minor valley curve, if you will, if you go to the next slide, with the primary difference being the capabilities at the reactor sites to handle larger casks. Again, these are bare fuel casks.

And, the other interesting information here is that in terms of handling a bare fuel cask, the handling of a bare fuel cask at the repository, whether it's a truck cask or a rail cask, it essentially takes the same amount of time. You've got to take all the bolts off, you've got to move the personnel barriers, take the bolts off, mate it to the cells, do all the things you need to do. The actual transfer of the fuel doesn't take very long. So, essentially, if you've got lower capacity casks that you're operating on, you have to run a lot more casks through the system and through the repository surface facilities in order to get the same amount of fuel.

And, what we're finding here is that you see a much larger deficit for that older system, if you will, based on the fact that the capabilities of the sites, the assumptions that we were using, changed. And, with updated assumptions, again, our requirements were not being met as well.

The other thing on the right side of that curve, I think gives you a perspective based on different heat loads--

or, not heat loads--there's heat requirements for disposal going to the coldest, which is the red line--I should--yeah, the coldest, which is the red line, which is the top, down to the hottest repository, if you will. So, it's 7.5 on top, 11.8 in the middle, and 18 kilowatts down below. And, you can see that the amount of aging that we have is very, very sensitive to the emplacement regime that we have at the repository. But, the colder the emplacement regime, the much more on-site storage we're going to have, or on-site aging that we're going to have to do.

Okay, now, let's look at our TAD system here. And, this is one, a specific case where we looked at our ability, and, again, when we did this study, we didn't have any designs to base this on. The modelers made some assumptions associated on the cask handling facility that we were already in the process of designing in terms of its ability to handle TADs.

What we find here, if you go to a mostly rail scenario, and at this point, we looked at a medium TAD, which we call the 21/44, and a small TAD, which is a 12/24, and looking at legal weight trucks for some sites, you can see that in this scenario, at least, the mythical facilities, if you will, that we developed in order to model, that we can meet our annual processing abilities at the, in other words, accepted and deal with it at the repository site.

The one issue, however, is that we could get a great deal of aging, or need a great deal of aging associated with that, based on the total amount of fuel that we have to move.

So, again, this provides some perspective as to what a TAD system would look like. Let's look at one where we're changing another parameter here. Again, this is using the TAD system, an 18 kilowatt case, the former one was 11.8, and you can see that there's quite a difference in terms of our processing capability. What this dip shows toward the end of the operational life of the repository is that we're running out of fuel at the reactor sites that's cool enough in order to just transport it, and that's why we're getting this dip. And, that's effectively, potentially, what can happen.

In addition to that, this also looks at the other parameter we revised here, is a large TAD, and you will find when you go to a large TAD, and even to an 18 kilowatt package, it doesn't provide you that many benefits, because you've got ten more slots that you're utilizing. And in order to meet the heat load, it's even more challenging to do that with a 32/68. So, you're not getting a lot of benefits in terms of reduction in aging going to a larger package.

Again, this gives you a flavor, if you will, of the types of analyses that we conducted. And, the summary I

think to all of this is that when we did these analyses, we felt that our capabilities, based on our understanding of the types of facilities that we would need on site, that effectively, that our system requirements could be met to meet our waste acceptance goals. The aging limit, depending on how you looked at the system, could stay within what our current plan is, which is roughly about 21,000 metric tons of aging, and we can get the specified amount of material in the statutory case, which is the 70,000 metric ton repository, done within 50 years of initial receipt.

I know the Board will probably have a variety of questions, and I'll be happy to try to address them now.

ABKOWITZ: Thank you, Chris. Board members want to start the questioning? Dr. Kadak?

KADAK: Kadak. I'm curious about based on our conversation this morning, what the key assumptions you assume in the TSM are regarding packaging of the TADs, and particularly the spent fuel that is now in storage at the reactor sites, and the ability to blend for, let's just say, the 11.8 kilowatts?

KOUTS: Okay, I think the bottom line is what the model indicates, and it depends on the scenarios that you run. But, depending on how you operate, you can meet the 11.8 for the statutory case, which is the 70,000 metric ton case, 63,000 of that is spent nuclear fuel, commercial spent

nuclear fuel, and about 7,000 of that is defense material. So, what the models show is that you can stay within our 21,000 tons of aging, which was our initial plan, and still meet those requirements.

KADAK: This is surprising, because when we had some of our meetings with the utilities, they didn't feel that they were able to meet the blending requirement, which, if I understand it correctly, is now going to be a requirement for TAD.

KOUTS: Okay, let's take first things first. In terms of the performance specification that we will issue, we will not require that the TAD has to be 11.8 kilowatts. We will not require that. Our expectation is that we will want to design the TAD for as broad a heat capability as possible, and I think the only limit that it will have is probably that which would allow it to still be transported, which my assumption is somewhere around 21 kilowatts per cask, or per TAD, if you will.

So, our expectation is we're not going to put a heat load, or heat design requirement on the TAD other than you have to have a certain heat rejection capability, so that it meets the same requirements that we have, that a waste package would have in a drift. So, in terms of the heat transfer capability internal to it, and the heat flux that comes out of it, given a heat source, we're going to have to

have that same requirement, and that's something we have discussed with the industry, and I don't anticipate that that will be a problem.

But, in terms of your question, where you're getting to is whether or not we're going to require an 11.8 kilowatt TAD to be loaded at the utility site, if they can do that, fine. If they can't, then we'll have to take it to our facility and age it, and then it will have to age there until it's ready to be emplaced and meet our thermal requirements.

KADAK: So, let me just make sure I understand what you just said. You said as long as the TAD can meet, from a heat load perspective, that the TAD can meet the transportation requirements, which looks arguably perhaps more limiting, for on-site storage requirements, you will accept it for either disposal or on-site storage?

KOUTS: The simple answer to the question is yes. If it meets the requirements of the, you know, if it has the right criticality controls, it has the right internal materials, and so forth, then that would still be acceptable. But, what I think you need to separate out here is what we could accept from the utilities and move over the rails, if you will, to Yucca Mountain, and then what we could put in Yucca Mountain based on our thermal requirements.

So, yes, we can accept that from the utilities. Our desire would be to try to minimize our aging on site, or

to the extent they can't support that, and we're servicing the utility site, then we'll take those materials on site and we'll age it until it's ready to be emplaced.

KADAK: What is the outside window on the time permitted for on-site storage at Yucca Mountain?

KOUTS: That would all be determinate of the license that the NRC gives us to operate, which could be--our ongoing assumption has been historically that for our preclosure safety analysis, we're looking at a 50 year time period. That's not to say that the operation of the repository couldn't be extended beyond that if we were unable to get that in. But, then, our preclosure safety analysis would have to be adjusted.

ABKOWITZ: John?

GARRICK: Chris, I'm very interested in the level of detail of the scenarios that are input to the model. And, I'm sure I would have had answers to these had I been able to attend some of the meetings that the Committee members have attended. In particular, I'm interested in the representation of the interfaces between major activities, like acceptance and transportation, and transportation and the repository, and even more particularly, the fuel handling, the actual fuel handling operations.

Now, your Table 5, or your Slide 5 and 9 give some insight into that. But, could you give us a little

confidence-building explanation of how some of these details are represented in the model?

KOUTS: Sure. First of all, our desire, in terms of doing modeling with any of the components within the system, is to go to that individual system component to get the information, so if there is specific information associated with the design of the facility, we will go directly to the designers and ask them, at least for the purposes of our needs to model it, what the capabilities are for those facilities.

For instance, how long does the repository--the repository designers are designing an acceptance cell in one of their facilities. How long does it take, and what's their expectations for how long does it take for them to handle a cask, whether it be a truck cask or a rail cask? How long does it take them to unload it? How long does it take them to return it to service? All this kind of information is basically received from the people who are actually doing the design work. We take that information, and we input that into the model.

So, the modelers don't sit down and make up this information. We go internally to the program, to those sources, and to the extent that we can, we try to find a document, or documentation, associated with every assumption that we use, so we always have traceability of exactly what

we're modeling and what we're analyzing.

So, the simple answer to your question is that we go to the source, if you will, for that information. Except, in the case, the only point I'll amend is that when we were doing this study, we had to make some assumptions associated with how canister handling would be done, since we really hadn't designed any facilities for TADs back when we started this, back in March of 2005. So, we had to take the old canister handling facility that we had designed, which was designed essentially for DOE spent fuel canisters, and for DOE high-level waste canisters, and make some assumptions associated with how those might be handled within a facility like that.

But, the simple answer to your question is that we go back to the source, if you will, the source of information within the Program, and document exactly where we get that information. We try to keep that updated as much as we can.

GARRICK: The model, of course, is primarily for the purpose of simulating different operating scenarios, and you've heard the Board raise the question of whether or not you intend to consider upset conditions. The problem with addressing upset conditions in most simulation models is that the details that you need to really represent the kind of failures and faults that generally happen is such that the model can sometimes blow up.

Are you intending to move in that direction, however?

KOUTS: As we get further into this. I totally agree with you, Dr. Garrick. Our ability at this point would be okay, if this facility is shut down, we'll shut that facility down, now, let's see how the repository operates in response to that, how much we have to put in aging, how much other facilities could potentially take. But, what you're suggesting is more modeling in there, you know, off-normal events, if you will, where there would be a down time in certain areas. I think that's something that will be coming, but I don't think we're there right now.

GARRICK: Thank you.

ABKOWITZ: Thure?

CERLING: Cerling, Board.

I was going to ask a very similar question, so I'll just follow on on that. When do you think you will be able to get onto that sort of a time scale to look at these events that have a lot of inertia that are sometimes hard to change once systems get going?

KOUTS: I think that the modeling will need to be updated to reflect the design work once we have a decision as to whether we're going formally to the canistered approach, which we hope to receive in the next month or two, then there will be a lot of design work that will be done to address the

facilities that we will need in order to operate. I think once those designs mature over the next year, we will get that input in there, and I think we can potentially run some of the scenarios with the Board that it is interested in. But, until we get a little bit further along, again, you know, we are re-baselining the program, and we get some design work done, we are not going to be in a position to do, from my own perspective, meaningful analysis that will be helpful to us. But, I think that is certainly something that we want to do as soon as we get far enough along in our design.

ABKOWITZ: Ali?

MOSLEH: Mosleh, Board.

On how you're planning to utilize this system, and we understand that you have the foundation for when you do a number of quite interesting exercises, I was wondering if you had the space, whether you can actually do optimization, or not?

KOUTS: I think that's--I don't think we are at the stage where we can think about optimizing. I think we need to get a system that we think can work, and work safely, and perhaps inefficiently, and then perhaps we can look at ways to make it more inefficient--or efficient, I should say, excuse me. But, right now, given our level of where we are in terms of marching down a new path, I think we can gain

insight into the model. Just as these charts indicate, going to a larger TAD, for instance, can bring certain benefits from the standpoint of, yes, you can move, potentially move more fuel from the reactor sites, but you still have limitations on the amount that can actually handle those larger TADs.

The same thing with heat load, if your 11.8 heat load stays the same, going to a 32/68 waste package will require much longer aging because you've got more assemblies in there, and the amount of time it will take in order for them to age down to 11.8 could be a problem.

So, again, this is something that I think we're going to monitor and try to figure out how best it is going to operate in the future, but our initial intent here is to try to get something that will operate initially. It may not be the most efficient, but along the way, we will look to make that more efficient as we move forward.

MOSLEH: On that line of spending to keep it relative, I think I asked this question sometime back, but I'm asking it again to see if you are actually moving in that direction, and maybe the treatment of uncertainties in a rigorous way, because I think at this point, you're selecting points from a range of parameters that you have and that you run scenarios individually; right?

KOUTS: Well, I think all we can do is bound the problem

I think at this point. I think we can understand the best that it can operate under a certain configuration and the worst that it can operate under a certain configuration. And, the answer is it will probably be somewhere in between.

But, again, without further design work, without further understanding, without getting a specification out and actually getting some designs and understanding what those designs look like, and how they can be handled, and so forth, I think we're going to have to hold off. We can do some theoretical analyses, but how applicable they will be to how the system will essentially operate, you know, I don't think it would be that useful.

MOSLEH: So, you are basically not--you have knowledge limitation as opposed to computational?

KOUTS I think we can model anything. I think the effectiveness of the results of the model are all dependent on your inputs. If your inputs are still imprecise, then it doesn't make a lot of sense to optimize it. But, as your inputs become more precise, and as you get a better idea as to specifically what your buildings look like and how they are going to operate, then I think you can start looking at those kinds of issues and determine, hopefully, I think, and my desire is actually as we go through the design process, and once we receive the go-ahead to go to the canister approach, hopefully in the next month or so, there is going

to be a great deal of design effort underway to try to make these facilities, to get to the level of design that we'll need for a license application.

And, one of the discussions we are having internally is how the total system model can help that process, in other words, can provide some guidance as to how the system and how those facilities can operate effectively, and more efficiently while they are designing it. So, I think that's something I think that we have the money for this year, and we will be able to do that. And, you've heard about our new organization. That's one of the things that I hope to work very closely with the designers of the repository to make sure that we are getting TSM inputs and making sure that at least they are being informed by how this is going to work.

ABKOWITZ: Chris, I'm going to take my turn in the order here, as you know, as Chair of the Waste Management System Panel, and someone who has been studying TSM for a while, maybe I'm going to delve a little deeper than what your presentation has showed us so far.

KOUTS: Okay.

ABKOWITZ: I do want to start, though, by commending your office once again for developing what I think is an excellent tool. It's well founded. It's representative. It's transparent if you allow it to be. I think it offers

very important insights that the DOE really needs to take stock of, and in many respects, I think it's not even fully utilized at this point.

I want to start actually by going to your concluding slide where you have come to the conclusion from the study that the 21,000 metric ton aging capacity limit is achievable, and emplacement can be completed within 50 years.

Why did you not show us the results, or the run that showed those results?

KOUTS: There were 40 different combinations. What we selected in terms of showing to the Board, and the Board does have the report and you know basically which scenario that is, my desire here was to try to show how the model can show us, if you will, based on different assumptions, how the differences, you know, visible differences in how the system can operate. In terms of the actual scenario that indicates this, actually, there were several scenarios, not just one. And, we can certainly pull out that report and walk through that with you.

ABKOWITZ: It would seem to me that the key study observation from Phase One was that the aging pad was large enough, and that emplacement could be completed within the expected time frame, and it would be worthwhile to show that.

Now, I would like to go to the scenarios that you did present, and I think they were scenarios 10 through 13.

There were four all together?

KOUTS: Right.

ABKOWITZ: Are you aware that you presented to the Board four cases that have been run on the 142,000 metric ton scenario, which I believe has really nothing to do with the scenario that you are supposed to be offering a license application under; is that correct?

KOUTS: That's correct. One of the reasons I run, and I demand that we run all the fuel through it is because if we only run the 70,000 ton case, then we don't understand the implications of the first 70,000 tons on successive, and whether or not that goes into Yucca Mountain, or whether that goes into another repository somewhere else, you know, that's not what we're trying to understand here. But, we do run the full gamut of the fuel, so we understand, again, from the system standpoint, if there are any effects from the first 70,000 tons, if you will, and how that might affect the second 70,000. And, simply all you have to do is just go to approximately 50 years of operation, and you get a pretty good idea as to where the cutoff is for the 70,000 ton case.

ABKOWITZ: If we could go to Slide 12 then?

KOUTS: Okay.

ABKOWITZ: Which I believe is the slide where you were making comments that you thought this was a fairly realistic scenario to represent what the cutoff ratio might look like?

And, picking up on your comment a minute ago that if you look at the first 50 years of operation, that would mimic pretty close the first 70,000.

You have an aging pad of close to 70,000 metric tons being shown there; is that correct?

KOUTS: Right.

ABKOWITZ: 7,000 casks at 10,000 a piece. So, how do you come to the conclusion that your aging pad of 21,000 is compatible with your 70,000 here?

KOUTS: Let me help you with that. Our acceptance capabilities that we model, as I mentioned earlier, four, six, twelve, two, three, so, in the fifth year of operation, if you will, we are moving 3,000 metric tons a year, and what you are seeing on the upper left there is that the facility has the capability to process those in TADs. So, when you are really looking at total amounts of operation, in order to get the 63,000 metric tons that you need, it's roughly 25 years of operation.

Okay, so, if you look at the first 25 years, if you will, here you are roughly--again, this is an imperfect case. It's a scenario, and so forth. If you design the repository, and if your acceptance was such that you only wanted to run the 70,000 ton case, and you cut this off so you didn't accept fuel beyond that 70,000 tons, and you were working off instead of bringing more fuel in, okay, and aging

it, what you were doing is waiting for the ones that you were aging to get to your heat load, then what this peak, and so forth, would not be as high and wouldn't be moved to the left. So, you would stay still within the 21,000 requirement.

Again, we ran this model, we ran this case to understand the effects, if you will, of the entire inventory, if you will, as opposed to the 70,000 ton case.

ABKOWITZ: You referenced a heat load, and I wanted to get some clarification on one aspect of heat load, which is the line load one, which I know that you have also tried to understand the implications. As I understand it, it's 1.45 kilowatts per meter. Is that at emplacement, or at closure?

KOUTS: I believe that's, as we look at it, it's at emplacement.

ABKOWITZ: Okay, at emplacement.

KOUTS: Correct.

ABKOWITZ: My understanding, in looking at the, and Paul, I hope you are hearing this, my understanding, in discussing this issue with your repository folks, is that the 1.45 limitation is such that that has to be met either every seven packages or every 40 meters. My understanding, in looking at the results of the TSM work that's been done so far, is that that has not been a constraint in running this. But, if you actually look at the way loading takes place,

you are not anywhere close to satisfying that objective.

KOUTS: Well, again, the model does what we tell it to do. And, our assumption is that if we have an 11.8 package, and we intersperse with that the DOE materials in between, because we use the DOE materials, if you will, to lessen the line load, if you will, that, again, we need that. If we need the model that differently, we can model that differently, but that's what our going-in assumption was.

ABKOWITZ: And, I don't want to take forever here, but I think I can wrap a ribbon around this. You have an excellent tool. You have the ability to push this tool to a place where it can really answer the total integration questions. There is no reason why this tool can't put, as a constraint in the process, the line-load limitations. And, when you put those line-load limitations in, and you realistically represent them, and when you put in different scenarios for how much of the percentage of waste is actually going to be countable, and you start to put all of those issues into this pool, and you allow the different pieces of the organization to openly communicate and understand what everyone is doing to everyone else, you might be able to win this project. If you don't, you will definitely lose.

KOUTS: Well, I certainly take your comments to heart. The TSM is not something I hide. It's something that we do a lot of missionary work within the program. My expectation is

we're going to be using it a lot more as we move forward. And, I think your comments are excellent, and I believe we will be doing it.

ABKOWITZ: However, let me just also add that I understand from Mr. Golan's presentation this morning that all of these questions have to be answered so that you are presenting something in front of a group by June 30th; is that correct?

KOUTS: I don't want to speak for Paul, but I will. I think the design concept, the approach that we're going to take to surface facilities, to the canister concept, as Paul indicated, we're going to be providing the Energy Systems Acquisition Advisory Board within the Department our design approaches as to how we plan to go to the canister based concept. That's not a final design. That design, once we get the approval of the Deputy Secretary for the Secretary, we will then go into a very substantial design process and try to develop exactly the kind of designs we need for the license application.

So, if you have the impression that our design work stops after we have a decision, no, our design work is in very preliminary stages. Once we get that go-ahead, we're going to be marching down that path, and this model will help inform that design process.

ABKOWITZ: Okay, let's move on. Dr. Petroski, I believe

you have a question?

PETROSKI: Petroski. If I understood you correctly, you said that you bounded with the worst and best cases that you ran, effectively. And, that you haven't run any upset cases yet, but you might. It seems that experience with really complicated systems, like this one appears to be, has not been such that you should be too optimistic. And, I think of, for example, the Denver airport baggage handling system. I'm sure they had a lot of simulations that bounded with worst and best cases. And, also, I think about NASA's shuttle program, where I think they were going to fly every week, or something like that, in their initial simulations.

How do you answer the potential critic that you are doing it better than they do?

KOUTS: That's an interesting question. The only way I can answer that is that we're taking it step by step, and our first step is to basically get approval to walk down this path, formal approval. We're working with the industry to try to get the benefits of their understanding of how to handle these materials and how to handle canisters. I think industry input into our design, based on their experience with what's going on at reactors, will be very critical to us. And, any path that you march down in life has risk associated with it.

I think all I can tell you is that we, as the

Department to the program, felt that this was the better path for us to march down, and we're going to do our best to make it work, and I think we have some very bright people working on it, and we're going to try to do the best that we can, and, at the same time, being flexible hopefully, so that we can adjust this as we move forward, and make it operate more efficiently as we move to the future.

Your comment is excellent. There is a long history of plans that don't work out, and this program has a few. Nonetheless, you know, I think we have a new approach. I think it's a viable approach. I think it can work, but it's going to take a lot of hard work by people, a lot of integration, as the Board has indicated earlier, a lot of talk and a lot of sharing of information, such as from this model, in terms of design process. If we do that, then I think we have a good shot at making it work.

PETROSKI: Give it your best shot, of course.

KOUTS: That's all we can do.

ABKOWITZ: Dr. Kadak?

KADAK: Yes. Can we go to Slide 12, please? I'm trying to understand the TADs and aging number. Earlier, you said there's 9 metric tons of heavy metal in a cask.

KOUTS: Right.

KADAK: So, nine times 7,000 is--

KOUTS: 63,000.

KADAK: Right.

KOUTS: Right. And, again, this case models approximately 142,000 metric tons of material.

KADAK: Roughly half of it would have been roughly in aging pads?

KOUTS: Right. That's if, again, you're looking at the end of the operating reactor lives. You've got a lot of hot fuel that's out there that has to cool. If we're moving it to our site, it's not being cooled at the reactor site, therefore, you get a very high, if you will, a high aging field. However, again, getting back to what I was responding to Dr. Abkowitz's question, if we're only emplacing 63,000, this curve, and you cut it off, basically, the acceptance, the amount of acceptance you have cuts off probably within the first 30 years, and you're basically emplacing and waiting for that aging pad to go down the last 20.

KADAK: You also state there that the shut-down sites dump to pool. Am I to interpret that that there is an existing spent fuel pool operational at the shut-down sites?

KOUTS: That's correct. We can't dump to a pool unless there is a pool.

KADAK: Okay. And, what I'm really going to get to is the assumptions that are driving this analysis are not necessarily correct, especially for shut-down sites.

KOUTS: This is a simulation of a scenario.

KADAK: Well, why show it to us if it's not real? What we're trying to understand is the real capability of the system, and perhaps worst case, best case. I think it would be nice to see what you really expect to see, and then kind of look at it and make some judgments about whether the system is workable, and then go off-normal. You know, was that youngest fuel first?

KOUTS: Yes.

KADAK: At five years. Now, is that a credible assumption for a model like this?

KOUTS: That's a very credible assumption for a model like this. It's one of the scenarios, if you will, that looks at kind of a worst case situation. Contract calls for a minimum of five year cool aging. So, if it is the youngest fuel, five year cool, this is the worst scenario that we could expect. If we're looking at a different scenario, perhaps ten, you know, YFF10, which is ten year cool, youngest fuel first, then that curve changes. The intent was to try to show the bounds and the implications of kind of a worst case situation.

KADAK: The other question is is this work--I mean, I don't know what assumptions you made in the facility design of the surface facilities to be able to process this stuff. From what we have heard from you and others, that design isn't finalized. Now, what is it that you have assumed in

the facility, the surface facility design, that supports this kind of calculation? And, more importantly, is this calculation being integrated into the facility design?

KOUTS: Okay, let me help you with your comment. I said at the beginning of my talk that this work was done last year. It started in March of 2005. We did not make the decision to go to a canistered approach until October 2005. What you have here and what I indicated earlier, and perhaps I wasn't clear enough in my remarks, was the fact that we took some educated guesses about what the surface facility capabilities of a canister-based system might be. And, those educated guesses were based on our understanding of what the capabilities were of the old system canister handling facility that we had developed up to a certain point, which we are no longer designing.

So, this work basically was done last year to try to understand whether or not a canister-based system made some sense, and whether or not we ought to walk down that path. In no way is this intended to reflect any of our current designs. Those current designs are being developed now during the process that we're going through with the critical decision. And, my Acting Director would like to say a few comments.

GOLAN: Thank you, Chris. I know you didn't want to speak for me, but you did a good job.

As we contemplate the canister design, the first thing we want to do is prove the concept. And, one of the things, as we have talked about before, we like the monitor approach. We like to look at things in terms of off the shelf. And, when we talk about throughput, the most important part of the throughput is getting throughput, in other words, getting a facility that can actually move waste through the facility.

The other part of our project that we have only partial control over is the amount of annual funding we get. And, so, I would just tell you as we look at these facilities, as we look at these facilities over time, the question is is that if one facility can process "X" number of canisters per unit of time, and we want to get to "Y" in terms of total process through, one of the variables that we can actually manipulate in this case is the number of facilities we actually place at Yucca Mountain, depending on what we project our annual funding to be, and what would be a good throughput.

But, again, the first thing we want to do is prove that we can get the throughput through a single facility. After we do that, if we do this right, then we can say okay, now, what's the next logical step to ramp up that throughput through either this facility or maybe of seven facilities.

ABKOWITZ: You've got the last followup.

KADAK: Thank you.

ABKOWITZ: The last question.

KADAK: I guess what I would recommend, if I'm in a position of recommending anything, is that you ought to take your best shot at what you think the surface facility should be to handle the volume that you are expecting, and make sure that the model that you now use, which may not be obviously perfect, but at least represent your current thinking. And, I'm not hearing that, and you've had over a year or so to change it, since you're working on the new TAD concept.

And, secondly, to run a case that is more realistic that you might, having all these discussions with the utilities, feel is feasible that would show that there is some true value in a TAD concept, given all of the contractual issues that you have to deal with. And, then, I would feel, and I think you should feel, comfortable that if you have off-normal situations, then you make the adjustments in your flexible mode, as opposed to being so flexible you are not sure what the facility's capability is, which I don't get from these charts, because I don't know whether this is even close to being real. And, then, maybe a hundred others.

KOUTS: Just a comment, and perhaps it was my error that I chose the slides that I did choose. But, the intent of the slides was not to show the world as we expect it to be, but more on the capabilities of the model in order to show us the

impacts of different scenarios.

Now, what I would strongly commend to you reading, and you already have the whole report, we run not only the 142,000 ton case, but the 70,000 ton case, and you can look at those and you can gain perspective from that as to type of aspects of the system and how it would operate, and how it can operate successfully. Again, that is based on our simulation of facilities that had yet to be designed when we did this last year. As we move forward, we will be getting more to the actual capabilities of the facilities we are designing, and we will be able to do more of exactly the kind of thing that you want us to do.

ABKOWITZ: Okay, I think we need to wind up Chris's session. First of all, thank you for being tolerant of our questions. I think, as you can tell, there's a great deal of interest in what TSM can do for the Program. And, I think that we are beyond needing to know how flexible and agile it is, and really much more smack dab into the how can it be used constructively and realistically to deal with what we think are some highly inter-dependent issues that have to be resolved.

So, thank you, Chris, and I'm sure we'll ask to hear from you in the future, and I hope you will be equally as willing to participate.

Our final presentation in the TAD component of

today's meeting is a design and engineering update on the surface facility, and the effect of the TAD decision on surface facility design. Paul Harrington will be giving that presentation. Paul is the systems engineering lead for the Director of the Office of License Application and Strategy at the Yucca Mountain Project, and leads the effort within OLAS to develop engineering processes and products.

However, I saw from the work chart that perhaps that responsibility has changed somewhat, since I believe I saw you as the Acting Chief Engineer. Is that correct?

HARRINGTON: Yes, you did.

ABKOWITZ: Okay. So, we're glad to have you here today, not withstanding whatever title and responsibilities you presently carry.

HARRINGTON: Thank you.

I will talk about surface facilities, and also to put into context a little bit of the subsurface and the waste package.

The day has been sort of illustrative for me, though, in terms of what your interests are, what your questions are with respect to surface facility capabilities, so I'll talk through that. I will talk about what the CD-1 revision process is and is not. It is a change to a previously approved CD-1 that we got back in 2004 that was based upon a primarily bare fuel assembly handling process.

And, we have adopted, as you have heard, the canister-based approach. Go on to the next slide, please.

And, because of that, we thought it appropriate to go back to the Energy Systems Acquisition Advisory Board to tell them that we were proposing to make a, we think, relatively significant change to how we handle fuel in the repository. So, for that reason, we're going back for a CD-1 to accommodate that canister-based system.

It is not the final design. It's not even the preliminary design. It's the step from a conceptual to a preliminary design. The CD-1 will be followed by a CD-2, which will go from a preliminary to a final design, and then, finally, a CD-3.

So, in this, we gave direction to Bechtel SAIC in October to provide a revised CD-1 package to accommodate this canister-based approach. We gave several requirements along with that. Those included, not precluding the ability to change waste package, thermal content, to change waste package size in the future. We want to have a facility set that is flexible enough to provide for changes in the future. But, this particular CD-1 action is focused on accepting canister-based fuel rather than having to handle it there.

So, for purposes of bounding the problem, we defined the TAD capacity to be the same as was in the standard waste packages, same thermal output, but, again, not

to preclude the potential for changing in the future, for system optimization, for reacting to future changes, and waste streams.

I need to also introduce the concept of the preclosure safety analysis. I've heard several people talk about the postclosure analysis, the TSPA, but for the license application, we also have to provide a preclosure safety analysis. That is driven in part by the amount of fuel that gets handled through a repository, and the rate of fuel handling. So, when we talk about looking at the capability of the facility to accommodate different amounts of fuel in the future, if the 70,000 limit were raised, as an example, one of the effects is the need to reassess the PCSA limitations, requirements, on facility design and safety basis. It's not to say we couldn't do that, but right now, the nominal throughput through the facilities is 3,000 MTHM per year. To provide some margin on that, we evaluate in PCSA space, 3,600 MTHM per year.

If we determine that due to a need to process greater amounts on an annual basis through a greater number of facilities, I'd have to redo the PCSA accordingly.

We've already talked about the attributes of the canister-based approach. So, going onto Page 4, this, again, is a conceptual design. It's with a range estimate. The product we got has a modular, flexible configuration. It was

based upon an assumption of 90 percent of the waste stream coming in TADs disposable. One of the criteria for evaluation of the design, though, is flexibility to accommodate potential changes to that for other criteria.

If in the future we find it not to be only 10 percent uncanistered fuel, we want to understand how the system as a whole can accommodate potentially a greater percentage of uncanistered fuel.

This design that we got from BSC had some dedicated facilities for receipt and waste package closure. We will talk about those in a little more detail a couple of slides later.

The overall set of products that support the revised CD-1 action include the conceptual design report, the actual design product. Along with that, though, we have a preliminary hazard analysis. That looks at facility operating hazards, similar to the NRC required preclosure safety analysis. There's also a risk assessment. That's more programmatic risk. Can we get the funding? Will utilities participate in supplying TADs, other more programmaticly things.

A project execution plan, how we propose to implement the repository facilities. Some cost and schedule information. And, there's also an acquisition strategy.

Next, please. As a reminder, until we get through

the ESAAB decision, and get approval from the Board, this information is preliminary. Because of that, I did not include general arrangement drawings, but I'll talk conceptually about what we expect to have happen inside each of the several sets of waste handling buildings.

After we get the ESAAB approval, development of the products to support the license application will have to be done. Those will have to be done in full accordance with configuration control processes to provide a basis to support the license application. But, the current activities with respect to selection from competing alternatives is being done more as a management process.

There are three main sets of surface facilities in the new design concept. The first facility is the receipt facility. The intent of that primarily is to accept incoming TADs or dual purpose canisters that are too hot to be disposed of at that time that need aging, and send them out to the aging pads in compatible overpacks for aging.

The canister receipt and closure facility is fairly similar to the previous canister handling facility. It can receive incoming transportation casks directly. We have actually eliminated the previous approach where we had a TCRRF, transportation cask receive and return facility, that received incoming transportation casks, off loaded onto a site specific rail system, a site rail transfer cart system,

and then used that system to disburse to the waste handling buildings. That was just an extra set of lifts, and an extra complication that we're trying to minimize. So, we don't do that any longer, but instead, send the actual national rail conveyances or truck conveyances into the individual waste receipt or transfer buildings.

So, the CRCF can accept individual transportation casks, open and transfer the disposable canisters be it TADs or Naval or DOE SNF or DOE high-level waste, into waste packages, close those waste packages, do all of the inspections, testing, backfilling with helium, that has to be done on the waste packages, then load those onto the subsurface transporter for transport to the underground emplacement drifts.

Finally, for the individual fuel assemblies that would come in potentially in truck casks without benefit of any sort of canister, or in non-disposable canisters that would need to be opened at the repository and transferred out of those non-disposable canisters, there is the wet handling facility. The intent there is that transportation casks would be put into the pool, similar to reversal of the outloading at the reactor sites. The casks would be opened. The fuel assemblies removed from the transportation casks, or if they were in a non-disposable dual purpose canister, removed from that DPC, and put into a TAD, rather than trying

to take the bare fuel assemblies and put them directly into a waste package. We didn't want to put the waste package into the pool for several reasons. We decided to go ahead and just load TADs in that pool and then transfer the TAD over to the canister receipt and closure facility, and put it into the waste package, and close the waste package there.

So, in the wet handling facility, any bare fuel assembly handling that would need to be done would take place. Those bare fuel assemblies would be moved into a TAD, the TAD closed in the wet handling facility, and then that TAD moved over CRCF for loading into a waste package, and transported underground.

The subsurface facility for these primary sets of surface facilities is essentially unchanged from what it had been before. There's still the four panels with the series of emplacement drifts within each of the panels. The perimeter drift, ventilation system stays the same. The method of emplacement of the waste packages on the pallets into the drifts remains the same.

As part of future optimization, we're looking at ways of potentially simplifying the waste package pallet interface to simplify transport and emplacement of that. But, that's not part of this current CD-1 exercise.

The waste packages themselves for the commercial fuel will change, in that the internal basket structure that

had been in the 21 PWR, the 12 PWR, the 44 BWR, in essence, that basket structure is now the internals of the TAD. As we talked earlier today, there are some issues with material compatibilities. So, some of the materials may need to change. But, that basket structure that had been in the commercial waste packages becomes essentially the internals of the TAD.

The TAD obviously has the cylinder, the wrapper around it to provide the confinement function, the handling function. The waste packages that the TADs will be put into are very similar to the waste packages for the Naval long canisters. It's simply the two walled cylindrical waste packages with no internal basket structure in and of itself. The basked structure is part of the TAD. They are similar in size to the Naval long waste packages.

Next slide, please. Some of the features of this is that the handling of the bare fuel assemblies, uncanistered fuel, will be done in pools, no longer try and do that in the bare fuel hot cells, dry cells, as we had had in both the previous fuel handling facility and dry transfer facility. That just introduced too much operational complexity. Also, recovery from off-normal events, or even maintenance activities. Just handling it in the pools we think will be simpler, cleaner.

Canister handling. We took a page out of the

Navy's approach to how they intend on handling their canister at their facility in Idaho. And, rather than trying to handle the canisters, since the canisters themselves don't have full body shielding, the previous approach had handled them in hot cells remotely, there was no local access to them, what we will do is introduce a fuel plug into the closure end of the canister, so that as we load the canister into the waste package, and then provide shielding around the OD of the waste package, that will support having local access to the waste package closure welds.

Inspection, reweld. If we have to do any rework of that weld, not to say that we intend on having that be a manual weld with someone sitting up there with a torch and trying to do those, but, instead, to facilitate setup of automatic welding equipment, facilitate rework of that weld not be constrained to having to do all of that remotely in a hot cell. That just, operationally, we think makes a lot more sense.

There are a couple of different ways that we can approach that. In the full diameter canisters, those will include shield plugs within the canister itself. The Naval ones already have had those in as part of their designs. We will add that to the TAD.

The partial diameter canisters don't have those in the ones that have already been made, neither the multi-

canister overpacks, I think they have a small one, the high-level waste canisters don't, but when you go to open a transportation cask with a series of small diameter canisters within it, even if those canisters had internal shielding, you would still have the streaming from the annular space between the waste package--or between the canisters. So, we will go ahead and insert the small diameter canisters, high-level waste and DOE SNF and MCOs, into the waste package, and then put a shield plug on top of those small diameter canisters, but inside the waste package, to give the same benefit of being able to then to locally access the waste package closure welds.

The deletion of the separate site rail system I already mentioned.

Potential effects on the preclosure safety analysis. In the design from last year, we only had two Category 1 event sequences. Category 1's are those that are likely to happen one or more times during the life of the facility. So, for a 100 year duration, 10^{-6} per year, or 10^{-2} per year. Category 2 are those that have about 1 in 10,000 chance of occurring over the preclosure duration, 10^{-6} per year for a 100 year duration.

The two Cat 1 event sequences that we had were drops or bumps of individual fuel assemblies. That was driven by the number of them that we had, approximately

221,000 individual assemblies, and as I think Paul mentioned earlier, we were potentially going to have to handle each of them as many as four times. So, that was a lot of individual lifts, moves. So, even at a 10^{-5} drop per lift probability, that still put that into Category 1 event sequence phase.

With the reduction by a factor of ten of the number of bare fuel assemblies to handle, and the change in the handling approach, there will be less lifts to make, so it's looking at this point like that will move from a Cat 1 into a Cat 2 event sequence.

Also, since it will be in a pool instead of in a dry area, either in air or in an inerted cell, the consequence of that drop in a pool will be lesser, simply because of the confinement provided by the water in that pool. There have been some drops in utility pools, and they are fairly readily recoverable.

Likely, there will be little change to the Category 2 event sequences. Those have been primarily associated with drops of the larger components. The transportation casks, the MPCs, DPCs, rather, the waste packages, simply due to the number of them, factoring in that same 10^{-5} drop per lift, those were Category 2s.

Now, we have added some TADs. There will be on the order of 8,000 TADs additional to that number of large lifts, but it does not look at this time like that will move that

from Cat 2 into Cat 1 space. Consequences of those will be the same as before.

The ITS classifications before have been driven primarily by the components that were necessary for lifting and movement of the different waste forms, and, then, for the confinement provided in the event of potential drops and breaches of those waste forms, and the mitigating features. So, the lifting components, the cranes, the structure for confinement, the ventilation systems, the power to run the ventilation systems, those are primarily the ITS set before. Likely, it will be that same set now. We still have the need to minimize the potential for drops, so all of the lifting components associated with this will continue to be ITS.

There is still, obviously, the potential for a drop. So, we will still credit confinement for the structures that have waste forms inside of them that would pose a problem in a drop and breach. We will still need to provide the ventilation and power where we need to credit those confinement functions.

Next slide, please. The independent engineering study that's been alluded to, late December, early January, we had our Site Support Services contractor take a look at alternative design concepts that could also be used for approaching a canister based handling system. The intent was

to further simplify, think a little bit further out of the box than we directed BSC to do. Part of the BSC direction was to consider parts of the design that could be used without significant rework. We didn't want to try and start all over again. We gave MTS a little more latitude to be a little more creative.

They came up with an approach that I will talk about in a moment that had some similarities to the BSC approach, and it also had some differences.

The similarities were, not surprisingly, to also step away from bare fuel handling in a dry environment, be it these are inerted or in air, and, instead, shift to a pool based concept. And, also, to provide local shielding for the canister-based approach, so that if there were equipment problems, maintenance crews would have a much simpler time of recovering from that.

The differences, though, were in the equipment for how to handle the canisters. Paul mentioned earlier the tilt table approach. In the BSC approach, basically, the canister, the TAD is moved from spot to spot. It's inserted into a waste package. The waste package is moved, lids are installed, closed, moved, down-ended onto a transporter to be taken underground. The waste is moved several times through the facility.

In the MTS approach, the transportation cask comes

into a building. There's a shielded transporter, transfer cart, that's moved over it. The canister is pulled up into that shielded transfer cart that's moved over a waste package, an empty waste package, that's loaded into a shielded overpack on a large table, and the canister, or transfer cart shutter opens, canister is lowered in there, and then lids are put onto it. And, between the shielding provided by the shield plug inside the canister, and then by the surrounding shielding on the waste pack itself, there can be local access to do all of the closure processes.

The waste package is then closed, inspected, any rework to the welds is done, and this device, the tilting table, has the capability of movement up and down, of rotation, and translation, so the waste package would be lowered. The plane of the table would be rolled into a horizontal position, and then the access of the waste package would be spun around 180 degrees, and then a hydraulic ram would push it on a series of rollers in a horizontal configuration onto the subsurface transporter bed plate.

So, there potentially would be exposure as the waste package is being moved out of that shielded container onto the transporter bed plate. Also, at the point of removal of the transportation cask lid until the shielded transporter is put onto the transportation cask for the DOE SNF, the partial diameter canister, there may be some shine

there. Likely we can develop an approach for that. But, it has some potential benefits in terms of simplification of the overall handling process.

So, that's sort of the fundamental difference in the MTS approach.

So, we are doing now evaluation of the features of the two sets of design. I would not expect to end up selecting either the MTS study in its entirety, or the BSC design in its entirety. What we are evaluating are the relative merits of the different features for cost, constructability, licensability, flexibility, to adapt to future change, those sorts of things. And, we will, over the next several months, go ahead and do different down selects.

One of the things that people are doing yesterday and today is laying out the schedule for these different features, looking at how long will it take to create the design to support a license application for adoption of features. That will help drive the schedule for doing this series of down selects on the individual features.

So, in summary, simplification of waste handling, again, is preliminary until we get to ESAAB in the next month or six weeks. We will update the baseline and develop the LA supporting products after the ESAAB. Most significant change is certainly in the surface facilities, and some reduction and minimization of event sequences.

With that, I'd be happy to take questions.

ABKOWITZ: Do we have Board members with questions? Okay, I will recognize Dr. Garrick.

GARRICK: The surface facilities being engineered facilities lend themselves very well to contemporary analysis methods, safety analysis, risk assessment. I know how the preclosure safety analysis is generally done, but has there been any consideration of, at least for this component of the system, doing a more comprehensive risk assessment? And, the reason I ask that is because you are going to learn so much more about what happens inside this engineered facility by considering a level of detail of scenarios that you would never probably consider in a simulation model. So, I am just curious as to whether or not it has been under consideration. It would certainly answer a lot of questions about performance capability, particularly if the emphasis was put on operational risk as opposed to necessarily safety risk.

HARRINGTON: Let me answer the safety risk part first. Over the last year or year and a half, I am sure you have seen a lot of the technical exchange results between us and NRC, and it's clear that there is a need for a much more fully developed set of design and safety analysis than we had maybe been thinking several years ago.

So, with respect to facility performance specifically, where we are now is doing much more than what

we had defined earlier as the Tier 1, lump mass model, 2D structural analysis. We will now be at the point of nearing what we have referred to as a Tier 2, 3D SASI model doing seismic hazards analysis, doing fragility analysis on the structures, convolving the results of those. That's been determined to be the level of design and safety analysis to really support the ability of that structure to perform its credit and safety function.

With respect to the operational evaluation, most of the focus has been on the safety evaluation, frankly, to show that we can deliver the safety basis that we are crediting in the nuclear safety design bases.

A lot of the point, though, of the canister-based approach is to simplify the operations. You heard Paul talk earlier about his operational perspective. That's why we are talking more with Navy now. We will actually be going up to their facility early next month to try and pick up those operational lessons learned to try and simplify the operations.

One of the comments I might mention, we've talked some, one of the earlier issues dealt with operator exposures. I think I heard that a little earlier today. We had done a series of facility occupational exposure dose estimates. Those were driven by the operations that we took as we go on as part of the normal facility ops. We found,

not surprisingly, that the bulk of the operations came from the transportation cask handling, simply because of the need of the operators to locally access that.

What those did not consider was off-normal recoveries, and that's one of the reasons that we are enthusiastically stepping away from the much more complicated dry bare fuel assembly handling, and trying to shift to the canister-based approach that allows local operational access in the event of off-normal recover needs.

GARRICK: Just one simple question. What does the Energy Systems Acquisition Advisory Board look for, what do they evaluate?

HARRINGTON: For CD-1, this progress from conceptual to preliminary design, it's focused primarily on requirements and schedules. Have we identified clearly what the facility needs to do? Are those requirements clearly articulated and captured? And, is there a project execution approach that will likely get us there?

Paul, I think wants to add something to that.

GOLAN: The first thing that we're going to have to justify is to provide the basis for going down the path that we're going down as opposed to the previous path. The second part is, as Paul articulated, what does this look like, what's the technical basis? And, then, as we go through the project management manual, what are the next series of steps

that I'm going to be held accountable, that this office is going to be held accountable to by the Acquisition Executive for getting down to the next level of design.

So, we have to provide a technical basis for the design, as well as the cost, schedules, scope and all the other considerations to get down to the next level for this design in the design evolution process.

GARRICK: Thank you.

ABKOWITZ: Howard?

ARNOLD: This is going to sound more like a comment than a question. Arnold, Board.

First, you've whetted my appetite to learn more about the two alternative ways of going, trolley versus I guess tilt table, is the way you described it. And, I guess I'd just comment that there are some major decisions to be made. And, then, you've got to go into a process of detailed layout, and all the rest of it. And, it seems to me we are quite a ways away from a license application when you put those activities end to end.

The other question I have, and you've raised it, is the off-normal capabilities, presuming that's going to be key, because basically you're centering on this facility, now, a lot of things that can happen that can only be done here versus somewhere else.

HARRINGTON: Can only be done here versus somewhere else

in what respect?

ARNOLD: Well, for example, those dry storage sites that no longer have a reactor home, you've got to bring all that stuff in and do it there, maybe accidents on the road, who knows. But, you have to plan to do a lot of things at Yucca.

HARRINGTON: That's why we have the capability. We need to have the capability to handle individual fuel assemblies, because not all of these sites would be able to do TADs.

ARNOLD: I'm certainly in agreement with that. I'm just saying that you have a long road ahead of you.

HARRINGTON: Yes.

ABKOWITZ: George?

HORNBERGER: Paul, you mentioned that your safety cases, of course, have to include seismic analyses. My question is your TAD, your whole concept is to simplify things. Does the TAD concept simplify your seismic analyses? I know one of the concerns I guess has been the size of the footprint for the storage pad, and now you have introduced a pool as well. So, does this simplify or complicate, or do you know?

HARRINGTON: Oh, I think it simplifies it. Remember, that we had a pool in the old designs. We have never not had a pool. Even in the last design in DTF, there was a remediation pool, just for the same reason. The design prior to that when we had the five lines, the site recommendation design, that had pools. So, this has not complicated that.

Did that answer--

HORNBERGER: How about does it impact the design of the TAD system itself, the canister? Do you have to be sensitive to satisfying constraints that might have to be met for the storage, aging?

HARRINGTON: Dry canister storage also would have to satisfy seismic criteria out there. So, to accommodate that in the TAD, I don't see as a significant additional complication for TAD. Any dry canister storage system that we would have at the repository is going to have to be qualified for the repository loads.

ABKOWITZ: Paul, I wanted to get a little better handle on how specific the surface facility design specification is or needs to be at this point in time. Is it sufficient to just be able to say I need a canister handling facility, or I need a wet pool, or do you have to kind of get down to how many bays and what my processing capacities are? I'm sensing that you're not to that point yet.

HARRINGTON: We actually have some facility layouts, sketches, that we will use as the basis for the CD-1 action. The conceptual design report is probably 700 or 800 pages long. There's quite a bit of discussion, description, sketches, that are contained in there. So, it's not simply a very brief text discussion. For the CD-1 revision, we have to be able to show not only that we're adopting this

canister-based approach, but how, and as Paul said, why it is likely to succeed.

Now, we're asking the Board to accept a change from a position they had already approved, so I need to give them sufficient basis to believe that it's likely accomplishable, and that it warrants a change from previous position to this.

So, we have GA's. There's a lot of facility design in there. The hazard analysis, the preliminary hazard analysis, there's actually a look through the various operational hazards that the facilities can see, drops, potentials for drops and breaches, and loss of powers and recoveries, and those sorts of things.

ABKOWITZ: So, you actually have--the designs are sufficiently far along that you can actually specify how many different processing activities can happen in sequence or in parallel?

HARRINGTON: Yes.

ABKOWITZ: And, are those being evaluated in TSM?

HARRINGTON: I would ask Don or Chris for that. I think that they are. Don is saying yes. I've seen the TSM a few times, and they model the canisters as they come through the facilities. So, they're looking at how long in takes in each spot in the facility. I think his model has been based on the previous design. I don't know if they have done it yet for the concept that we're looking at now. I don't think

that they have. Have you?

ABKOWITZ: There's a difference between allowing the processing to take place, and to actually have designated a certain number of processing units, and then be able to see how it performs. That's what I'm trying to get at.

HARRINGTON: With respect to the TSM, I will let Don or Chris answer that. But, before he does, I'll say that for the facility design, we have designated a number of different handling units, if you will. We have identified the need for two, and potentially three, of the CRCFs. That is driven by the expected throughput through each of those facilities, which is driven by the expected duration of each of the functions that takes place within there.

What I don't know personally is how much of that has gotten into the TSC. Don, if you could answer that?

KIM: Don Kim with DOE.

Paul is correct. We haven't seen the specific reports that the contractor has provided so far, but within the TSM analysis, the concept of the layout, the modular layout of the facilities was provided, and we did a throughput study to help understand the number of weld cells that may be necessary to achieve the throughputs. So, there is analysis being done that we are waiting from the M&O, and I do believe that we are going to see that shortly.

ABKOWITZ: Wouldn't you need to see that and evaluate it

before going in front of this Board?

HARRINGTON: The action that we're asking for from this Board is really approval of the change from the bare fuel assembly handling approach, and primarily dry cells, to a canister-based approach. That's the main conceptual difference. The number of cells that I might need, I think I know now, based on the preliminary work that we have done. We will validate that through preliminary design. But, I don't want to overstate the degree of design completion that the CD-1 represents. It's conceptual to preliminary. It's not even the output of the preliminary.

ABKOWITZ: But, does it need to pass the test of safer, simpler, and more reliable?

HARRINGTON: And, I think it does.

ABKOWITZ: Okay, thank you. We have time for just two more questions. We are running a bit behind. Dr. Kadak and then Dr. Arnold, then we will wrap it up at that point.

KADAK: Yes, Kadak. I'm just surprised that, you know, since we sat through an engineering update and you had done all this work, why didn't we see some engineering updates relative to the surface facilities?

It was very hard to follow your discussion relative to what has changed. Is the pool twice as big? Three times as big? You got rid of a big fuel handling building, or two. Could you share with us some more detail than you said about

the high-level stuff?

HARRINGTON: Okay. The reason I didn't show more detail to this is until I get it through ESAAB and get that approval, I thought it was premature to do a public briefing like this on something that the Department has not yet approved. That's why I chose not to put sketches up there.

But, as far as where we are with the concept, what we've had before, consisted of two dry transfer facilities, one CRCF and one FHF. The two DTFs were on the order of 600 feet on a side. They had a couple of transfer cells for bare fuel assemblies, and down at one end, were pools that were on the order of 30 feet square, or so, for the off-normal remediation purposes. They were for those remediation pools.

The one canister handling facility was on the order of 450 feet long by about 300 feet wide, and it had two closure cells in there, but it basically was a single line through there that could only handle disposable canisters--well, canisters. It couldn't do any bare fuel assembly handling in there.

The fuel handling facility was the last addition to the suite of facilities that came on in January of '04, and that was to be a small, simple facility that was intended to be able to be constructed as quickly as possible to start receipt operations as quickly as possible, much lower throughput capability than the other larger ones. Physical

size on the order of 300 by 150 or 200 feet.

Those buildings are replaced by a different set of buildings. The one CHF is replaced by two or three CRCFs, same function, disposable canister receipt, and emplacement, loading into a waste package. Similar size.

The two big dry transfer facilities, on the order of 600 feet on a side, they're gone. The equivalent really is the one wet handling facility. Pool size on that is on the order of 70 feet by 60 feet, if I remember right. And, these are obviously not fixed final dimensions. But, for concept purposes, what we think we need to do in that pool at this time, that's about what it is.

And, then, the FHF, the facility that could have handled bare fuel assemblies, that also is gone. And, we have a receiving facility that, in essence, takes the place of the old TCRRF, transportation cask receipt and return facility. The receiving facility is a fairly simple building. All it does is receive a transportation cask, and removes the canister from that, puts it into an overpack to take out to aging, that's its primary purpose. It's on the order I think of about 200 or 300 feet square.

So, physically, the buildings are quite a bit smaller, and they are much simpler on the inside. But, until we have ESAAB approval to make this change, I just thought it premature to start putting up drawings and talk in much

detail to that. I apologize if it was confusing.

KADAK: I don't think what you said was particularly earth shattering. It's just a question of at least comprehending what you are doing, and I hope in the future, you will be able to share with us more information.

HARRINGTON: I do, too. I'd like to come back and brief you after we get ESAAB approval, and provide more detail.

ABKOWITZ: Howard, you have the last word.

ARNOLD: Okay. Good news first. Compared to almost two years ago when I first saw a definitive design of all those buildings, I think you're better off than you were then, despite the uncertainty.

Now, the bad news is you still have a number of major decisions to make. And, to me, it's going to be a while. And, I already said that.

HARRINGTON: That's why we are laying out the schedule that I referred to a moment ago, just to understand better when we have to make those.

ABKOWITZ: Thank you, Paul.

Mr. Chairman, I've succeeded in putting us behind yet again, and I turn the baton over to you.

GARRICK: I'm going to allow us to have a ten minute break.

(Whereupon, a brief recess was taken.)

GARRICK: Our next agenda item is the DOE inquiry of the

USGS e-mail issues, and reanalysis of the infiltration data. It's going to be given by Gene Runkle.

Gene works in the Office of Civilian Radioactive Waste Management, and he's been there since 2001. He now works in the Office of Project Control, providing independent oversight for Program elements and project control processes. Previously, he supported the OCRWM Director in changed management activities. Before coming to OCRWM, he conducted environmental, safety, and health technical support activities in DOE's nuclear weapons operations.

He has also been involved at the National Laboratory level in providing support and technical information for some of the regulations.

Gene, we're glad to have you.

RUNKLE: Thank you. Could I have the next slide, please?

What I'm going to talk to you about today is the evaluation of the technical impact of the USGS e-mails on our Project. I will also talk to you about some of the additional work that's ongoing right now, both at Sandia and at Idaho National Laboratories, to redo the infiltration modeling work, and give you some of the results, the most recent results from the Inspector General's investigation process.

The first thing I'd like to talk about is the

technical report. This is a report that was initiated after the discovery of the USGS e-mails back in March of 2005. What we were looking at there was the impact on the site recommendation, the key technical information that we had, the agreements that we had with the Nuclear Regulatory Commission, and the impact that the infiltration model work had upon the license application processes.

We focus mainly on the AMR that was completed by the USGS in June of 2000. That AMR had been updated in 2004 with some additional inputs. The question that we had was whether the net infiltration rates could be independently corroborated by published data. This was the question that we focused on. And, then, to look at any impacts that it might have on the site recommendation and the KTIs.

It's important to note that the report that we have here and the results will not be used as part of the technical basis for the license application, or for any quality effective work.

The draft report that was prepared was reviewed twice by an independent group of experts that we brought together. Dr. Peter Wierenga has extensive experience in hydrology with the University of Arizona. Dr. John McCray does a lot of modeling work at the Colorado School of Mines. And, Dr. Tim Green is with the U.S. Department of Agriculture and has a lot of experience in reviewing

infiltration and hydrology type work.

The independent review, the initial one that was completed in the October time frame, had a significant impact on the content of the report. The reviewers really indicated that there was a lot more corroborating data existing than we had brought forward in our report at that time, and they provided additional references, and suggested that we spend a lot more time on going back and looking at the outside literature. And, we proceeded in that manner.

After that was completed, we also focused heavily on the technical basis for the conceptual models. After that was completed, another draft of the report was provided to the reviewers, and we finalized the report in February of this year.

This is a chart that is in the report. There are copies of the report in the back. We have also provided hard copies for all of the panel members. And, in the back of the report is a disk with all of the references that we are allowed to provide. There are some proprietary references that we have given you the reference to that you can go to the website and pick them up, but we were not legally allowed to provide those on our disk.

This particular chart here shows the results from the Yucca Mountain modeling work that was performed by USGS. It also gives you the solid line, which is a Maxey Eakin

estimated recharge, and it compares it to several different methods, the Chloride Mass Balance, a couple of others, that provide some corroborating information on the results.

Some of the key findings that we have here, we found that the conceptual and numerical models built on earlier work are technically sound, and they're based upon the physical processes that govern water cycle. These are widely documented, and are available in the open literature.

The USGS net infiltration rates are consistent with the arid and semi-arid climates across the U.S. The net infiltration is a very small percentage of the precipitation, and usually within 1 to 6 percent of the precipitation values.

The net infiltration rates have been presented publicly, and are also published in several scientific journals that we have listed in the report. We have carefully chosen only those that were refereed and peer reviewed type references, so that we were not just bringing in presentations at meetings or other opportunities where there was not a peer review or some in depth review. Our outside independent panel was very strict on that process. The net infiltration estimates used--

KADAK: Could you just help me understand what it is you're showing? Which is the USGS?

RUNKLE: Oh, I'm sorry. I missed a viewgraph.

KADAK: I'm just trying to see what are you trying to tell us with these two charts?

RUNKLE: On this particular chart right here--I missed one. I'm sorry. This particular chart shows the comparison with the other corroborating data, and this one is the Nevada Hydrographic Basin Recharge, as well as the other Columbia Plateau, and other Southwestern U.S. data. And, there, we have plotted with the red squares, the triangles, and the dots, which represents the monsoon. And, these are the nine results from the infiltration work by USGS.

So, essentially, what we are showing here is the data from the USGS modeling work, fits well within the regions of these various climatic variances that we see from across the country.

KADAK: So, the focus should be on the red square and the green dot?

RUNKLE: And the blue triangle?

KADAK: Okay.

RUNKLE: Those are the ones that were in the USGS modeling effort.

Okay, the one thing on this particular graph is we are equating the infiltration rates that we see here from USGS work with recharge estimates. There is some difference there, slight difference, but for comparative purposes, both the technical people that prepared our work, as well as our

reviewers, felt that they were equivalent. It could be used for comparison purposes.

Next viewgraph. This is where I was. I'm sorry, I jumped ahead there. The net infiltration rates that we have seen on the previous two graphs back that had been used for the site recommendation are consistent with and corroborated by the independent data, and they support the site recommendation.

Next viewgraph. As a result of the detailed review that has been done at Idaho National Laboratories, we developed a new version of the software that was provided by USGS. This work took a line by line approach, taking every coded line and recoding it and making sure that there was full understanding of the algorithm behind it and the mathematical equations associated with it.

The evaluation and the updated documentation against other current procedural requirements was performed, and where there was an alternative approach, where the reviewers from Idaho felt that there was something that should be changed, there was a toggle switch put in the code so you could run it either as it would be run with the USGS work, or as they felt that it should be corrected. And, so, there are two methods that can be done using that code.

There are currently no plans to use this infiltration 2.2 in any future quality-affected work. It was

something that we developed early on in this process as we were figuring out the path forward. But, it is something that will be available in our system, if we needed to go back and reference that particular work.

The work that will come forward into the license application is currently being performed at Sandia National Laboratories. They are using the Mass Accounting System for Soil Infiltration and Flow. This is a Mathcad worksheet process, and it incorporates a revised evapotranspiration model.

That is different from the INFIL work that was done by the USGS, and that is probably the most significant change that we see in the new work that is coming forward.

There is independent verification that's ongoing, as this is being developed. Dan Stephens from Albuquerque is providing that oversight and insight as we are developing that process.

We also have sets of data that are in our system that have been impacted by the USGS e-mail process. Several datasets have been developed by the people that exchanged e-mails. We have gone back through the system, and are looking at that with a lot of rigor. Only a small number of the USGS datasets will be used in the replacement modeling. Those are unique and irreplaceable at this point in time, and only after we have thoroughly checked and validated that data will

we bring it forward into the new modeling efforts.

We're going to have three bins that will exist with the new data as it's brought forward. Use-As-Is, where there's no additional effort to qualify the data. Anything that we needed to remediate to bring into full procedural compliance, to look back on who prepared it, and how it was brought forward. That is all being done. And, then, we also have a category Do-Not-Use-As-Is, there are traceability issues. So, we will have fully traceable packages that will be brought forward in the new modeling efforts.

The ITT is looking at datasets that include the neutron probe moisture and the other listings that we have in the center there. It's either being requalified or redeveloped, and it will meet our quality assurance requirements and our procedures.

Again, Dan Stephens is providing concurrent independent review of this process.

In December of '05, the USGS agreed to accept the infiltration model for re-evaluation. They were looking at an evaluation of transparency, traceability, and looking at appropriateness and the mathematical accuracy.

After re-running the simulation that were provided in the 2000 AMR, our plans are to provide DOE with a technical report detailing the results. And, Bill Alley will be talking next about that process that they are following,

and will give you some updates.

Again, this particular work will not be part of the license application. It will be simply put on our model platforms.

Recently, the Department of Energy's IG, as well as the Department of Interior's Inspector General, has provided their outputs from their criminal investigation activities.

They have provided their factual record to the U.S. Attorney's Office, District of Nevada, and the U.S. Attorney's Office has declined to pursue criminal prosecution in this case.

There were three internal control deficiencies that were noted. There's a delay in surfacing and dealing with the e-mails, inconsistent with sound quality assurance protocols. There was a long delay in the reporting process from when the e-mails were initially discovered, until they were reported. There are some scientific notebook requirements that should have been in place and were not. And, critical control files relating to the U.S. Infiltration AMR were not maintained in accordance with the processes that were in place at the time. Those have all been called out in their most recent report of April 25, and we will be addressing those issues.

In conclusion, our technical report has found the net infiltration rate estimates support the site

recommendation, and are corroborated by independent data.

The Idaho National Laboratory model work has updated, fully documented, and has streamlined the user interface for the USGS modeling work that had been done in the original 2000 AMR.

Sandia is developing the replacement for the infiltration work, and that is underway.

There is an Information Technical Team led by BSC that is evaluating the data inputs and making sure that it meets all procedural and quality assurance requirements before it is applied to any future work.

Again, USGS is re-evaluating and re-running the INFIL 2.0 code, and will provide us the results of their evaluation. And, I've given you the input from the recent IG investigations, and we will be addressing their observations.

With that, I'll take any questions.

GARRICK: Thank you. Questions from the Board? Andy?

KADAK: Kadak. You focused on one of these areas, which is this infiltration model. Has DOE looked at the extent of condition relative to other similar types of e-mails, or issues that have been raised? I know you didn't search all your e-mails, but have you found anything that resembles anything like this?

RUNKLE: We are currently doing the extent of condition of evaluation that is a Level ACR-5223, and that activity has

been underway since July of last year. The results of that team is coming to closure at this point in time. They are focusing on looking at other AMRs and other AMR processes to identify any recommendations that they have in that area. They are also looking at nuclear culture and quality culture, and improvements in that area.

And, the other is the extensive work that we have done as far as looking at e-mails, both legacy e-mails, relevant e-mails that are going into the system to support the license application, non-relevant e-mails, so we have looked at approximately 100,000 real time read, to its extent, e-mails, and then addressing all of the outcomes of that. We have also looked at the condition reports and employee concerns, and all of that information is being brought together in a report.

KADAK: So, do you expect any further studies, like this one, to track things down?

RUNKLE: I beg your pardon? I'm sorry.

KADAK: Do you expect, based on your reviews, to have additional issues that need such an inquiry that you just finished with the USGS e-mail issues?

RUNKLE: It's preliminary at this point, but we have not seen extensive involvement in other parts of the organization.

KADAK: I take it as a maybe.

GARRICK: I'm sorry. Go ahead, Paul.

GOLAN: I'll just address your point, Dr. Kadak. We're looking at that right now. There have been things that have been brought to my attention. Gene has been leading that team. Certainly, nothing to the extent that we have seen in the USGS. But, we are finding things, and we are addressing them right now. But, none of them have come close to what we found here. We did learn a lot from this process, and there was a good team that was put on it.

RUNKLE: And, I'm a little hesitant to give out too much information at this point, because it's preliminary, and we have not briefed internal, but we have not seen extensive involvement. But, there will be recommendations in the other areas.

CERLING: Cerling, Board.

So, is it safe to say that as far as the infiltration study goes with respect to the USGS, that there will be no new experiments or measurements made, that it's just going to be purely a re-evaluation of existing and corroborating the quality of that data?

RUNKLE: Of the data. There are some data that are being reworked, but it's fairly small as far as the percentage. But, we are going back in to ensure that the information that we're bringing forward is correct and accurate. Some of the new evapotranspiration work is using

other data in addition to the work that has been done in the past. Again, it's a very small amount of the information that was developed by these folks at USGS that will be brought forward.

GARRICK: George?

HORNBERGER: Can I follow up just a little bit on that? The evapotranspiration, I mean, that is the one new thing that you indicated that Sandia was going to incorporate, a revised evapotranspiration model. Can you shed a little light on why that decision was made?

RUNKLE: There was a review that was done by Sandia in this area, and they felt that there was some newer information that could be brought forward from a modeling perspective. And, that's what's being incorporated. That work is underway, and it will be available as we get those reports completed to support the AMR on infiltration.

HORNBERGER: You mentioned that there was also some new data, I think?

RUNKLE: That's what I understand, yes. There will be new data brought in to support that new modeling concept.

GARRICK: Garrick, Board.

With respect to the more broader question, and with all the corroboration you've had, and the independent reviews and the supporting evidence that the infiltration rates were reasonable, why redo the work?

RUNKLE: Why are we redoing the work?

GARRICK: Yes.

RUNKLE: In order to be credible.

GARRICK: But, isn't all the corroboration making it credible? Why are you spending my money?

GOLAN: Can I, Dr. Garrick?

GARRICK: Yes.

GOLAN: Although the results were consistent with independently derived results, what other scientists did, it didn't meet our quality requirements. And, if it's not going to meet our requirements, I'm not going to send it to the NRC to ask them to meet their requirements. So, it didn't meet the requirements. I made a programmatic decision last fall to replace it. I'm the one who made that recommendation to the Secretary. I'm responsible and accountable for that. But, part of it is is it didn't meet our requirements and, therefore, we're not going to use it.

GARRICK: Thank you. George?

HORNBERGER: Paul, before you sit down, can you give us some indication of what fraction of the data and analysis from the USGS didn't meet the quality assurance? I assume it's quality assurance?

GOLAN: It's quality assurance, the quality assurance requirements on infiltration. And, I think Gene could probably speak more in terms of the percent. So, if you have

some numbers in terms of what--

RUNKLE: I don't have numbers. It's really the overall quality assurance perspective that has been brought to question by the e-mails. And, so, trying to defend against that from a technical perspective is very difficult. What we are doing is making sure that our quality assurance requirements are fully met with this work that's ongoing at Sandia. There have been quality assurance surveillances performed, and there will be a quality assurance audit performed prior to, or near the completion of the work, as well as an independent set of reviewers will be brought in to look at not only the process, but also the technical aspects of the infiltration modeling. So, we are really adding a lot more rigor in here. This has had a lot of attention nationwide in this area, and has been a very serious impact to our program.

GARRICK: Thank you. Any other questions? Yes, Dave Diodato from the staff?

DIODATO: Diodato, Staff. Thank you.

I just wanted to follow up and get some clarification on the MASSIF code. Your findings and your evaluation technical impact report said that the infiltration rate estimates supplied by the USGS were consistent with and corroborated by independent data. So, you felt good about that, your independent analysis felt good about that. So,

that suggested the analysis itself was sound technically. So, what I'm wondering is are all the, other than the evapotranspiration methodology that's being developed in MASSIF, I assume is how it's pronounced, or MASSIF?

RUNKLE: Right.

DIODATO: Other than the change in the evapotranspiration, are all the other physical processes that were simulated in the old code now going to be simulated in this new code?

RUNKLE: Many of them are using the same modeling concepts. There may be some changes and some nuances there. The biggest difference is in the evapotranspiration modeling activities. Those will, again, we will have all of that documented in the AMR process, and that will be available for review.

DIODATO: Thank you. With regard to Figures 5 and 6, you showed the Yucca Mountain estimates on these figures. In particular, the range of precipitation is between 400 and 500 millimeters. Did your independent experts provide you with some insights or hypotheses as to why these numbers were lower than either the Maxey Eakin estimates or the other field estimates shown in your plots here?

RUNKLE: We did not. We realized that when we compared these, they are somewhat lower. But, again, you know, this is looked at, you know, as all of the data together, and we

did not go back and specifically say this is because of this, or we did not look at the background as to why that is that much lower.

DIODATO: Thank you. The one final question is you are developing INFIL 2.2 up in Idaho.

RUNKLE: Yes.

DIODATO: And you talked about the changes that are going to be incorporated in that new revision of the code, what's the purpose for developing the code?

RUNKLE: The purpose of that development was early on in the Summer of 2005, we were not sure where we were going to be as far as the license application processes, and this was looked at as a method that may bring credibility to the process. And, so, that was initiated at a time, and it ran in parallel with the work that had been ongoing at Sandia. So, they were two paths to come to the same conclusion. We are now on a path that we will have time to complete all of the work on infiltration by Sandia, bring it back into the TSPA process, and bring it forward into the licensing application.

DIODATO: After concluding the work on INFIL 2.2, then I guess you're going to abandon that?

RUNKLE: That would be set aside, yes. That's what I indicated in the viewgraphs. That is, it will not be brought forward as part of anything in quality-affecting work with

the LA.

DIODATO: Would you place that code in the public domain, though, as a service to the public?

RUNKLE: I'm sorry, I couldn't hear you.

DIODATO: Would you place that code in the public domain when you are finished with developing it?

RUNKLE: Yes, it will be available.

DIODATO: Thank you.

GARRICK: Any other questions from the Board, from Staff?

(No response.)

GARRICK: It's a tough job, Gene. Thank you very much.

RUNKLE: Thank you.

GARRICK: Our next presentation is going to be given by Dr. William Alley, who is the Senior Advisor for Ground Water at the U.S. Geological Survey. He has responsibility for major Federal groundwater programs managed by the USGS, including the USGS Yucca Mountain Project Branch, and provides leadership in technology transfer and training across the bureau.

We welcome you.

ALLEY: Thank you.

First of all, I should say that the discovery of the e-mails written by USGS scientists showing both a lack of respect for QA, and in some cases, suggesting non-compliance

with QA, has been a traumatic experience for our organization over the past year, as you might imagine. And, we take the matter very seriously.

We continue to work with the Department of Energy and their contractors to resolve the technical issues, many of which Gene Runkle just described, and we are also taking actions to assure that such problems do not occur or extend elsewhere in the project. And, I'll mention a few of those in a moment.

First, I think one point it's important to make here is that certainly in the media, this has been simplified into a "data falsification issue." And, to date, there is no evidence that anybody anywhere made up any data on the Project. The issue which we have had to struggle with is circumvention or misrepresentation of QA during development and application of the net infiltration model, INFIL. I think it was just, Paul Golan and Gene Runkle just mentioned, the reason they are going through such a thorough analysis is because unfortunately, attendant to that is essentially an individual saying they're going to do one thing and tell somebody else they're going to do another, and that completely undermines your work when you have something like that out.

Gene just described the extensive review of the INFIL model, and its datasets. While we are working with DOE

as part of this effort, for example, initially, DOE had difficulty reproducing some of the infiltration maps from the model output. We resolved those issues early on, and we have been able to produce all the maps from the information provided.

In addition, we are working with DOE to assure that all the model output parameters, et cetera, can be tracked to original sources. That's the other major activity really, is trying to trace data back.

And, finally, we believe that the INFIL model should be documented in the general users manual, similar to other USGS models, such as MODFLOW, to assure its transparency and availability to the scientific community. We're undertaking this activity, which includes testing and refinement of the code. In fact, we will use this code. This code is a code that's being used elsewhere in the United States besides Yucca Mountain in the Western United States, so we feel it's very important that we go through this process and have a very clear documentation.

Indeed, our examination of the infiltration modeling work has reinforced the need for published products that are more concise and accessible to the scientific community. So, lots of scientists can actually see what's there, and put their own opinions forward.

In a sense, informed scientific QA, is a way, an

essential element of QA. The INFIL model, like any other model, is based on a set of assumptions, and many possible approaches could be used for the same problem. So, it's important it's very clear, concise to people knowledgeable in the field exactly what was done.

Thus far, I have focused on the technical elements. We also need to address the attitudes toward QA that were expressed in the e-mails. We've held a continuing series of group discussions and all-hands meetings with employees of the Yucca Mountain Project Branch within USGS to reinforce areas of concern as they have arisen--an example would be the proper dating of scientific notebooks--and to try to maintain morale on the Project as we move forward and keep people informed as best we can of what's happening.

With the release of the IG reports, we are planning the equivalent of a stand-down day in which the entire Project staff and management will stop day to day activities, and focus on the types of problems that were revealed by the e-mails. Also, a chance both to reinforce ethical and QA principles, and to allow an open discussion between management and employees on how we can address QA in the most efficient and responsible manner.

To further ensure that our work will stand up to scrutiny in the regulatory process, we have been soliciting an extent of conditions review, and we had a contract out for

that. We were close to closing that, and we had some contractual problems, so we are reopening that again this month.

Again, that would be somebody independently looking at the organizational questionnaires, audits, conducting employee interviews, et cetera, to see if the problems that were attitudes expressed in these e-mails are evident anywhere else in the organization.

In closing, I would like to say that I know from my experience with the Project that the vast majority of scientists in the USGS Yucca Mountain Project are extraordinarily dedicated to the Project, and do their utmost to act faithfully to its principles and demands. Unfortunately, the extraordinarily poor judgment and actions of a few individuals have caused the bad light to be cast upon the whole Project this past year. I think our folks have done well in dealing with that, but it's been a very trying time for essentially anybody that's associated with the Yucca Mountain Project and USGS because of the bad actions of a couple.

With that, I'd be happy to discuss any questions you might have.

GARRICK: All right. Questions from members of the Board? Howard?

ARNOLD: Arnold, Board.

Have you undertaken any specific disciplinary actions?

ALLEY: We've been waiting for the IG report for any disciplinary actions, which we have received within the past two weeks. The full IG reports are being evaluated by our personnel people. We have a plan to try to address these issues. I should say that because of the Federal employees, there's a certain confidentiality that goes along with that. I can't really speak to it today, but certainly that's being considered now as the IG report is out.

GARRICK: Andy?

KADAK: Kadak. What would you ascribe to be the root cause of this event?

ALLEY: Myself?

KADAK: Yes.

ALLEY: I think there's a number of things here. First of all, I think you had a couple of scientists who were not following the rules, and probably were not kept tabs on enough. Second of all, they were under a lot of pressure. There was a lot of pressure. If you read the e-mails, you can see there was a lot of pressure to get things done very quickly. They were developing a model and applying it, essentially developing code and applying it at the same time. And, so, I think they were very frustrated, and I think that their frustrations carried over to trying to deal with--there

were some changing situations, too. So, I think that there were sort of several elements, really, that probably led to the whole event.

GARRICK: Any other comments from this Board or the Staff?

(No response.)

GARRICK: Dr. Alley, we very much appreciate your having the courage to come here and share this information with us, and we look forward to reading the report and get better informed. And, we're very pleased that it didn't materially impact the underlying science.

See how easy it is to get back on schedule? You have a question?

All right. Our next presentation is going to be given by somebody that's presented to us several times, John Kessler. John is the manager of the High-Level Waste and Spent Fuel Management Program at EPRI, the Electric Power Research Institute, or formerly. His background includes Yucca Mountain total system performance assessment using probabilistic methods, colloid-aided contaminated migration research, low-level waste and spent fuel storage system design, and waste solidification R&D.

John has certainly been a pioneer in the application of the probabilistic risk assessment methods to repository design.

Welcome.

KESSLER: Thank you, John.

And, I just want to start right out by damaging my credibility in not knowing what date it is at the bottom there. I apologize for that.

On the next viewgraph, I actually do know what date it is. I want to, first of all, acknowledge the authors and remind you that what I'm presenting will be issued as a report of preliminary work. That report has been submitted to EPRI publications, and should be available at the end of this month.

I'd like to acknowledge the report authors. Mick Apted from Monitor Scientific here in the front row, was the lead author of that. John Kemeny from the University of Arizona worked on rock mechanics issues. Fraser King on waste package degradation. Al Ross on regulatory issues. Ben Ross on infiltration. Frank Schwartz on looking at the saturated zone. And, Wei Zhou on doing the modeling.

Next viewgraph, please. In terms of the motivation for this work, certainly it's no loss on the industry, as well as anybody else, that spent fuel inventories are rising, and at the current rate of generation, they will rise past 63,000 metric tons in a few more years.

This viewgraph shows really the distribution of where that spent fuel is sitting right now. The blue portion

of the curve is what's in pools. The red portion is what's in dry storage. And, the take-home message here is, again, nothing new to you, which is that the pools are just about full, which is why the thickness of that blue part isn't increasing anymore, and essentially for every stick of spent fuel that you put in a pool, discharging from your reactor, you've got to put one stick of fuel in dry storage until we have some sort of off-site solution.

Next viewgraph, please. So, the purpose and approach, again, I want to remind you that this is a preliminary analysis of the maximum physical capacity of the geologic repository at Yucca Mountain. We were looking only at the disposable commercial spent nuclear fuel, and, again, we are at this point aware that the Nuclear Waste Policy Act limits Yucca Mountain to 70,000 metric tons. Of that, 63,000 metric tons has been designated for commercial spent fuel.

The approach that we took in this preliminary analysis is that we wanted to assure minimal impacts on the cost and schedule of DOE's current 70,000 metric ton design, in the sense that, first of all, we want to consider only Yucca Mountain real estate that's been characterized already by DOE. Second of all, we wanted to start with DOE's current line-load, the high-temperature operating mode repository design, the 11.8 kilowatts max per package, 1.45 kilowatts per meter, and not essentially move away from that particular

design, but merely add to it, at least for our preliminary analyses.

Then, we applied thermal constraints on natural and engineered barriers that we felt were appropriate. Again, for this preliminary analysis, we used conservative convection only thermal modeling. That is, we used TOUGH2 code, and I will talk about that a bit more. We have identified a few alternatives in this preliminary work that may further optimize commercial spent nuclear fuel disposal capacity, and we intend to explore that more as the year rolls on.

Next, please. This viewgraph really is just kind of where we started from. It's a, if we at least pre-TAD, these dimensions down here in terms of spacing between the units of containers that we heard about this morning, is what we use for our initial study. Maximum waste package temperatures were in the 160 to 180 range. The DOE design had the 81 meter pitch between the drifts to maintain the sub-boiling pillar of tuff for drainage of condensate water.

This particular viewgraph down here just gives you an idea of how big that pillar is in the current DOE design. You can see that the lateral extent of boiling is more likely to be only maybe 5, 10 meters out, which leaves a very large pillar that stays below boiling at all times in DOE's current design.

Next viewgraph. So, when we did our analysis, we assumed really the following temperature limits. First of all, we looked at cladding, the 350 C cladding limit, and I've got optional there, because we are aware that, for example, in NRC's TPA, they don't take credit for cladding. In our own analysis, we suggest that cladding could be a backup engineered barrier, that in terms of its overall incremental contribution to overall performance, it's not large. Nevertheless, you don't want to throw away a barrier unnecessarily. So, we're holding onto that for now.

In terms of waste package surface temperatures, in the last backup slide, I show you what we estimated for a peak waste package temperature all the way up to 309 C, what the EBS failure distribution would be. What we find is that even up to that temperature, and presumably we could go higher than that, we find really no significant degradation of the long-term integrity of the waste package. You will see that in the permutations we looked at, we don't get anywhere near even the 309 C in our models.

Rock wall, we retained the 200 C limit. We recognize that there is somewhat higher temperature that one could even go to on the rock wall, that low to high Crystobolyte phase change doesn't occur until you are up about 228, or so, and 200 C provides you some margin there to stay away from that phase change that causes somewhat of a

thermal expansion.

And, as you will see, we have relaxed the goal of maintaining the pillars below boiling for all time. In the model results I will give you a sample of, we had a very short period in which the pillars dry out, and I will go through those details in a minute.

Next, please. We looked at three different options in terms of expanding the potential technical capacity of Yucca Mountain. In the first option, we really looked just at an expanded repository footprint, just increasing the real estate, looking to see what rock has been characterized adjacent to the main block that DOE is proposing now.

In Option 2, we looked at a multi-level repository, in this case, a three level repository, where we, again, retained 81 meters between the groups of three vertically spaced drifts.

Option 3, we did it the other way, where we had really drift triplets all at the same elevation, where the spacing between drift triplets is retained at 81 meters.

What we were interested in is the range of expansion factors, really, you know, the multiplying in terms of capacity factors on the current 63,000 metric ton of commercial spent nuclear fuel limit.

And, the last thing that I will talk to you about is we looked at combinations of options. One with Option 2

or 3.

Next viewgraph. I apologize for this not being the best of figures. But, what I want to talk about is that the current repository is a one-level, high-temperature operating mode design. What we looked at was expanding it over a larger area. What I want to point out is that the Topopah Springs tuff units are very thick, not only in the primary block here, but also in adjacent blocks off to the west of Solitario Canyon, and even to the east of the Ghost Dance Fault, as well.

So, the point is is that in the neighborhood of the primary block, there is still quite a bit of thick units of Topopah Springs tuff to potentially look at.

The proposed repository happens to be right about at the location of this fold. There's a white line here. In fact, that fold thickness is reasonably to scale in terms of the drift diameter. So, you get an idea of how much space there is in addition to the current drift horizon within the Topopah Springs units. It's on the order of about 170 meters thick in this region.

We have major northwest trending faults that define suitable rock blocks between units here, and we recognize that there would be a respect distance that would need to be considered as you go perhaps and expand the repository on the other side of some of these faults.

We believe that you can generally maintain 200 to 400 meters of rock cover as you look at other areas as well, and that you could maintain roughly 200 to 400 meters to the water table below.

Next, please. Regarding our Option 1, which is really to extend the footprint, we just took this figure out of the DOE's Final Environmental Impact Statement. And, in addition to really the primary block here, when they looked at a low temperature operating mode, they looked at expanding into a block to the east of the Ghost Dance, as well as a small block to the south of the primary. And, finally, they looked at a couple optional areas even farther west, all west of the Solitario Canyon. These are all discussed to some degree in the FEIS.

Next, please. So, when we looked at not only the FEIS results, but went back through the literature of other areas that were considered, and at least somewhat characterized throughout the years, when we did our own study here, we were confident that we could go to roughly two times the current footprint, that there was plenty of good rock right in adjacent blocks to the primary block, roughly doubling the available acreage. And, it's possible that if one were to maybe make use of some of the other blocks, you could get up to a factor of 2.6 to 3.5 times the available area that's being used in DOE's current design.

Next, please. The second option was looking at a multi-level repository. This is just a cartoon of what a three-level repository might look like. In our particular model, we looked at additional drifts that were 30 to 50 meters above and below the current DOE HTOM design. And, we looked at some of our options, and I'll show you in a minute here, at the same and lower line loads. We looked at 1.45 and down to 1.0 kilowatts per meter.

Next viewgraph, please. Multi-level repository designs are not new. They have been considered before. DOE has considered them themselves for Yucca Mountain. The Europeans and Japanese are considering using multi-level repositories. And, back in '99, Charles Fairhurst in a report to the ACNW presented some ideas for multiple level repositories. In this case, he was looking at Richard's Barrier approaches. Nevertheless, the concept of a multi-level repository was introduced then.

Next, please. The third option is looking at the grouped disposal drifts, where in this case, we're looking at groups of three, with 81 meters between each one of those groups of three, and roughly 20 meters between each of the drifts in the triplets. That leaves us 41 meters between these groups, which we will call our pillar in this case. And, again, we looked at same and lower line loads, 1.45 and I think this should be half of 1.45, the table corrects that,

per meter that we looked at, depending on the particular drift.

Next, please. All right, getting onto what our preliminary model looked like for this. We used TOUGH2. It's the same code that DOE, Yucca Mountain Project has used. This is a 2D model initially, so this is a conservative model in the sense that we have essentially no heat transfer off to either the sides or the ends, so that this particular model here which has--this is a unit cell of the model where you can see again the half cells for the vertical and the two half cells for the horizontal triplet model. This would represent the very center of the hottest drifts, the model that we looked at here.

I'll show you in the next viewgraph that this was calibrated against some DOE results, and the Option 2, the vertical triplets, is on the left here, and Option 3, the horizontal sets, are on the right.

Next. This is just a quick viewgraph to show that we calibrated our model using parameters for the units that are within the range of what DOE used to get roughly the same peak drift wall and side temperatures here. And, in this case, we plotted our gas saturation versus time, which really is an indication of the amount of time that the area right around the drifts is dried out.

Next, please. Okay, for the multi-level

repository, the ones that are stacked, the stacked repository design, we looked at really six different permutations. In this case, we looked at 30 meter or 50 meter spacings. We looked at initial line loadings of either the current 1450 watts per meter or 1000 watts per meter for all waste packages, which is two-thirds of the line load now. So, two-thirds times three is an expansion factor really, an increased density factor of a factor of two, and, of course, we looked at up to three here.

We looked at ventilation times from zero to 50, or 50 to 300 years, with different ventilation efficiencies based on the ventilation AMR produced by DOE.

Next, please. This is one example of the output we got for a particular Option 1 here. And, I know it's a little hard to see, especially for those poor souls in the back of the room. But, what I've got here on the left three is the temperature distribution around those stacked drifts versus time. The top line is 55 years, second line is 100, third line is 1000 years after closure.

What is of more interest, or perhaps clearer, is when we look at gas saturations versus time, where again, this darker orange color is a gas saturation of one, meaning that that portion of the repository has dried out. And, what you see is that at about 100 years, or roughly about 200 years, we get a temporary dry-out of the entire pillar. And,

then, by the time it is at 1000 years, again, we have a lot of the pillar back.

Next viewgraph, please. This is a pretty busy viewgraph of temperature versus time at various positions within the package and across that pillar. What I want to really draw your attention to is this gas saturation versus time viewgraph for this case. This light blue inner curve here is at the center point of the pillar. And, what this suggests is that in this conservative model that we developed, we show a full dry-out of the pillar that only lasts for a few hundred years before we start resaturating the center of that pillar. And, as you see, we've got a good section of the pillar back even within the first thousand years.

So, one of the other things that we conclude is that block condensate water is unlikely to be transported via heat pipes through the thermal barrier to the emplacement drifts. Again, what we see is that the liquid water that might pile up temporarily in the pillars is laterally, there's some lateral distance before it could potentially drain into those lower drifts off to the side. I think that's very unlikely that that would happen.

Next viewgraph. Okay, now, from the stacked drift design, we go to the side by side triplet designs. We again looked at six more cases. In this case, those triplets have

20 meter spacing, again, with 81 meters between the groups, leaving a 41 meter pillar. We looked at initial loading of either the 1450 watts per meter, which gives us an expansion factor of three again, to a differentially loaded, line loaded, where we again preserve the 1450 watts per meter in the center of the three, and then go with half thermal loading in the two side drifts, which would give us an effective expansion factor of two, again, looking at different ventilation durations and efficiencies here.

Next viewgraph, please. Here again is one example output for this particular grouped design, where you can see temperatures evolving, both up and then back down again, around these drift triplets, versus time, again, 55, 100 and 1000 years. And, here's the gas saturation, evolution versus time, and what you see again is that at 100 years, down at this level, we have dried out the drift completely, but then within a few hundred years, and certainly by 1000 years, we've got a sub-boiling section of pillar available again.

Next, please. Same viewgraph. Again, I want to draw your attention to this light blue curve, which shows you the duration of time at which the entire pillar dries out. Again, you can see that it's just a few hundred years, and then we have started dropping below boiling in the center of the pillar.

Next, please. So, the derived expansion factors

from these three options. For the extended footprint, we have determined that you can go to roughly 2 to 3 1/2 times the acreage that we think is available, with a current commercial spent nuclear fuel limit of 63,000 metric tons.

For both the multi-level repository, and the grouped-drift repository, we looked at increases in density of factors of 2 to 3.

Next, please. So, if we combine Option 1, the increased footprint, with Options 2 or 3, the increased density, even at the end of this preliminary study, we were confident that at least four times the existing commercial spent nuclear fuel limit can be emplaced at Yucca Mountain, with even the current or limited additional information. That would give us about 260,000 metric tons of technical capacity.

And, then, if you wanted to work hard, you could go possibly upwards of nine times the existing commercial spent nuclear fuel limit that could be emplaced at Yucca Mountain, which gets you up to about 570,000 metric tons.

Next, please. One of the questions we have certainly been getting since we started presenting this work is that, well, gee, aren't we already close to the dose limit, and how would we increase the capacity by batches of four to nine, that would go over it. Well, that might be the case in a conservative model. In EPRI's model, when we try

to use the more best estimate approach, what you see is that our peak dose at a million years is under a tenth of a millirem per year, and on a long scale, you can see where 15 and 350 are relative to our results.

Why are our results different? It's primarily because we are assuming that the neptunium solubility is governed by secondary phase precipitation rather than Np02, which I believe is what DOE is moving to now, and we also do not feel that there are any high temperature deliquescence issues, and that the Alloy 22 is going to last a long time. We don't see any localized or stress corrosion cracking in the Alloy 22 analysis.

Put those two together, and we get peak doses on that range. So, that again, with the more best estimate model, we even increase this by a factor of four to nine, we're still well below those kinds of numbers.

GARRICK: I want to make sure I understand this. This is for the high capacity?

KESSLER: No, this is--we have not done a TSPA on the high capacity. I'm sorry, John, I should have clarified. This is for the base case, the 70,000 metric ton HTOM design. That's what this dose analysis is for.

GARRICK: Okay.

KESSLER: Thank you. I should have clarified that.

And, so, what we are saying is is that if you

roughly said that the source term was directly proportional to the loading, you could multiply these numbers by factors of four to nine. We don't believe that's the case, especially for the stacked repository design. We believe that given somewhat longer dry-out times, the fact that you could have a drift shadow that protects the lower two drifts from the upper--or, the upper drift protects the lower two, you might actually have a lower proportional release rate, or average release rate, such that we don't even think the dose would go up by that much.

But, thank you for the question. This is for the 70,000 metric ton design.

Next, please. We're not done. I've tried to emphasize that this is our first pass at this work. We are currently looking into what additional analyses we want to do, and we are open to suggestions even.

We certainly want, first of all, we want to do more detailed kinds of thermal modeling. We recognize with this simple 2D model that we've got that's really modeling the center of the repository, we are missing a lot of edge effects that would cause us to over estimate the peak temperatures, as well as whether the pillar would really dry out or not if we went to more detailed models.

We are also looking at construction issues, or will look at construction issues. We don't expect there to be

any. Certainly stacked drifts or side by side drifts with the kind of spacing we'll look at with the kind of rock properties we're looking at is far from unprecedented. Lots of mining experience in doing those kinds of things.

We also recognize that as we look into those construction issues, that the second or third drifts may not even be drilled until the first drifts are starting to load. Remember, we want this work to be done, our vision is that this work would be done in parallel with the first 70,000 metric tons being licensed, constructed, et cetera.

Certainly, there would be a need for additional ventilation if the desire was to keep temperatures where the current HTOM design is for the preclosure period. Again, we don't believe that that presents any insurmountable technical challenges. It does require more ventilation shafts, but we don't see any particular reason why that couldn't be done if there's a desire to do so.

We're looking into whether additional surface aging may allow even higher mass loadings, or some other options. We're going to look at different loadings within the drift triplets, in addition to what we have seen here, or what I have shown you here. We want to do some description of the additional site investigation and R&D needs, and, in general, schedule for completion. We want to look at the effects of higher pillar temperatures on fracture opening and closing,

maybe running some UDECK models. And, we are going to try to do the second phase of this work toward the end of this year.

Next, please. So, just to summarize, again, emphasizing this is preliminary analysis of the Yucca Mountain maximum physical capacity for commercial spent nuclear fuel. We're going to do some more work throughout this year to explore the options in more detail. But, our conclusion now is that we have a lot of confidence that we can get certainly four times the existing limit, and with additional work, potentially up to nine times the existing limit for commercial spent nuclear fuel in Yucca Mountain.

The options that we looked at have minimal impacts on cost or schedule of DOE's current 70,000 metric ton design, and that we have started with DOE's high temperature operating mode, line-loaded repository design, 81 meter spacing. We've used current site characterization information, and that additional information that's required to expand the repository can be collected in parallel with the licensing and construction of the first 70,000 metric tons.

Thank you.

GARRICK: Thank you. All right, Bill?

MURPHY: That was very nice and very provocative and optimistic, also, I would say.

You mentioned some possible uncertainties

associated with the 2D model as opposed to a 3D model, and you refer to it as being conservative with respect to temperatures and heat flow. Are there possible problems associated with this, the alternate design associated with edge effects, or other things? Have you identified problems that might occur, for example, the vapor transport in the third dimension, or concentration of the liquids around the margins, or anything else? Is there a down side to these options?

KESSLER: Well, as I said, we have not looked at edge effects yet, so we haven't looked at that. Our feeling is that it's not going to be a major stumbling block for a potential design like this. We haven't looked into that one.

Other questions were we are going higher in temperature right around the drifts than what is currently in the DOE projections. Our peak waste package temperature, instead of being in the 160 to 180 range, for some of these options, go up to about 200 C, maybe a little over that, the waste package surface temperature. The rock wall temperatures, we have looked at in these designs go up to about 200 C, but not beyond 200 C. So, again, we don't see that as being a major issue.

We are going to look at, because we are going to somewhat higher temperatures all the way across the pillar, we do want to look at the effects potentially on fractures,

opening and closing due to that thermal expansion across there.

Are there problems? There are challenges. It's not going to be something you can just plunk down. We recognize that more work would have to be done. Nevertheless, we still feel confident we are not being optimistic with our factor of four number. Factor of nine, we recognize more work would have to be done. But, with a factor of four, we are very confident that the technical basis can be made for a factor of four.

GARRICK: Let me ask a corollary to Dr. Murphy's question, a corollary question.

Have you learned anything from this exercise about performance parameter dependencies?

KESSLER: Well, that's an open question. Certainly, we haven't looked at that many parameters yet. I want to emphasize this is preliminary work. We're still looking into those dependencies. What you have seen us look at is spacing, line loading, and vertical versus horizontal, is what we have looked at so far. And, again, what I think surprised us, even with this what I still would argue is a conservative 2D model, is that the temperatures and the amount of dry-out were less than we expected. So, we noticed that.

And, even what we're still missing is mountain

scale convection, so we've still got those things that can be put in.

GARRICK: One of the most dramatic doesn't have anything to do with the capacity question, was your dose slide, indicating the impact of a source term that involves secondary phases. It's those kind of things that really can add a major impact.

KESSLER: Right. And, I think that the reason I put that in was that we have gotten questions about, well, gee, isn't DOE close to the limit now, whatever it is, EPA will decide the limit, and, therefore, we couldn't possibly extend it, just based on dose rate considerations. Well, DOE is going in with a current design, and the degree of conservatism now, and perhaps with additional work--I think not perhaps--definitely with additional work, those conservatisms could be revisited in the future, such as neptunium solubility, such as the long-term Alloy 22 degradation. And, if that work is done in parallel with DOE proceeding with the designs and the models they've got now, we could justify expanded capacity, and still show reasonable doses, you know, certainly doses in compliance with the ranges of numbers we've been seeing EPA proposing.

GARRICK: Ron, and then David.

LATANISION: Latanision, Board.

John, I would like to follow up on your last point.

And, I am just wondering what sorts of conversations you've had with the DOE folks, or whether some of the folks who are here could comment on the Project's response or reaction to this study? Perhaps Russ, or some of the other folks on the Project?

KESSLER: Well, I will say from my perspective, we didn't ask for DOE input. This was requested by EPRI's members, and DOE saw it at the same time that the public saw it. So, I don't know if DOE has a reaction. You know, Russ or somebody can say it.

DYER: Russ Dyer, DOE.

I'm assimilating it, just got it now. I know that we're looking at some things that are somewhat similar, some of the options for how you might configure the underground, looking at stacked drifts, things that might take advantage of drift shadow effects. But, we're just looking at it in the "what if" category right now.

GARRICK: David?

DUQUETTE: Duquette, Board.

You did just right at the end comment on the Alloy C-22, and as I am sure you are aware, the property of the C-22 can degrade at higher temperatures because of possible metallurgical changes, and there seems to be some indication that as you increase the temperature, the localized corrosion resistance decreases. You had a throw away comment, I don't

mean that pejoratively, that you think the Alloy C-22 is going to last for a very long time.

KESSLER: Yes.

DUQUETTE: A number?

KESSLER: Can you go to the very last viewgraph, please? Let me see. I can give you a number here. 29, please. This is for a case where we have a peak waste package temperature of 309 degrees C. And, please note the scale, 10,000, 100,000, million, 10 million. We can run models forever. But, the idea is is that even by a million years, here's the drip shield in terms of cumulative fraction failed for this, quite high temperature design, or high temperature case that we ran, versus time, and the waste package is the black line here. Again, fraction failed versus time, and what you see is that we are out in the--by the time we get to a million years, I believe our number is 15, 20 percent failed, something like that, even for this high temperature case. We have taken into account the changes in the properties as we go up to those temperatures.

DUQUETTE: Duquette, Board.

What failure model are you using for this data? Is it just simply, is it creep, is it metallurgical transformation, is it embrittlement material, is it stress corrosion cracking, is it pitting? What failure mode are you assuming?

KESSLER: I will do my best to remember. Okay? Fraser King is the better person to answer this question. My recollection is it is localized corrosion, stress corrosion cracking, general corrosion, MIC enhanced corrosion, thermal sensitization have been considered, and I'm guessing I'm missing something. But, those are the ones I remember that we have in our model.

DUQUETTE: Thank you.

GARRICK: George?

HORNBERGER: John, you showed your dose curve, and you suggested that the Project, if they were to revisit the conservative assumptions, that there might be room. However, the Department has taken the approach, at least up until now, that they need to have a reasonably conservative approach to meet the license application. So, in your estimation then, if they stick with that, they really don't have much room; is that correct?

KESSLER: Maybe, maybe not. Again, we recognize that to expand the capacity is going to require a few changes in some things that are on the books now, so to speak, like the current law still is 70,000 metric tons, even though we have these proposals out there.

If one were to look at expanding the footprint, especially if you went to one or the other side of the fault, potentially, you would have different flow lines down to the

Amargosa Valley region, and it may no longer be a basis upon which EPA chose the 3,000 acre feet per year of water usage into which you dump essentially all of your radionuclides passing the compliance point, may not be appropriate in such a design.

In that case, it would require, obviously, legislation, multiple legislation, changes in regulations. We've got time. This is the point, that what we are proposing doesn't change the current design, doesn't require a change in regulation. It does require a learning over the long-term. We do think that there's already a lot of data out there to support an expanded footprint to some degree, and that as we learn more and DOE might develop a better basis for removing some of these current conservatisms, then we think that compliance could still be maintained.

In addition, I already mentioned that for the stacked design, it may be that the lower drifts would be protected somewhat by the upper drift and your source term may not increase that much. We haven't looked at it yet. But, those are all possibilities.

So, the answer is maybe, maybe not. We recognize that over the periods of time we're talking about, to characterize, develop, support, defend, license, amend, an expanded repository design would be some time, and DOE would have that time to do that.

GARRICK: Andy?

KADAK: Kadak, Board.

Given your presentation, what advice would you give to DOE so as not to preclude the options that you are talking about in terms of being able to situate or site such a facility in the future?

KESSLER: I don't think that what we've done here--we deliberately chose the options we chose, Andy, so that DOE would not have to change anything. Okay?

KADAK: Well, I'm talking, for example, location in the rock formation, in the center, put it a little bit lower?

KESSLER: I believe that where they've got it is roughly in the center of these zones that we're looking at, that you could go certainly 30 meters above and below, and stay out of the formations above and below, and 50 meters above and below, in a lot of cases, and still have plenty of room above and below.

KADAK: The technical question I have is have you had a chance to review the DOE multi-scale model and compare it with your hydrothermal modeling?

KESSLER: Yes and no. We have reviewed their multi-scale model. I believe we have talked about it in previous EPRI reports as well. We haven't incorporated the multi-scale model. This is really a single scale model that we have looked at here. Okay? We recognize that there are

mountain scale effects, that there are edge effects, that we haven't gotten into yet, and that's what gives us the confidence to suggest that what we have done is conservative, and that if we get into multi-scale models and start incorporating elements of that, conceptual models, that at least for the conceptual model part of the multi-scale model, we think that would only help with this kind of an approach. But, in terms of what we've done here, no, we haven't incorporated the multi-scale model yet.

KADAK: Have you been able to correlate the 11.8 with the 1.45 line-load and your peak temperatures?

KESSLER: We haven't worried about it. We have assumed the same line loading, with the same spacing as I showed you in Figure--whichever it is. Okay? So, that's not something we've investigated yet. But, we recognize that TADs are going to add a bit of length, such that if you put in the same amount of, you know, kilowatts per waste package, the line loading might go down a bit. Never mind, don't worry about it.

KADAK: Okay.

KESSLER: But, we haven't investigated that yet, other than looking at different line loads, 1.45 kilowatts per meter, 1 kilowatt per meter, and .725 kilowatts per meter, we have looked at in some of these permutations.

KADAK: And, do you believe the need for having a pillar

of that magnitude is important to the thermal hydraulic performance of the rock? In other words, they take that as a design constraint, a design requirement. It sounds like your model suggests that you don't need that as a design constraint, and you could tolerate much smaller pillars and still have the same effect of performance.

KESSLER: Correct. That's what we think, that the size of the pillar that DOE has now is very ample, let's just put it that way, and that, again, with additional work, one could justify a smaller pillar than what DOE has done.

KADAK: I need to ask a localized corrosion question. Could you tell me how you FEPed that out?

KESSLER: Well, we looked, as you may be aware, you know, it was before your time on the Board, we have looked into the deliquescence issues, and are still looking into the deliquescence issues. When we did that, we found no evidence of localized corrosion. We have looked at the binning of the near-field waters, and, in fact, another report that I'm getting into the system that will come out at the end of this month, we re-evaluate that binning, and does it somewhat differently.

Fraser King, our waste package degradation guy, last week at the International High-Level Waste Management Conference, gave a talk on how localized corrosion is limited to one bin that I believe has a 1 percent probability of

occurrence. I'm probably going to get--oh, here I go. I don't know whether I've got stress corrosion cracking or localized corrosion the right way. I think stress corrosion cracking was the 1 percent chemistry bin. The localized corrosion actually occurred in 2 bins, with a total probability of 71 percent. So, we do take it into account. We haven't FEPed it out.

GARRICK: Okay. Bill, did you have a question?

MURPHY: Yes, please.

You mentioned that you have a model for incorporation of neptunium in secondary phases, and that apparently has a significant effect on your results that show, for example, that iodine is a more important contributor to dose, ultimately. Could you elaborate a little on that secondary phase model, what phase is it, and are there other radionuclides incorporated in it?

KESSLER: Co-precipitation with uranium and, goodness, I wish Don Langmuir was here. We again, EPRI published this work--last year, EPRI put out a report evaluating the three neptunium phases, Np205, Np02, as well as secondary--precipitation into secondary minerals, primarily uranium, with the U02 rate there. Don and Company looked at quite a few mechanisms, quite a few phases, and if I started naming names now, I'd just get myself in trouble. So, that report is out. I can make it available to you. It's publicly

available on our website. I will get you a list.

MURPHY: Thank you.

KESSLER: Mick, do you want to add anything?

APTED: Apted. Just a notion. Some of the responses John has been making are all correct. Going backwards, some of Bill's early questions, another issue, you worry about some of the other issues we're worried about. Certainly, the underlying Calico Hills and the Zeolite issue there, we're taking that on board, too, in terms of possible alteration.

I should point out in addition, talking about the sort of conservativeness of the three-dimensional modeling, I think at a previous Board meeting, even February or November, Sandia made a presentation to you on the Board on sort of three-dimensional effects, and sort of strong condensate formation at the ends of cooled drifts, up to 50 percent or more, and the condensate could be disappearing. We won't capture that in our model. So, in a sense, we are building up far more water there in the condensate zone than we think probably would occur in a three-dimensional model.

I think Dr. Garrick had a question about what properties we've sort of explored or tested on a performance basis. I think one of the key properties you see that we are testing is that none of these particular options lead to any sort of condensate flow or sort of flooding of the repository environment at any early time. So, in that sense of testing

when water will return to the system, we find that these systems perform pretty much the same as the current design in terms of water beginning to be the bad actor for corrosion, and eventual release.

KADAK: Is that due to the hotter repository for longer periods?

APTED: It's not particularly--that was my next point that Dr. Duquette raised, and some others--although John showed a 309 degrees curve. I mean, we looked at various, you know, going up in temperature, where are we going to get uncomfortable for the very reasons you pointed out. But, in these simulations, our peak temperature is only 200 degrees. Okay? And, the time/temperature evolution of these plots that you see that John showed are very similar to the current one horizon type.

So, we get back to the same sort of transition temperature that the corrosion people are concerned with in very comparable times. And, so, this entire three level or triad, they are performing very similar in terms of time and temperature, and history. If there's any difference, it's probably that they stay dryer longer than the current design, especially the second and third when we stack them up.

KESSLER: The next point. Just take a look at--this is Figure 28 in the backup slides. What you see is for a maximum waste package temperatures in these twelve options,

there's only one that goes to 229. And, for the drift wall temperature, we never exceed 200. And, this column right here gives you an idea of how long the pillar completely dries out, if it does at all, even in our conservative model.

APTED: And, if we go to Figure 5, Slide 5, that curve on the bottom there, the bottom left, that's not an EPRI figure, that's from the paper that was given last week at the High-Level Waste Conference. It's entitled Multi-Scale Thermohydrologic Model for License Application of Yucca Mountain. So, that's not our calculations. That's, indeed, what the project is finding from their interrogation of their set of properties for infiltration, thermal conductivity, and I think there's one other factor that they've got there, probably permeability of the rock. So, that solid line that John was pointing, about 8, going down to 10, is sort of the mean boiling distance away, so that's where--there's probably an engineering conservation factor, conservative factor, about a factor of 4 in this 81 meter pillar distance, based on DOE's own analysis.

GARRICK: Thanks, Mick. Any questions from the Staff? Yes.

DIODATO: Dave Diodato, Staff.

John, thank you for a very stimulating presentation. We appreciate it.

I wanted to turn to Slide 9, and just look at your

extended footprint option here for a second. To the west of Solitario Canyon, there's areas 5, 6, 7 and 8 that are labelled there. And, if we back up to Slide 8 now, we can see that Solitario Canyon is marked by that where the drop-off in the block, the normal fall from the extensional dynamics of the mountain, and at that point, the water table is about 60 meters higher on the western side of Solitario Canyon than the east. So, all of a sudden, the water table is coming up a little bit.

The other thing that I think about when I look at those rocks, there's this yellowish Paintbrush Tuff non-welded unit that's 40 percent or so porosity, so that provides kind of a lot of storage, and people think that maybe that can help the transients to come into the system, and help to shed water, and it comes off, and so, it kind of provides some kind of a performance function for the repository in that sense.

So, if you go to the west on your white line, now you kind of come down, and I wonder what the role of PtN is there, and then where the water table is in areas 5, 6, 7 and 8. So, I'm just wondering if you're thinking it may, you know, in the event the waste packages don't last a million years, then could there be some performance implications of siting waste over to the west of Solitario Canyon fault?

KESSLER: That's why we have a range, David. We

recognize that the properties in every single one of those blocks isn't the same. The blocks aren't the same size. They're not the same thickness. So, that's what we have come up with, is a range of potential expansion factors.

Again, if we assume that some of these givens are not given, like depth of a load, the ground surface, or distance to the water table, which are to some degree arbitrary and you could make them performance based in the future, you could get some more flexibility. But, we are very aware of the kinds of concerns you are raising, which is why we have this range in expansion factors.

Again, between the combination of the increased footprint that could be available, and some increase in density, that's why we're confident we could go to at least a factor of four higher. But, the factor of nine, we recognize is perhaps optimistic, would require a lot of investigation, questioning what the design criteria should be, and what's the basis for them, the degree to which we have confidence in the long-term degradation of Alloy 22, all of those things would go into getting up to expansion factors on the order of factors of nine.

DIODATO: Well, that makes sense, and I can understand that response. So, then, have you developed maybe a risk based order of preference of which of these options you would like to see explored first?

KESSLER: No, we haven't. At this point, we were looking for some preliminary results on some different kinds of options, looking at some different layouts that we could build, we could add onto the current layout, and this is as far as we've gotten so far.

DIODATO: Thank you.

GARRICK: Thank you, John. We very much appreciate the presentation.

This actually concludes our formal presentations. But, before we move into our public comment phase, I guess I'd like to make a comment or two about what happened today.

The last meeting, I believe those of you that were in attendance recall that I had registered a couple of complaints. One of those complaints had to do with the presentations being too congested in terms of allowing the Board adequate question and interaction time. Today, I think we saw exactly what we are looking for. The agenda worked very smoothly. The Board had adequate time to ask the questions, and I just want to be sure that the presenters realize that we appreciate that very much. And, we hope that this is the way future meetings are conducted.

Now, we come into the part of the meeting that we think is very important, and that's the public comment period. I have been given two names of people that want to make a public comment. And, of course, if there's others, if

they so indicate, we can allow time for them as well.

The first name I have is Michael King, who is a consultant, I believe to Inyo County. Is Michael here?

KING: Hi, I'm Mike King. I've been a long-term consultant for Inyo County. As a consultant, flying halfway across the country, I have to come up with one comment.

I'd like to address comments this morning regarding legislation to permanently remove lands for the--by DOE over the Yucca Mountain facility.

First of all, Inyo County would certainly applaud this legislation, and DOE's effort. If you look at it, hopefully we'll have no incidence in transporting waste to the site. The canisters perform well. The site is closed. The creation of this permanent wildlife preserve has the opportunity to provide a long-lasting legacy to protect the public from disturbance of the waste, as well as providing this buffer from the waste itself, short of creating the Yucca Mountain God that strikes you down, we think this legislation has far ranging capability.

The concern I had was this morning, I believe Paul Golan indicated that they are using the WIPP, numbers from WIPP to determine the number of acres to be withdrawn. My partner, John Brederhoff, worked for the Attorney General for New Mexico. The issue there that he found from a hydraulic standpoint was the oil and gas development in the area, that

it would possibly impact the hydrology and the repository's performance.

Groundwater development was limited. There wasn't a big interest in land development in the area. And, the hydrology and the salt repository lended itself to creation of a simple square boundary around this.

Now, if we switch to Yucca Mountain, the Department of Energy has invested quite a bit of money in Nye County drilling wells and the hydrology. For the Board's information, Nye County has applied for water rights to extract 20,000 acre feet of water in the area, in the Ash Meadows area. BLM is currently looking at liquidating several hundred acres of land in this area.

Now, our hydraulic studies show that this level of groundwater development could certainly encroach upon this legislative boundary as a buffer, particularly it could certainly impact the gradients and make sharper gradients from the Yucca Mountain site down gradient. You also look at we've got this porous volcanic rock system on the high-level waste, very different from what we have at WIPP.

We are also concerned that this development will impact the lower carbonate aquifer system, which provides a barrier to radionuclides because it has an upper gradient in it.

So, here's an opportunity for this legislation to

provide an adequate buffer, not necessarily a simple square buffer over the repository to consider the hydrology and actual site conditions, and don't just apply the WIPP conditions to this site.

If you look at the Nevada Test Site, adequate boundary was defined there to contain the underground nuclear waste events. We have no trouble taking public lands for baseball parks.

So, when we look at a high-level nuclear waste project, here is an opportunity to actually do the science, and we encourage DOE to do the science and look at the data they've already paid us to do, as well as their staff, to define a boundary that would make sense, and provide this long-lasting legacy of protection to the public.

Thank you. I don't know if DOE can address the use of the WIPP data or not, whether there's scientific basis to that or not.

GARRICK: Russ, do you want to try that?

DYER: Russ Dyer, DOE.

I think what Paul was talking about was the WIPP precedent, the legislative approach. I know that we looked at developing, as we looked at potential areas, we did look at what was needed to provide a protective boundary, based on a technical basis, not just on a precedent of that's what was done at WIPP.

GARRICK: Thank you. All right, the next name on the list is Charlie Fitzpatrick, and it's shown here as an attorney for the State of Nevada.

FITZPATRICK: Thank you. This will be brief, and I think Mr. Kouts would probably be the person, and I think he's left, so this could turn into comments instead of a question.

But, first, his presentation focused on the TAD system proposed, would simplify DOE operations, minimize handling of--minimize fuel handling at the repository, reduce worker radiation exposure at DOE facilities, reduce complexity and cost at DOE facilities. But, there would be a concomitant transfer to the utilities, to some 80 locations around the country, to purchase equipment, hire people, train them, quality assurance, and so on, to buy the TADs, pack them, send them off.

So, I just wondered if any study or analysis has been done, and if it will be publicly available as to what, either individually or cumulatively, the cost burden placed on the utilities around the country would be if this change were made, where that responsibility was moved.

The second question is a totally different arena. Mr. Kouts indicated that all the TADs would be sent by rail to Yucca, and, therefore, the rail spur would have to be in operation for the TADs to get there. After DOE published its

FEIS, it published what it called Supplement Analysis, in which it predicted that for some years, it would be likely that waste would have to be brought to Yucca without benefit of the spur being complete. And, so, it discussed rail as far as near Yucca, Caliente or some other location, followed by transfer to truck, and taken the rest of the way.

And, so, I guess the question is if what Mr. Kouts said is correct, or stays the same, would not the transfer of the first TAD to Yucca be delayed for years by the anticipated circumstance of a spur, rail spur, not being available for years after the license is received?

GARRICK: Thank you. Well, your questions will certainly be a part of the record.

Are there any other--yes, a former colleague?

PARIZEK: Richard Parizek, a citizen and taxpayer.

I had a question that was going to be to Director Golan about the funding status currently related to the Science and Technology Program, and maybe Russ Dyer could respond to that. In the natural systems area, a number of projects were funded, but only at half rate. And, a question was whether or not that has been resolved or not, because some of those projects are quite important to the list that you had cited earlier this morning, and at half funding, some of them wouldn't really get anywhere at all.

So, that's one question, has there been any motion

on adding to the missing money for those projects?

GARRICK: I don't know. Russ, do you want to comment?

DYER: I'll take a shot at it. This is Russ Dyer, DOE.

We have looked at the portfolio of S&T programs for this year. For some of the programs, we have plussed up the funding. For a lot of the programs, we're still hanging on, and have not provided any additional funding, that's true for most of the natural systems work. We're looking at we've got an awful lot on our plate, and what do we absolutely have to do this year.

PARIZEK: Continuing then. Maybe the start-up on some projects, you could do paperwork or maybe some calculations, but anything that requires field activities, or instrumentation, might get deferred, and may not be a good use of that money if they start something, but can't ever finish it. But, you mentioned this morning that there were important issues that you recommended go forward, and one of them was the work on radionuclide transport, colloid transport, and I would think both on saturated zone and unsaturated zone, secondary minerals and matrix diffusion. I would assume that that work, if it's ongoing or needs to be ongoing, would only come through the Science and Technology, a national program source of funding.

DYER: No, I don't think that's necessarily true. I mean, some of the division of work between us and the

repository program, we need to relook at that, a better look at integrating some of those programs. So, because some work is currently being done in S&T doesn't mean that we're not going to pick that up with a baseline program at sometime in the future.

The programs that you mentioned, those are all very worthy programs, and if we can figure out a way to continue them, I mean, nobody wants to kill them, we might have to put them on back burner for a few months, but everybody believes that certainly come the, say, the '07 budget time, that there will be a S&T program that will continue these kinds of work. We've got a sticky wick in here for the remaining few months of fiscal '06.

PARIZEK: I asked the questions mainly as an outside observer trying to keep track of the Program. We don't always know what's being worked on or not being worked on. That's the purpose of those questions.

John Garrick, you also mentioned that at least some conceptual modeling need not go forward or begin a low priority, a statement I think you made this morning. And, I would submit that, for instance, the role of faults in Yucca Mountain, in terms of potential fast pathways that might cause flow lines to deviate further west than was originally suggested by some early computer runs, and that was information shown to me for the first time last summer, I

guess it was at the Devil's Hole workshop, two workshops ago, showed that maybe a role of higher permeability pathways could shift the flow lines to the west, and that would shorten transit times compared to a southeasterly alluvial route. And, given that, that's a conceptual, a difference, quite a significant conceptual difference.

So, I would submit that there is an example where conceptual model refinements may not be trivial, or shouldn't be relegated to the back burner issue, particularly as it relates to transport and the role of faults. There is a Nye County initiative to look at locating perhaps horizontal drill holes to look into faults, to add to further understanding that. So, if that work gets done, maybe it will address this point.

Thank you.

GARRICK: Thank you very much.

All right, any final thoughts, comments, by any of the Board members or the Staff? I think we have had a very good day. I think we have made progress, which is what we are looking for, and I think the time has come where we can adjourn the meeting for the day.

Thank you very much.

(Whereupon, at 4:55 p.m., the meeting was adjourned.)