UNITED STATES

NUCLEAR WASTE TECHNICAL REVIEW BOARD

WINTER BOARD MEETING

January 24, 2007

Atrium Suites
4255 South Paradise Road
Las Vegas, Nevada 89109

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

SENIOR PROFESSIONAL STAFF

Dr. Carlos A.W. Di Bella
Dr. Daniel Fehringer
Dr. Bruce Kirstein
Dr. David Diodato
Dr. Daniel Metlay
Dr. John Pye

NWTRB STAFF

Dr. William D. Barnard, Executive Director
Joyce Dory, Director of Administration
Karyn Severson, Director External Affairs
Linda Coultry, Program Support Specialist
Davonya Barnes, Staff Assistant

I N D E X

I N D E X
(Continued)

P R O C E E D I N G S

8:00 a.m.

GARRICK: Good morning. On behalf of the Nuclear Waste Technical Review Board, I'd like to welcome all of you, and thank you for attending our first meeting in 2007.

As you know, our meetings tend to begin with introductions, and I'd like to go through that process with you right now, and I'll start with myself. My name is John Garrick. I'm Chairman of the Nuclear Waste Technical Review Board. My professional life these days is primarily that of a consultant, primarily on the application of the risk sciences to a variety of industries. My background and areas of interest are the risk sciences, with emphasis on quantitative risk assessment, and nuclear science and nuclear engineering. Among my Board assignment is to have the technical lead on dose assessment.

Now, as I introduce the Board members, I ask that they raise their hands when their name is called. First, Mark Abkowitz. Mark is Professor of Civil Engineering and Management Technology at Vanderbilt University, and Director of the Vanderbilt Center for Environmental Management Services. Mark chairs the Board's Panel on System Integration, and is the Board's technical lead on transportation.

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. Howard chairs the Board's Panel on Preclosure Operations.

Thure Cerling. Thure is a Distinguished Professor of Geology and 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. Working with Panel Co-Chairman George Hornberger, Thure is our technical lead on the Natural System.

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. Working with Panel Co-Chairman Ron Latanision, David is the Board's technical lead on Corrosion.

George Hornberger. George is the Ernest H. Ern Professor of Environmental Sciences, University of Virginia. I think he's enjoying this year at Berkeley on a sabbatical. His research interests include catchment hydrology, hydrochemistry, and transportation of colloids in geological units and media. George co-chairs the Board's Panel on

Postclosure Repository performance.

Andy 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, and improved licensing standards for advanced reactors. Andy is the Board's technical lead on Thermal Management.

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 co-chairs the Board's Panel on Postclosure Repository Performance.

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 done a lot of risk and safety assessments, reliability analyses, and decision analyses for the nuclear, chemical and aerospace industries. Ali is the Board's technical lead on Performance Assessment.

William Murphy. Bill is an Associate Professor in the Department of Geological and Environmental Sciences at California State University-Chico. His areas of expertise

are geology, hydrogeology, and geochemistry. Bill is the Board's technical lead on the Source Term.

Henry Petroski. Henry is the Aleksandar S. Vesic Professor of Civil Engineering and Professor of History at Duke University. His current research interests are in the areas of failure analysis and design theory. Henry is the Board's technical lead on the design of Surface Facilities.

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 clear about the distinction between member opinions and official Board positions. Board meetings are spontaneous by design. We express ourselves quite freely, and we want to be able to continue to do that. So, when Board members speak extemporaneously, it is important to realize that we are speaking on our own behalf, and not on behalf of the Board. We'll do our best to identify what represents Board positions.

Before we begin today's discussion, it is my task, my sad task to acknowledge the passing of two individuals who made substantial contributions to the program, and to the project over the years.

John Arthur passed away on December 26th after a 27 year career with the Department of Energy. The Board first heard from John almost four years ago when he became Deputy

Director of the Office of Repository Development. Actually, I had connections with John much before that in the nuclear weapons business, particularly with respect to nuclear weapon safety, and with respect to the Waste Isolation Pilot Plant. John's considerable acumen in managing an extremely challenging national program, and the unflagging enthusiasm and energy that he brought to the public service will indeed be missed.

Bo Bodvarsson passed away on November 29th, this past year. Bo authored his first Yucca Mountain technical paper in 1986. His subsequent research supported fundamental field investigations and lead to substantially improved conceptual and numerical models of fluid flow and radionuclide transport in fractured unsaturated rocks, earning him the respect of his associates and colleagues. We will remember Bo for his leadership and for his exceptional ability to understand, and, more importantly, to explain the relevance of complex hydrologic phenomena.

Both John and Bo will be remembered as friends and for their personal and professional contributions.

Today, the Board looks forward to a broad and thorough project overview and status report from managers of the Office of Civilian Radioactive Waste Management. The presentations begin with Program and Project Overviews by Ward Sproat, Director of OCRWM. Ward was confirmed Director

of OCRWM by the United States Senate on May 26, 2006. Since his confirmation, he has announced his intention to submit a license application for the construction of a repository at Yucca Mountain to the Nuclear Regulatory Commission on or before June 30, 2008. We appreciate Ward's presence and look forward to his remarks.

Following Ward's presentation will be a presentation Program Chief Scientist Russ Dyer on the ongoing and planned activities of his office that support the project baseline.

After a short break, ongoing and planned activities that support science and technology, including work on source term, natural barriers, and materials performance, will be described by John Wengle. After that talk, we will break for lunch.

Following lunch, Paul Harrington, Chief Engineer of OCRWM, will describe the ongoing and planned activities of his office, with a focus on surface and underground facility design, operations, and capacity.

Waste management planning and integration will be the broad focus of Chris Kouts' presentation, with particular emphasis on the status of the transport, aging, and disposal, or "TAD" canister concept, operational integration, and the Total System Model.

Following a short break, Gary Lanthrum will present

the Yucca Mountain transportation strategic plan, including the feasibility and impact assessment of identified routes and the status of infrastructure acquisition.

Finally, Scott Wade will discuss Yucca Mountain site operations, including the status of water, power, infrastructure, and tunnel access.

As usual, following the presentations, we have scheduled time for public comment, an aspect of our meetings that is extremely important to 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 of the room. 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 is for you to write down your questions and submit them to either Davonya Barnes or Linda Coultry. They are seated in the back of the room near the entrance. We will cover as many questions as we can, time permitting.

Finally, to minimize any interruptions, we would like to ask all of you to turn your cell phones and pagers to their silent mode.

I'm pleased to introduce Ward to lead off our discussions. Thank you.

SPROAT: Thank you, John. And, good morning, members of

the Board, and good morning, members of the public.

First, John, thank you very much for your kind remarks about John and Bo. Their loss is a significant loss to the program, and a shock to all of us who knew them and valued them, and your taking the time to recognize them here is very much appreciated. Thank you for doing that.

What I'd like to do this morning is, as you can tell from the topics that John talked about that we're going to talk about today, this is not the typical let's get down into the detailed science kind of NWTRB meeting. This is more about the big picture of where we're going, key aspects of the program, how we're managing it, the directions we're going to take, and give you an opportunity about how we as the management team are approaching this program, what we are doing, what we're concerned about, what we're really working on, and focusing on. And, that's what I want to do with my presentation kicking off this morning, kind of giving you the big picture.

And, what I'm going to do, as I do that--can I go to the next slide? What I'm going to do is just go over and quickly give you a recap of what I told you at the last meeting. I think that's really important from a big picture standpoint. I want to give you an update on certainty issues that you are probably either aware of or would certainly like an update on, things like budget and the EPA standard, and

things like that, just so you've got the latest up to date information that I have regarding some of these key issues.

And, finally, I want to give you an overview of what I'll call the key areas of senior management attention, the areas that I'm personally heavily invested in, and going to be working on very heavily during this coming year.

Go to the next slide. This is something I showed at the last meeting. No dates have changed. It's been three or four months, we haven't changed any dates. The milestone dates are still the same. And, I think as you'll recall from the conversations we had at the last meeting, key milestone there are License Application submittal on or before June 30, 2008, with a best achievable--and I underline the word again--best achievable that I talked about at the last meeting, the beginning in March 2017.

But, those are the key milestones in the project as we have laid them out. They are based on a minimum construction period of time. In other words, if you'll notice the rail line construction, to meet those dates is to start October of 2009, that is, implications for design, and you'll be hearing later, I think, that, you know, we've started the design on that preliminary design.

The environmental impact assessments are going on on that. So, we have looked at this program from an integrated standpoint, and taken a look at what we need to

make this date happen, you know, with certain assumptions. And, that's our milestone schedule. That's the schedule we're programming into the overall program baseline and major milestones, and we're building the cash flow requirements for the project needed to support that. And, so, we're treating this as an integrated total project, with milestones, schedules, and a lot, a lot of planning detail behind that. And, you'll hear a little bit more about that later today.

Next? Remember, last time, I talked about the four key strategic objectives for guiding the program as we move forward. The first one is about the license application. You'll hear more about that a little bit later today also. But, we are fundamentally, we're managing the licensing process for this, and the development of the license application fundamentally different than we did before.

We have a number of integrated teams. This is not an exercise like it was before where contractors were writing things and tossing it over the wall to DOE, and DOE would come and toss it back. We have integrated teams of scientists, engineers, licensing engineers, attorneys, working together in drafting a writing these sections of the license application on a very detailed schedule, with the engineering inputs, the science inputs, that are needed to support that schedule planned, mapped out and being managed with weekly senior management overview meetings. So, this is

being treated as a real project with real deadlines, and real milestones, and being treated in an integrated way with all the key players coming together to write this thing, and do it right the first time, and not have a number of circuitous repetitive iterative processes put into it.

I'll talk a little bit more about what I'm doing and what some of the senior management team is doing about that in a few minutes.

The second is about the organization. I'm also going to talk a lot about that a little bit later. But, the one piece I'd like to point out about this, I talked about the need to build the capability within the DOE senior management team to carry this program forward, to bring in the skill sets and the expertise we need to really manage this program for the long haul. I'm very proud to announce that on Monday this week, our new Director of the Office of Quality Assurance started. Is Larry Newman out there? Larry, could you stand up?

I'd like to introduce Larry Newman, who is the new Director of the Office of Quality Assurance at OCRWM. Larry has a very broad and long experience in the commercial nuclear industry. He's held senior reactor operating licenses for both PWRs and BWRs, has led nuclear operations training organizations, has led the Nuclear Site Quality Assurance Organization at TVA, and has extensive nuclear

operations training and quality assurance background. And, so, it's that kind of expertise and experience that we're looking to bring into this program to set it up for long-term success.

So, that's just one small piece of what we're starting to do under this strategic objective. But, I wanted to introduce Larry, because you'll have an opportunity, I'm sure, to meet him and hear from him at some future meetings.

Next slide, please. The third one we talked about last time was about the continuing mounting federal obligations associated with the non-performance of the standard contracts. One of the things I'd like to point out is that within this area, there are certain things that my office can do, and there are certain things we can't do. For example everybody who's currently suing the federal government over this, those negotiations take place between those parties and the Department of Justice. The Department of Energy doesn't play in that, not directly. We can't negotiate that directly. We support DOJ.

But, there are some other things that we're working on that we think may have some potential impact there, but they are in the early stages of discussion and conceptualization, and I'm not ready to talk about those yet.

And, then, finally, the last piece is about transportation. And, the recognition that we can do a really

great repository, come up with a great design, great license, we can even get it built, but if we can't get anything there, we've just wasted a lot of time and a lot of money. And, so, the recognition of the transportation is a very key part of this overall program, and the aspects of it, which are very complex in terms of planning, route planning, interaction at the state, county, local levels, emergency responder training, it's a major effort for us, and you will hear a little bit more about that today in terms of how we're moving forward, we're putting together a very detailed strategic plan. We're implementing the transportation piece of this project.

Next. Three key update areas. One is legislative proposals. Last meeting, I talked about the legislative package that the administration had sent up to Capitol Hill to fix a number of legal and structural issues associated with the program, things like land withdrawal at the Nuclear Test Site, Nuclear Waste Fund access, some other things like that. That legislation died at the end of the last Congress.

We are currently evaluating whether to send another legislative package up, and what would be in that package. Those discussions are going on. I anticipate some decisions on that in the first quarter of this year. Don't have any definite dates on that yet, but we are in active discussions of what we want to do in terms of sending up additional

legislation, and if so, what would be in it.

So, I just want to be clear that that other legislative package that we talked about last time basically died at the end of the last Congress, and new legislation, if we send it up, would have to be reintroduced in this Congress.

Under FY '07 appropriations, as you know, the federal government is under a fiscal year from October 1st to September 30th, so we're now four months into FY '07, and we don't have an approved budget. We are under continuing resolution, which means just keep doing exactly what you did last year, and you'll have exactly the same amount of money as you had last year.

That continuing resolution expires on February the 15th. There is, I guess the best way I can describe it, is we are not getting consistent messages from the Hill as to how this is going to get resolved. It seems like everybody has got their own opinion. So, I'm not going to put any money on this at all, how this is going to come out. But, there's a possibility of--there's some school of thought that says there's going to be continuing resolution for the remainder of the year, and it's going to come out fairly soon.

There's another school of thought that says we're going to get to the 15th, and there will be another interim

continuing resolution bill, and there's some school of thought that says we're going to do an omnibus bill and it's going to have a bunch of changes in it, and earmarks. Nobody knows. There doesn't seem to be a consistent message coming back from our contacts on the Hill. So, the bottom line is just like every other federal program, we are under continuing resolution to the 15th of February, and we're trying to figure out how much money we actually will have for the remainder of the year.

Andy?

KADAK: Kadak, Board.

I thought you had to be at the lowest of the Congressionally approved committees, rather than just run on your--

SPROAT: It depends on how the continuing resolution bill was written. The continuing resolution bill we're operating under right now is basically exactly what we did, what we were authorized last year.

KADAK: So, no budget cuts for you right now.

SPROAT: As of--it's less than what we asked for in our '07 budget. So, from that sense, it's a budget cut.

KADAK: Okay.

SPROAT: In terms of what we're going to get, I don't know.

And, then, finally, on the EPA standard, and just

to refresh your memory, this is the issue where the EPA is required to issue the Yucca Mountain Environmental Impact Standards, in terms of release limits and long-term exposure limits. And that draft standard is now in interagency review, which means the EPA has finished their work in a draft form. They've sent it out to the various other governmental offices, DOE, DOJ, OMB, and there are discussions going on on those interagency reviews right now.

It's kind of like the continuing resolution. There's not a clear consensus as to exactly when that final revision to the standard is going to come out, but I personally expect it to happen in the first quarter of this year. There's an awful lot of people working on it, trying to resolve issues and get everybody on the same page across the different organizations of government. But, exactly how long that's going to take, I don't know. But, I am expecting it's--if you were to ask I'd say the probabilities are its going to happen in the first quarter of the year, but I'm not ready to commit to that, because I can't commit to that. I'm out of the loop at this stage of the game.

So, those are three key issues that are currently going on that, you know, at this moment that impact the program I thought that would be appropriate for the Board to understand where they stand.

Can we go to the next slide, please? All right,

this is my last slide. This is the one I'm probably going to talk the most on, and it's about giving you a sense of what I'm paying attention to as the Director. Now that I've been here for seven months, I've learned enough to be really dangerous about this program, and I've got three specific areas that I'm focusing on on a going forward basis, the license application, the organization, and the Congress. And, I want to talk about those three areas and how I'm going to be spending my time in those three areas.

First is around the license application, and when I talk about that, I really mean the application, the license application, the Supplemental Environmental Impact Statements, the licensing support network. All of that is part of delivering the license application. We are doing--we have instituted monthly program review meetings. We just had our fifth since I've been here yesterday. It's a half a day meeting, where we go through with all the senior management team from DOE, BSC, Sandia, USGS, all the key managers sitting around, and we're going through these projects, where they stand, what the issues are, what are the cost organizational issues we need to work, and getting them on the table and working them. We're assigning teams to work them, and reporting back to us.

So, it's a whole fundamentally different way of managing this program than what we've done before. We're

treating this as an integrated management team, and the focus on that, license application, and the SEISs, and the LSN as projects, with project directors and project schedules and deliverables, are how we are managing this program going forward. And, that's why I feel very confident that we're going to meet that June 30th date, and if not, beat it.

The second area is around strategic licensing decisions. And, this is an area that I think the Board will be interested in as we get further down the road this year, and into next year. As I've gotten involved with the program, what I've recognized is that there were decisions made in the past, or there were issues where decisions never were made, and things were just kind of drifting along in terms of, okay, we've done the science work, we've analyzed the data, we've run the models, and we've identified issues. And, obviously, as this Board is very well aware of, around all of the issues with some of the time frames we're talking about, there are great uncertainty bands around some of the issues. And, so, what position the program and the project is going to take in the license application around some of these issues, how we address the uncertainties, how we take some of these what we've learned from the science, and incorporate it into the design, how we are going to structure the license application to reflect what we know, with varying degrees of uncertainty, and the design approaches you want to

take to address those, there's some very key licensing and strategic decisions that are needed associated with that.

And, so, what we have done is we have put together a strategic licensing team that I share with people from both inside the program, with people from outside the program, who have real world NRC licensing expertise, and not just people who, like me, who licensed stuff 30 years ago, but--or 20 years ago, but people who have been actively involved in risk informed regulation, which Part 63 is, and more up to date licensing activities, where the licensing team and the design teams will bring issues to us, and we will debate them and we'll make decisions about the positions we're going to take in that license application.

So, my purpose in sharing that with you is to let you know that in terms of senior management involvement oversight in terms of key decisions that are being made about how this repository is going to be designed, how it's going to be built, how we think it should be licensed, that's going on now, and it will continue to go on over the next two years as we move through finalizing the license application.

The second area is around the organization. And, I think I told you at the last meeting, and I am very serious about this, that while that license application is priority number one, this is priority number 1A, and it's about setting this organization up, the DOE and the program

organization up for long-term success. It's not just about getting the license application and saying hey, great job, and then walking out the door. This is about making sure that this program has the capability of designing, licensing, building, and operating this repository for the long haul. And, it has a number of different issues associated with it, and aspects to them. I just want to touch upon them very briefly.

One is around business processes. Now, you might say why should we care about business processes within the federal government. Well, I think a number of you have been involved in the industry and involved with technology long enough to recognize that you have some very smart people. But, if your processes aren't top notch, where they're in control, you're getting good data, you are controlling it, you are able to retrieve it, you are able to manage it, then you're going to have problems. And, so, we're taking a look at what I call the key business processes of how this program does business, configuration management, data management, document control and document management, which from my taking a look at it, with some other people looking at it, it's working, but boy, is it inefficient. And, it is byzantine. And, it is fragmented.

And, so, if we think we're going to make this program set up for long-term success, we've got to figure out

how to do that, using today's standards, today's technology, and make it simpler, so that when people, you know, if you come back and ask me, you know, show me a dataset, it doesn't take five people five days to find it. You know, you can press a button, and print it out. So, we have a long way to go there. But, that whole issue of business process analysis, business process modernization and streamlining, and getting our key business processes in control is what this is all about.

Staffing. I talked about it the last time. I'll keep talking about it every time we get together. It's about making sure that this organization has the skills and competencies in it for long-term success. And, so, what we're doing right now is I've had everybody in my organization, as of Monday this week, it was due, give me a one page summary of their education and their experience. I needed an experience inventory of, you know, who have I got on this program and what's their background and experience. That's never been done before. So, part of this is understanding what we've got in the organization, what their background, skills, and education are.

The next piece is taking a look at what the gaps are between what the organization needs to look like three years, five years out, what the skill sets are that it needs versus the skill sets it has, and then identifying those gaps

and then targeting those gaps to be filled through recruitment and hiring, and to go after that aggressively. And, DOE has not done that very well in the past. It just hasn't. It hasn't been a priority.

You know, obviously, there are other issues under this also, like succession planning. There are a lot of people whose--in this program is the same as mine, and the idea of getting it set up for long-term success, with younger people coming in, is very, very important.

The third area is management development, and this isn't about well, okay, the current DOE, in general, government approach in general, is, you know, there's a suite of courses out there, you can look them up and you go on the computer into computer based training, this is not about that. This is about being very clear about the management team and the leadership team for this program in the future, understanding today's business, understanding the industry, understanding the requirements of an NRC licensee, and being able to manage effectively towards that.

So, we're doing things like we're bringing mentors in from outside, from the industry, to come in and work next to my management team in a mentoring role, to kind of accelerate the knowledge and experience influx into the organization. We're going to be setting up rotational assignments where maybe two, three, four week things, where

senior managers and supervisors from my team go out and they go live in a nuclear power plant for a month, a good nuclear power plant for a month, and follow people around and just see how it operates. This is about a little more thinking outside the box, but accelerating the learning process within the organization about what they need to look like, how they need to act, and what the organization needs to look like for long-term success.

Along that, that last piece is around the culture, and there are two key areas around the culture that I want to talk about. And, in the future, I hope we'll have the opportunity to talk to the Board about quality in more detail. But, you know, this program has a history of issues around its quality assurance program, and I've spent a lot of time reading the outside reports, the inside reports, condition reports, and I think I've got a pretty good understanding of the evolution and the root causes of what went on.

And, all I'm going to say about it right now is that now that I've got my three headed quality management team, with Larry Newman on board for us, and his counterpart from BSC, and the counterpart from Sandia, I'm going to be working very closely with those three people about overhauling the quality assurance program in all three organizations, overhauling, and not overhauling the

implementing procedures, but a major cultural intervention across the entire program that I'm going to be personally involved with in going out and talking to everybody on this program about the expectations and what the price of the mission is in terms of quality expectations, if they want to continue to work on this program. That's one of the root causes of the problems it's had in the past.

DOE senior management hasn't been involved, hasn't been setting the expectations across the program, and they've been kind of insular within their own little DOE house. Not any more. If you want to work on the program and you're working for me, you're going to meet our standards around quality expectations. And, that's going to be a very heavily--that's going to take up a lot of my time in this coming year.

Somewhat associated with that, but also a separate focus, is the corrective action program, another process within the program that has had chronic problems in terms of its effectiveness and its ability to get fixed. And, the difference now is the senior management team across the program is focused on this issue. We've put together a single corrective action request that brings in all of the myriad, a couple hundred CRs that have been written over the years on the corrective action program, and Paul Golan, my Deputy, and Scott Wade, who is our sustaining sponsor, and we

are working together across the program to fix this once and for all, because it's an underpinning and a base of having a strong nuclear culture, and continuously improving and learning organization. So, that's getting a lot of senior management attention at this stage of the game. So, that's about the organization.

The last piece I want to talk about is the Congress. As you know, the Congress, we have a brand new Congress, we have a lot of new members. And, what I started to realize as I, right before Christmas, I sat down and said I want to understand the nuclear waste fund. You know, I've heard a lot about it. People, you know, keep saying things about it, does the money exist, the money is not there, where does the money go? I don't know the answer to those questions. So, I sat down with people who run it, and it took me an hour plus to start to understand it.

Now, okay, I'm not the sharpest guy in the room, but, you know, I figure if it takes me over an hour to kind of start to get it, how many people out there don't get it, particularly, how many people in Congress don't get it and don't understand it. Plus, when you add in the fact there's new members, there's new staff, there's turnover in the staff, when you recognize that this program, from both an appropriations standpoint and an enabling legislation standpoint, is so dependent on Congress for its future

success, you have a Congressional staff that really doesn't understand the legal construct of the program, how it was set up, why it was set up, the legal construct for how it's supposed to be funded, you won't be successful.

So, there's a major piece of what I need to do this coming year in terms of educating the new members of Congress, the staffs, some of the existing members of Congress and their staffs, about how we got to where we are, why we are where we are, the nuclear waste fund, how it's set up, and how it's going to be needed in the future to make this program go forward.

And, then, finally, the last piece is about building credibility on the Hill. I've met with a number of senators of congressmen and their staffs from both Houses, and I can tell you that there is bipartisan support for this program up on Capitol Hill in both Houses of Congress, absolutely. And, bipartisan, by very senior people on both sides of the aisle in both Houses.

Their biggest problem has been that this program, the Department of Energy has not given them great confidence of the Department's ability to pull this program off. And, so, it's incumbent on me and how me and my management team, how we manage this program and start delivering and doing what we said we were going to do, absolutely critical to building credibility up on Capitol Hill so the people are not

only willing to listen to what we have to say as we try and educate them, but they're willing to do something about it. So, that's where I'm going to be spending also a lot of my time in the coming year.

So, that's really the message I wanted to deliver in terms of, you know, management focus areas and key issues, and I hope that gives the Board a little more sense about where we're trying to go with the program. So, with that, John, I'll open it up to questions.

GARRICK: Andy, do you want to start the process?

KADAK: Yes. Kadak, Board.

I was very intrigued by your organizational plans, and maybe this is a good opportunity for you to perhaps comment on Commissioner McGaphigan's (phonetic) comment about taking this project away from DOE and putting it into a quasi government corporation of some sort, which has been discussed for many, many years, as you know. But, do you feel that your approach here might address some of those concerns?

SPROAT: Yes, I do. I guess about two months before I got confirmed, I sat down with Commissioner McGaphigan, because I've known him for quite a while from some other projects, and he expressed to me a number of the concerns that he expressed in that interview that he did.

I would like to point out, though, depending on which paper you read his interview in, there were certain

comments that were left in and certain comments that were left out. And, from the LJ article, which I read yesterday, I noticed there were two things left out of that article. One was Commissioner McGaphigan did say he felt that Yucca Mountain was licensable, and the second one was he felt that the senior management team now in charge of this program was the best it's ever had, and has a chance for success. That wasn't in the LJ article, but I just wanted to point that out.

In terms of--but, the concerns he has in terms of some of the management challenges and continuity of leadership challenges that this program has had, because of the way it's structured, he's not the only person who has expressed those same concerns.

I would say, however, that there are a number of issues that are broader than just that associated with this. And, quite frankly, just the creation of another quasi governmental agency will not fix those problems. So--and, that's probably as far as I want to go with this. I think Commissioner McGaphigan had a lot of, you know, had a number of very good points that are valid, and that how we--and, some of those issues will need to be addressed for the long-term success.

GARRICK: Other questions? Yes.

LATANISION: Latanision, Board.

Ward, I want to compliment you for the description of the management issues that are being given your attention. I think they're right on target. I just wonder if at this late date, and it is--this is a project that has been underway for quite a long time--is this too late, too little, too late?

SPROAT: I don't think so. And, I'll tell you why. When you take a look at--first of all, let me say there are a lot of very good people on this program, both within DOE and the contract organizations. I'm very pleased with the management team now in place at BSC, and the management team at Sandia. I think the senior management teams there have the right mindset, have the right vision to drive this program forward.

Building an organization for the long-term success of the program is a long-term effort. However, for the people we have in place in the program right now for where we are in terms of completing the preliminary design, doing the license application, and defending it over the next three, four, five years, I think we've got the right people in place. And, during that period of time, it gives us the opportunity to further build this organization, DOE organization, you know, bring in new people from the outside, develop the skills and competencies of the work force and the management team, and set it up for long-term success for the

next phase of the project, which would be construction. So, I don't think it's too little, too late.

LATANISION: Latanision, Board.

Let me just ask one very specific question, and this relates to the interaction with the utilities and the ongoing litigation. The show stopper in this whole process that is associated with transportation continues to be out there as an issue. How are you going to improve--I don't see on the list, although it may be buried in one of the items listed here--how are you going to improve on the communications with utilities with that litigation hanging over--

SPROAT: I have a judgment that for reasons that aren't quite obvious to me, that in the past, certain people have hid behind that as an excuse why there can't be dialogue and discussions with the utilities around this. I don't buy it, you know, because I'm now--I have been on one side of the argument, and now I'm on the other. And, you know, what's clear to me is I personally, and my organization, can't negotiate settlements for those lawsuits. That's DOJ's job. I can't--that's not our job. We support them when they ask for the help.

But, for where we are right now, for every single one of those sites where either spent fuel or high level waste exists, my organization needs to know what the plant

layout is, what the equipment is, what the capabilities are in terms of, you know, if we want to take the MPCs out and move them, or if we need to repackage things in the TADs at the site, what are the capabilities, what can they do, what can't they do, we need to understand all that. And, the only way we understand that is going and sitting down and visiting with them. And, whether they're currently involved in a lawsuit or not shouldn't matter at all. And, from my standpoint, it doesn't matter. We're going.

LATANISION: So, meeting are underway, or you're going to implement on that basis?

SPROAT: Yes.

LATANISION: And, one final question. This is Latanision, Board.

What were the legislative proposals that you had sent up last year that have been tabled that you're revisiting?

SPROAT: There was a relatively lengthy set of provisions in that legislation, but there were a couple key ones. One was land withdrawal at the Nuclear Waste Test Site. But--normally has control of that land, but it hasn't been withdrawn for future public use. Before the NRC can give us a license to construct, that land has to be withdrawn to show--the Department of Energy can show that it has permanent control of that land site for in perpetuity.

There is the issue of the nuclear waste fund, where all the current revenues coming into the nuclear waste fund, and the expenses are scored as deficit spending. So, in other words, whatever money gets appropriated to me for the repository program is kind of like independent of the $750 million a year that are coming in from the utilities to pay for this program.

Getting that fixed is another issue. And, there were about five or six others that were of different levels of legal detail that I just can't remember.

LATANISION: Okay, thank you.

GARRICK: Mark?

ABKOWITZ: Abkowitz, Board.

I wanted, Ward, to echo Dr. Latanision's comments about the effort you're making to re-invent the way in which the program is being operated. One of the aspects that I notice is missing, and I would like you to comment on, is the lack of a senior management advisory council that would be made up of experts and representatives from fields such as utilities, cask manufacturers, transportation carriers, logistics providers, local, state and tribal officials, and even public citizens, and I was curious if that thought has crossed your mind, and if not, why not?

SPROAT: The thought has crossed my mind, and it is there, it's not--didn't want to put it up there right now,

it's not at the top of my priority list, but it is something I intend to address. The issue, though, is--one of the issues is that I need to be clear in my own mind, before I go and propose that, how it fits in with your role, the role of, you know, there's, I think there's a requirement around independent oversight on the quality assurance side. I'm still trying to dig through some of the historical stuff to find out what's required, number one.

But, in terms of an advisory board, I like the idea, but there are federal laws required that when an advisory board gets set up, how is it set up, how is it constituted, how are people selected. It's not something that I can just say we're going to do it, and I want you, you, you and you. It's a more complex process. So, what I'd ask you to do is hold that thought and ask me about it again in about six months.

GARRICK: Howard?

ARNOLD: Arnold, Board.

I think implied in that strategic licensing decision's bullet are some key technical issues, and I'm asking basically are you able to spend enough time on them. For example, one is the criticality issue.

SPROAT: Right.

ARNOLD: And, the current difficulties I think in providing poison in the TADs, and so forth. Another one is

modelling of early failure in the waste packages. These are real tar babies, and if they don't get enough attention early on, I think they're going to bite--

SPROAT: Well, all I'd say, Howard, is this is not about solving the technical issue. What this is is recognizing the current state of the technology assessment, and the modelling methodologies associated with it. This program has a number, and it's more than ten, issues where there are varying levels of uncertainty around our understanding of these various processes over very long periods of time. And, this Board knows that. I'm not telling you anything you don't know. But, the point is is that the approach, we are not taking an approach that says we need to have all of those processes very well understood, with very narrow bands of uncertainty before we're going to submit a license application. That's not required. That's not the approach the law or the regulations require, and we're not doing that.

What we need to be able to do in the license application is to say very clearly here is what we know, here are the uncertainties around it, here's the position we're taking relative to its importance, and the approach that we're going to take in the future to further narrow those uncertainty bands, and how we factor that into our design. That's what we need to do, and we can do that now.

GARRICK: Bill?

MURPHY: Bill Murphy, Board.

I was very interested in your comments under business processes, the discussion of data management, and in conducting technical review, I'm interested in where the data are. And, I've been looking at the documents that exist. Presently, there's quite an enormous suite of abstractions, technical abstractions, and from those, are derived technical basis documents that seem to me to capture the technical information that is likely to be used in support of a license application. And, I'm wondering in the context of revisiting data management, if you foresee updates to those, or revisions to those, or if that structure is going to continue to be a core of the technical information you have available.

And, one specific question--

SPROAT: There's two questions. But, go ahead, keep going.

MURPHY: One specific aspect of this is that most of these documents were published in the 2004 time period, and have a great deal of relevant and useful information, but they're almost exclusively focused on a 10,000 year time period, and I'm wondering how the variation, or the different concern about the relevant scales might be addressed.

SPROAT: Okay, that last question first, I'm going to punt. I'm not the right guy to answer that question. Okay? Russ can talk--ask Russ that question. Okay? I'm not the

right person. But, let me go back to your first question, which really had two pieces of the answer. One was around how you manage and control the data that's been collected. And, right now, that data exists, you know, that data started being collected 20 years ago, and it exists in myriad data bases under different sets of controls, under different programming languages, and one of the things that I'm primarily focused on is getting that all together in a common up to date database so it's easily searchable, easily retrievable, and it's under control, and it's consistently applied. That's the primary focus of what I'm trying to do when I talk about business process.

The second part of your question, though, which is a very appropriate question, was okay, so you've got all this data that you have accumulated over the years, what are you doing--I don't want to put words in your mouth--but, what are you doing as you build this license application and updating all the inputs into it, how are you making sure that data is right. And, we put together, we asked the Sandia management team to put together their overall plan to make sure that--because, they're going to be the people who, when we get into defense of the license application, are going to be up there answering questions about the AMRs, and the models, and the TSPA results, and all that stuff that I don't fully understand, but they're going to be the people who have to be

able to talk about the quality and the level of reviews, and the validation of that data that's come in upon which the license application is built.

And, they've put together, I believe, a very, very strong plan that says as we finalize this license application, we finalize the analyses going into it, we will be able to assure through our independent checks and certification process that--and in some cases, rework, like we're redoing on the infiltration model, where we're reworking data where the quality was either, you know, the chain of command was lost and the control was lost, where we have to redo it, to bring that back in so that we have a fully validated and defendable basis for the results in that license application.

So, there's a lot of rework going on to make sure that the data that supports that license application is correct.

GARRICK: All right. Henry and then I'd like to ask a question before our time runs out.

PETROSKI: Petroski, Board.

I appreciate your update. It's very, very interesting. What interests me is the culture question. Basically, I wonder how much time do you expect to spend on this issue? How long do you think it's going to take to change the culture, and how will you know that you've changed

it successfully, or what are your measures of success?

SPROAT: Very good question. Let me answer the third part first. So, how are you going to know this is successful data? We do annual surveys, and the survey instruments we're using, you know, I did this back in the private sector, too, and I've been pretty impressed by the thoroughness of the survey instruments. They're benchmarked. They're very widely used. But, the cool thing about them is is that the respondents are allowed to write in individual comments.

Well, the last survey, which was done, finished in July, there were 487 people who took time to write down specific comments that weren't covered, you know, covered things that weren't in the multiple questions, and, I've read every single one of those. And, what we're doing, for example, is that in DOE, all of my senior management team, we put together, we've designed a facilitated session where the managers will be sitting down with their teams over the next four weeks for a minimum of a two to three hour session, where they're going to be talking about what people told us in the survey, get clear on what they said, get a sense of is it getting better, is it getting worse, or is it still staying the same, and get some feedback from that.

And, then, we're going to be working as a management team in February about taking that data back from those feedback sessions, and laying out more definitively

what are we trying to shift the culture from, to where are we trying to shift the culture to. And, that then gets cranked into the overall strategic plan for that second strategic objective. It gets cranked into resurveying on an annual basis, with maybe some spot surveys on a periodic basis, and maybe a particular organization to see if there's a problem, or things are changing. There's ways to measure this.

And, it's been done before. I've done it before. And, your first question was how much time am I going to be spending on this. About half. I got the license application process in place. I've got a management team in place to run that the way I think it needs to be run. I'm going to weigh in on some technical issues like there's licensing strategy issues. But, I think that's moving the way I want it to move. The organization is where I'll probably be spending half my time.

PETROSKI: Thank you. Follow up just briefly. If there's a question of quality, and if the culture of the organization now is having trouble with quality--

SPROAT: That's not--I wouldn't say that.

PETROSKI: You wouldn't say that?

SPROAT: No, I wouldn't say that.

PETROSKI: How would you state it then?

SPROAT: I would say that there is a recognition of the need to do things right. Some people feel they've gotten

mixed messages in the past about, well, do you what right, or do you want fast, and it's not an either/or, it's both, and we need to help educate the management team about so, what happens in terms of when that dilemma happens, what do you do about it? Do you ask for help? Well, people don't like to ask for help. It's almost like guys not liking to ask for directions.

So, it's not an issue of people don't care. There's a perception--there's been a history on the program that management says one thing, but says we really don't care about quality, you've got to go get it done. Which I find very interesting because from what I can tell, this program really never had a real tight schedule, so how people were schedule driven, that's still a mystery to me. But, that's for a topic for another time.

So, anyway, in terms of driving this issue of quality, I'm going and talking to the entire thousand person BSC organization next month for an hour on just that, and we're going to work it.

PETROSKI: Good luck.

GARRICK: Garrick, Board.

Ward, you started off your presentation making reference to implementing a fundamental integrated approach. Of course, as the Board members have commented, this is something of good news and of great interest to the Board.

Is the activity you are implementing to manifest that going to generate some products that are confidence building, that it in fact is working? And, what I'm thinking about is functional flow diagrams that actually show how the functions are performed, and how the preclosure activities connect with the postclosure activities, and how, in fact, you have developed a framework that gives you sort of a metric against which you can assess and measure progress towards indeed a fundamental approach. Because, we've had difficulty finding documentation that does reflect that in a convincing manner, documentation of a systems engineering type.

SPROAT: Your observations of that issue I think are correct in terms of a lack of that top down driven integrated management approach. One of those processes, one of those business processes I talked about here is business planning. Now, you might say why should we care about business planning? One of the first issues I picked up on that everybody was willing to tell me about when I got here was we're all working to a different plan. We don't have a common plan.

Everybody is making their own decisions about what's important, and they're working on their own stuff. The whole concept of business planning is there is a top down and a bottoms up approach that comes together where you've got a strategic direction, set from the top, which is what

those four strategic objectives are about, but you've also got a bottoms up approach of, you know, the tactical aspects of here's what we've got to accomplish that meet those objectives, and here's when we're going to do them. And, then, holding people accountable. And letting everybody in the organization know what their piece of the plan is. That hasn't existed in the past, and that's what we're putting in now.

Now, at a higher programmatic level, we are re-baselining the program. And, what I mean by re-baselining is the top level major milestones, some of which were up there, there's some other internal DOE ones that weren't up there, that results in a, you know, a top down driven set of schedules and plans to deliver this program on that schedule. That's going on now.

GARRICK: I guess the real question is are there some products being developed that are confidence building that in fact this approach is being implemented?

SPROAT: Well, I guess I'm a little confused. Is your focus on programmatic management or is it on technical work flow process? In other words, the process flow through the surface facilities. I'm not clear on which area you're talking about.

GARRICK: I'm really talking about what--I'm trying to interpret what you mean by integrated, fundamentally

integrated approach, and see if that matches up with what the Board has been seeking to better understand. And, that is, how all the pieces and parts are integrated, and what management tools are being used to measure the level of success you're having.

SPROAT: The answer to your question is yes, we are developing those, and you'll be able to see those as they get further developed.

GARRICK: One final comment that's an extension of Henry's comment on culture. And, I was very pleased to see you identify specifics with respect to cultural issues and cultural changes, such as quality and corrective action programs. And, I was even more pleased to hear you use in context the word nuclear culture. I think several of us have been somewhat critical of the lack of a nuclear culture in this program. And, I think it's evident not only in terms of the management processes and the preparation of reports, it's evident in the population of what I would call real nuclear experts in some extremely critical areas that are fundamental. And as you know, this Board stresses fundamental understanding, and we all have our pet projects in that regard, and mine is what I would consider to be the absence of fundamental nuclear chemistry with respect to the development of the source term.

But, I was pleased to hear you comment and to

implement activities that bring project people closer to fuel handling operations, and activities associated with nuclear power plant operation. And, I think that is very valuable.

SPROAT: Just one thing I didn't mention about that. The Department of Energy has an agreement with the Institute of Nuclear Power Operations, which this program has never--I shouldn't say never--has under utilized in the past. And, I'm going down there with a few of my senior folks, down to Atlanta, next month and we're going to really strengthen that, or leverage our relationship with INPO, as we develop the organization.

GARRICK: Very good. Andy, did you have--

KADAK: Kadak, Board. Just a brief question.

How does the lack of a final EPA standard affect the progress of your program at this point?

SPROAT: It does not. And, the reason it doesn't is because we're going to do the analyses to show how the repository responds under--during the various lengths of time under the various scenarios, and the EPA standard, when it comes out, will be the EPA standard. And, so, it comes down to where we draw the acceptable line on the last graph, on the last page of the license application--not quite, but pretty much that. And, that's really the only effect it's going to have at this stage of the game.

KADAK: Thank you.

GARRICK: Any other questions?

(No response.)

GARRICK: Any questions from the staff?

(No response.)

GARRICK: Well, thank you very much.

Okay, I guess we're ready for Russ Dyer.

DYER: Good morning.

Next slide, please. There's a number of things I want to talk about today, and we can really kind of break them up into three different areas. First off, I'm going to talk about--this may address I think part of Bill's question to Ward--scientific investigations supporting the license application. What's driving change that will be captured in the license application. Where are things changing since the time of the site recommendation, the 2001-2002 series of documents that we put out that documented the state of knowledge at that point in time.

Then, I want to talk about four specific areas where there's been new information, knowledge developed, what we're getting out of it. The infiltration studies, you're aware that we're redoing infiltration. The infiltration model and analysis, I'm going to talk about that a little bit. I'm going to talk about some of the seismic ground motion studies and what is driving those seismic ground motion studies, which is in fact one part of the proposed

draft EPA regulation. A volcanic hazard assessment update, we're well on the way to fulfilling some regulatory commitments we made with the NRC to revisit the almost a decade old probabilistic volcanic hazard assessment. And, then Chlorine 36 investigations, there was a series of reports that came out in the summer of 2006, and I just want to give you kind of a brief overview of what we found to date.

And, then, the last thing I want to talk about, this is a long title, but it ties into the organizational and cultural element that Ward was talking about. What are we doing to try to foster continuity and growth of the intellectual culture community, if you will, from now on into the future?

So, let's go to the first topic, and this is going to be almost a--what I'm going to get to eventually is a long list of things that are changing. But, first, let's go through what are driving the changes.

Well, the starting point is the technical foundation, which was documented at the time of the site recommendation and the final environmental impact statement. And, this is all of the technical basis documents and technical arguments that fed into the Total System Performance Assessment. And, some of the significant things that have changed since the time of the TSPA include changes

to some of the component models based on updated science, and some of these include infiltration studies, new saturated zone borehole data. Nye County has some new boreholes, and we have information from those boreholes.

Obviously, changes to the repository design. The incorporation of the TAD, the transportation, aging and disposal canisters has driven some fairly major changes into our analysis. Extension of the models for the post-10,000 year analyses, and I'll talk about a fairly major change this has driven in the seismic scenario class.

At the time of the site recommendation, we excluded seismic features, events and processes based mainly on low consequences. We can't do that anymore, and what that ends up doing is driving the need to look at cumulative effects over a long period of time.

And, enhanced treatment of uncertainty, breaking out and being more explicit about the treatment of both the aleatory and epistemic uncertainty. And, then, there's additional analyses that are related to the proposed, the draft 10 CFR 63 rule change.

Next slide, please. Okay, in the TSPA-input models and analyses, the AMRs, the analysis and modelling reports, some of the things that are expected to change driven by either science updates, requirements for post-10,000 year analyses, or model improvements, these are general categories

of things that we've kind of lumped together. So, there's new infiltration studies, infiltration, unsaturated zone flow, calibrated properties, unsaturated zone radionuclide transport, unsaturated zone transport abstraction, drift seepage abstraction, multiscale thermohydrology. These are all AMRs that are kind of lumped together that are driven by one or more of these drivers I've listed at the top.

We've got new data from the Nye County Early Warning Drilling Program, and there's an update of the regional groundwater flow model. Also, the hydrogeologic framework, saturated zone flow, saturated zone transport, saturated zone flow and transport abstraction. These, again, are AMRs that are driven by changes up here.

Because of the work we've done associated with the update of the probabilistic volcanic hazard assessment, we've got new igneous data, new analysis, atmospheric dispersal and deposition of tephra framework for igneous activity. In the biosphere, we've got new soil input parameters.

Next slide, please. The design changes, primarily TADs, but some other design changes you'll hear about from Paul Harrington later, and the requirements for the greater than 10,000 year analyses have driven us to some changes in the drift scale thermal-hydrologic-chemical seepage model, in-drift convection and condensation, in-drift precipitates and salts, the engineered barrier system radionuclide

transport abstraction.

And, kind of another category, if you will, dissolved concentration limits, in-package chemistry abstraction, waste form and in-drift colloids, and the associated radionuclide concentrations, waste package inventory allocation.

And, kind of the materials performance arena, stress corrosion cracking of the drip shield, waste package outer barrier, and stainless steel structural material, general corrosion and localized corrosion of the waste package outer barrier, analysis of mechanisms for early waste package/drip shield failure.

Obviously, I'm not going to spend any time--almost each one of these things could be a topic of a pretty lengthy and very interesting presentation. But, I am going to spend some time about this one a little later, and that's seismic consequence abstraction, and the drift degradation analysis. I'm going to be at a pretty high level, but I do want to talk about what happens when you need to look at the cumulative consequences of a very long period of time.

And, the number of waste packages hit by igneous intrusion. This is driven in part by design, and in part by new information from the volcanism studies.

First, let me now I want to shift and talk specifically about the infiltration studies. So, I'm going

to spend about three slides here kind of summarizing where we are on the infiltration studies. And, I think everybody is aware of what drove the need to revisit infiltration, and in 2005, we chartered Sandia--this is before they became the lead lab--but, Sandia was charged with assembling a team to develop a replacement infiltration model. And, that infiltration model is being documented. There's a complete revision to the model that will come out in this analysis and modelling report, and we're scheduled to put that out this summer.

The preliminary results from this model indicate that the new infiltration rates are somewhat higher than the previous infiltration model result, but they fall within the range of recharge estimates for groundwater basins in Nevada.

Next slide, please. And, let me tell you where I get that conclusion from. Here is a graph, and on the X axis is precipitation in millimeters per year. It goes from zero to 700 millimeters per year. And, the Y axis is a log scale, but it is plotting infiltration or recharge in millimeters per year. So, .1, 1, 10, 100, 1000. And, there's a number of different techniques for making the correlation between precipitation and infiltration, going back to the Maxey Eakin technique developed here in Nevada in 1950, which is this blue line, which has a number of step functions in it, if you will.

There are different methods, the chloride mass balance method, groundwater, water balance model, all of which have different symbols on here. But, for the new infiltration model, we're looking at three--the present day climate, which is the red dots, generally fall in here; the monsoon climate model, which is the green sideways diamonds, and you see them primarily in this region here; and then the glacial transition climate, which is blue triangles, and they generally fall up in here.

Now, how does--and, you can see that for all of these techniques, they fall roughly in this band here. So, it appears that what is coming out of the infiltration model is reasonably consistent with other techniques for trying to get this correlation between precipitation and infiltration.

Now, how does this compare with the previous model that we had? Well, for present day climate, the red dots, the mean, it's a little hard to figure out what the mean here is when you're looking at a log plot. Right now, it looks like it's about 13.4 millimeters per year. That's about 3.7 times what the old infil. model gave us.

For the monsoon climate, the mean is about 19.8 millimeters per year. That's about 2.3 times what the old infil. model gave us. And, for the glacial transition climate, that's the blue triangles in here, the mean is about 30.5 millimeters per year. That's about 2.3 times what the

old infiltration model gave.

Next slide, please. Yes, sir?

KADAK: Can you say why there's such differences from the old to the present day?

DYER: Yes. Next slide, please.

KADAK: Okay.

DYER: There's a couple of things that I think--the models are slightly different, and there's a slightly different treatment of the data. I mean, we built a new model from essentially the ground up. When we look at the new model, the most important parameters are soil depth, soil water-holding capacity, and precipitation. I don't think you would get the same list of most important parameters in the old infil. model.

The differences can be attributed in part to the following. There's a more thorough treatment of uncertainties associated with soil and rock properties, especially in the soil depth, the soil hydraulic properties, near-surface bedrock permeability.

One of the major changes between the old infil. model and the new MASSIF model is that the new model does not account for evapotranspiration from bedrock below the soil zone. It accounts for evapotranspiration down through the soil zone, but not in the bedrock like root zones and fractures in the bedrock. And, that's because we didn't have

sufficient data. When we went back and looked at it, we did not judge that we had sufficient data to really come up with a defensible estimate for that. But, in total, we think the approach yields reasonably conservative estimates of the infiltration.

Now, what's the impact of this? Well, because infiltration sets at the top of a long series of processes, culminating eventually in a dose calculation, it's going to lead to revisions in some of these downstream models, like the unsaturated zone flow and transport model, drift seepage abstraction model, the multi-scale thermal hydrology model, and, of course, TSPA. And, our current schedule is to complete all of this AMR and all of the documentation associated with it by June of this year.

Let me go now to seismic studies. And, there's a couple of things I want to talk about in the seismic arena, and we're going to talk about both preclosure seismic applications, and postclosure, those things that are required to support design under 10 CFR 63. We're--somewhat different than I think the nuclear industry has experienced to date.

One of the things that we need to do is provide a seismic hazard curve for the surface facilities area to be used in a probabilistic analysis demonstrating preclosure performance, consistent with the requirements, these specific requirements of 10 CFR 63.

We need to update the preclosure ground motions to reflect additional geotechnical data for the surface facilities area and repository block. Some of that information we've already gathered, some we are in the process of gathering, and I'll talk about that.

Continue geotechnical investigations to enhance the confidence in the surface facility area properties for licensing defense. These would be things that are not necessarily available for the time of license application, but will be available in a licensing defense

Some of the things that are being done to update the preclosure seismic ground motions is to incorporate additional geotechnical data collected since 2001. There's quite a bit of it. Bring this into a seismic hazard curve for the surface facilities area, and incorporate approaches to reasonably bound extreme ground motion at Yucca Mountain.

You remember probably several years ago, some of our seismic analysis using existing process and approach drives you to results that seem to be physically unrealistic, and how to deal with that has been a major challenge. All of this is going to be documented in a revision to this Analysis and Modelling Report.

Now, what's going on in the realm of geotechnical testing? What's going on? Well--I'm sorry, next slide. Yes. It will support licensing defense. One of the major

things we're doing is boreholes, additional boreholes in the surface facility area. Once we got the new configuration of surface facilities, and the layout for those facilities, we need to get site specific information for that layout. And, we've got a program underway to provide that information. A large part of that program is the boreholes and the downhole tests in those boreholes. And, that will be going on through the summer.

This will facilitate additional downhole velocity testing. To complement this, we've had a program for looking at spectral analysis of surface waves for some time, but will be expanding that survey to include the update surface facility area.

We'll be doing additional downhole velocity surveys in existing boreholes on the repository block. This is to help us get the seismic response better understood. Doing dynamic property testing of larger alluvium and tuff samples to better understand size effects, and doing in situ dynamic property testing of alluvium.

Next slide, please. Now, in postclosure, a different set of issues and problems. One of the first things that we need to do is because of design change, the incorporation of the TAD canister and overpack into the disposal system. We need to explicitly represent that. And, then, because of the need to accommodate the very long time

period that is covered by the draft EPA regulation, we can't just screen out seismic consequences based on low consequence, but, rather, must accommodate them, and not just once, but look at what happens as the cumulative effects of multiple seismic effects over a very long period of time.

So, not only do you have the seismic effects taking place, but you've also got corrosion effects going on and the accumulation of rockfall in the drifts. I'm going to show you a cartoon in a minute that kind of shows the progression in time. And, we need to look at other failure modes for both the waste package and the drip shield, rupture of the outer corrosion barrier of the waste package, rupture of the drip shield plates, buckling of the drip shield framework, the possibility that some part of the system may lose its functional capability due to primarily cumulative seismic effects.

And, as I said earlier, a big part of this is looking at the cumulative effects from multiple events.

Let's go to the next slide, please. Now, there's a number of things that get incorporated here. I mean, we've got the corrosion models going on, but kind of in the background at each time step on the analysis. But, what needs to be incorporated is what's happening associated with seismic effects.

So, in the early stages, which might be out here

before you really have much rubble accumulated around the waste package, looking explicitly at what might happen due to ground motion, where the waste package would be banging into the drip shield or bouncing up and down on the pallet, which can induce damage which might lead to enhanced failure modes in the future, and I'll say corrosion, could lead to an actual break at some point, too, over time, as we have both just rattling of rock in the crown, and perhaps seismically induced damage, you're going to start accumulating material surrounding the drip shield and waste package.

And looking at how this rubble is going to change the functional capability of both the drip shield and the waste package, at very long periods of time, hundreds of thousands of years in the future, you have a substantial--our modelling shows a substantial degradation of the drift. And, how does that change the seepage in the near field of the waste package? How does it change the corrosion environment on the waste package? And, then, finally, out here, you've got essentially loss of any functional capability of the waste package to contain waste.

Next slide, please. And, this is just the words that I said on the previous slide.

Next slide. Now, let's turn to the volcanic hazard assessment. In 1996, we did a probabilistic volcanic hazard assessment using formal expert elicitation process, and right

now, it provides the basis for the license application.

But, in exchanges with the Nuclear Regulatory Commission since 1996, there were questions raised, and we made some regulatory commitments to go back and address some of those questions. And, we did that by a program of field studies. We did some aeromagnetic surveys. I'll tell you about those. And, we drilled and sampled some aeromagnetic anomalies, which could have been buried volcanic occurrences, data analysis, and we also made a commitment to do an update to the formal elicited probabilistic volcanic hazard assessment.

The PVHA, as I said, what we will have for the--to support the LA is the PVHA that was conducted back in 1996, actually conducted about '94 through '96, finished up and documented in '96. We will be finishing this new work in fiscal year 2008.

Next slide, please. So, what are some of the things that we did associated with this? Well, we did a pretty extensive low-altitude helicopter-borne aeromag survey that gave us much better resolution to create an aeromagnetic map to look at magnetic anomalies in the area, and basalt having more iron in it than the rhyolitic tuff that makes up most of the rock mass, or the paleozoic carbonates. The presence of basaltic, young basaltic rock usually shows up as an aeromagnetic anomaly.

And, we identified a number of anomalies on the aeromagnetic map, and to date, we have drilled seven of those anomalies to determine what they are, and how old they are. And, where we've drilled anomalies and encountered basalt, and we haven't done that--actually, of the seven that we've drilled, three of the anomalies are actually in Miocene tuff, but they weren't buried too deep, so they gave kind of a false positive on the aeromag map.

What we found from age dating, both potassium argon and argon/argon dating is that of the anomalies drilled that were actually basalt, only one of them is a relatively young basalt, Pliocene basalt, and that was in northern Amargosa Desert, it's south of Highway 95. The other basalts are older than 9 million years. And, essentially what this confirms is that the spatial patterns that were kind of developed as an understanding at the time of the original PVHA, we've confirmed that. We have, if you wish, reduced the uncertainty about the representativeness of that understanding. We found no buried Pliocene or Pleistocene basalts to the east of Yucca Mountain in Jackass Flats.

Next slide, please. Now, the expert elicitation process is a formal structured process, which has a number of stages associated with it that involve developing a common understanding of data to start off with, then field trips, interactions to further this common understanding. Then,

individual interviews with the experts, followed by feedback, giving the experts an opportunity to revise their input.

The end result is the probability of igneous events that could disrupt the repository. And, if I remember correctly, the result from the 1996 PVHA is on the order of 1.7 or 1.8 times 10_{-8} per year, as a probability. And, we'll see whether that changes at all, or dramatically as a result of the PVHA. This will be documented in the update report and update to the igneous framework analysis report.

Let's go to the next slide. This shows the schedule of things that need to be done as part of this overall planned activity. The things that you see in yellow are things that have already been done. Where we stand right now is preliminary hazard calculations and sensitivity analyses, and that's going to run from January to April of this year. The next workshop where all of the experts get back together and provide each other feedback will be in May of this year, and we're looking at the final results in June of '07 to January of '08, and then wrapping everything up in either somewhere between late this year and the middle of 2008.

Next slide, please. Okay, Chlorine-36 investigations. It's been a while, but in 1996, while we were constructing the exploratory studies facilities, we had a number of tests that were following the TBM, as we

excavated underground. And, one of the results that came out fairly early in the excavation of the ESF was a report from Los Alamos investigators that they had detected high values of Chlorine-36, this is the Chlorine-36/Chlorine-35 ratio, in rock samples from the ESF. And, this is what's known as bomb pulse chlorine. There's an elevated level of Chlorine-36 in the atmosphere, mostly associated with the Pacific Nuclear Weapons Testing in the Forties and Fifties, which put large quantities of Chlorine-36 in the atmosphere.

And, if you detect elevated levels of Chlorine-36 at depth, that suggests that you have had water from the atmosphere get down to depth in a short period of time, 50 to 60 years. So, this was taken as evidence that some fast pathways for water movement exist from the surface down to at least the depth of the exploratory studies facility.

DOE subsequently conducted a peer review of the LANL results. One of the things that the peer review suggested was additional studies.

Next slide, please. So, there were a number of additional studies that have been conducted. One, in 1999, DOE initiated confirmatory studies led by the USGS and Lawrence Livermore, kind of made up one team, and Los Alamos National Lab, the original discoverers of the Chlorine-36 anomaly made up the other team.

And, the results were kind of enigmatic. The

USGS/Livermore team did not replicate the earlier results of Los Alamos, and even the Los Alamos results weren't exactly the same as what they got the first time. They did replicate some of the earlier results.

In 2003, DOE chartered an independent study of all the Chlorine-36 studies to date, and we asked an entity of the what's now called the Nevada System of Higher Education, the Harry Reid Center, here located at UNLV, and involved an individual from New Mexico Institute of Mining and Technology, also was involved in this.

Now, I'm going to go back a little bit. The original USGS/Los Alamos/Livermore, and I forgot to mention the Atomic Energy of Canada, AECL, was involved in the joint validation study. The report on that came out in August of 2006, and this is about--this summarizes about four years of effort on the part of all of these entities, and this is the citation for it, and this is posted on the web. That's where you can find it. It documents the joint validation study, including previous studies, the methodologies used to analyze the samples and evaluate all results, the results, and conflicting interpretations, because even though there was a unified sampling program, and we were working with splits from the same sample, we got different results from the different studies. Besides Chlorine-36, this also discusses tritium and Chlorine-36 and study conclusions and

recommendations.

Now, what about the study conducted by the University of Nevada people? Well, that was documented this summer in a July of 2006 publication, and they talk about what they found, how they used it. They looked at some other things besides Chlorine-36, Chlorine-36, Technetium 99, Iodine-129, and what--this report kind of summarizes what they found.

One of the problems that they had was contamination of the lab. In fact, early on, the lab was so contaminated that they actually had to walk away from it and construct an entirely new lab, because you're dealing with measurements and parts in 10 to the 15th, which is pretty close to a godzillion, I'm not sure exactly what it is.

Okay, so what did we find out of all of these? Well, the USGS/Livermore team did not find elevated values of Chlorine-36 in samples from, some from around the Sundance Fault zone, as previously reported by Los Alamos. Los Alamos confirmed their earlier reported elevated values only in one location, although they found some new samples in the cross-drift, which was not available at the time of the original study. They found some samples in the cross-drift that gave elevated values of Chlorine-36.

The Harry Reid Center, whenever they finally got their lab and their analytical line working, they were only

able to process I think it's seven or eight samples. Only one sample gave an elevated value of the--anomalous value of Chlorine-36.

But, the Harry Reid Center did report detectable levels of Technetium 99 in six of nine rock samples from the ESF, and that's something that we're going to need to follow up on.

Why this disparity? Well, how can you take credible labs, give them essentially the same experiment, and get different results?

Next slide, please. Well, Chlorine-36 measurements are very difficult, and the interpretation is challenging. And, some of the causes may include sample contamination. We certainly saw that in the laboratory that was put together. There may be a very heterogeneous local distribution of chloride. There may be micro-environmental controls that are complex and poorly understood.

But, our take is that we have got bomb pulse Chlorine-36 detections at a limited number of locations in the ESF, which indicates the presence of few fast flow paths within the repository host rock.

So, how do we accommodate that in the current models? Well, the current unsaturated zone flow and transport models reflect this Chlorine-36 data in what we think is a reasonable and conservative manner. We have about

1 percent of the fast and transient flow paths--well, fast and transient flow paths carry about 1 percent of the water, primarily through faults and fractures, in our UZ flow and transport model, but they don't significantly affect the overall flow paths in the unsaturated zone.

And, where we stand right now is we're not pursuing the Chlorine-36 issue further at the moment. We think we've adequately addressed it in the existing state of models that we have. It would appear that perhaps we need some advances in Chlorine-36 technology before we can fruitfully use it in this arena.

And, let me close with a talk about what do we do for the future? How do you--this program was involved in site characterization for almost 30 years. There was a pretty large cadre of scientists that spent a significant part of their career on this program. Their work is documented in a series of papers. We are, to address one of Bill's earlier questions, we are committed to updating those technical basis reports, be they of analysis modelling reports or whatever, as the state of knowledge evolves.

Now, we're not going to be doing nearly as much field work as we did at the time of site characterization. We'll be picking and choosing the important things that we need to focus on. But, how do you get the cadre of personnel who can look at results coming out five or ten years from

now, maybe not in our program, it may be a result published in a European journal, or something like that, and being able to make a determination that that is a--that can perhaps have significant implications for this program. How do you foster the continuity and development of what I'll call the intellectual cadre?

And, Ward mentioned this earlier. I am also of the white haired population. And, we've got an aging population of experienced management, and it's not unique to us, not just management, but it's across the board, engineering, scientific, other technical staff. And, the reality is there's a significant learning curve for the development of productive workers. When we bring somebody on, even if they are technically up to speed, it takes somewhere between nine and eighteen months to bring them up to where they feel confident to really jump in and really contribute to things.

Identifying and attracting candidates to mentor and providing the staff, be it engineering, scientific, or other technical staff, with career development opportunities is a challenge, especially if you're focused on something for right now.

So, balancing the short-term project work and goals with the long-term needs and goals in a multifaceted, and what's got to become a multigenerational program is one of the big challenges, and it's tied to the second strategic

objective that Ward laid out.

So, we've got to enhance the management approach to conduct of both the short-term and long-term work, and I have, for my part, Andrew Arrell (phonetic), the manager of the Sandia effort, and I talk about this on a pretty regular basis, about how we can do it. He's got the bulk of the problem, because Sandia has about 500 employees, and in my organization all together, I've got about 12.

Next slide, please. Well, some of the things that you can do to foster this environment, and this is in addition to the things that Ward talked about about strengthening staff, recruiting, succession planning, but what can you do in addition? What can you change as what I'll call a programmatic environment that can foster this objective?

Well, one of the things to do is to seek excellence in documentation so that the person that picks up a product in ten years doesn't have lingering questions about how something was done or where this assumption came from.

One thing that we I think are going to be able to put more emphasis on is publication of project documents in peer-reviewed literature. John Wengle is going to tell you we put a real premium on this in the S&T program, but we have not had that much of a premium for the project. And, as a result, much of the project information resides in what many

people call the gray literature. It is copiously documented, but getting to the documentation is not terribly easy, and it's not well circulated in the peer community.

The Science and Technology Program is a venue that we can get ideas both in and out, an exchange of information, ideas, and a dialogue. And, John will talk about that, because this gives us an opportunity to interact with a great many organizations and people across the country.

Monitoring what's going on in both U.S. and international research and development is a major thing that we need to look for for the future. This is one of the things that we've charged Sandia with, is monitoring what's going on in all the various technical areas, to understand when something might arise in a publication that could potentially have an impact on the program, and being able to evaluate that potential impact.

Fostering development with Nevada institutions. We have a cooperative agreement with Nevada institutions now, and we need to continue that. We probably need to refocus that periodically to look at the things that are of highest priority to the program.

We participate in a lot of international programs now, and we propose that we continue to do that, again, for the idea of the remaining currency of information and remaining part of the active technical peer community.

And, then, providing--this is actually one of the things that was a rationale behind the idea of developing and selecting a lead lab. And, that's to provide the repository program with a pathway for continuity for the scientific, management, and institutional continuity of the program. And, that's going to be one of Sandia's challenges, is bringing in the fresh people, moving them through programs within Sandia, developing the expertise, developing the competencies that will eventually be an advantage to this program.

And, with that, I would like to take the Board's questions, if I may.

GARRICK: Thank you. George?

HORNBERGER: Russ, I have a couple questions with regard to the infiltration. And, I realize that this is high level, so please take my questions as being at a high level. We'll get into details at a meeting we have scheduled coming up.

But, I was curious the model, the original model, of course, had Alan Flynt's very detailed model of a representation of the spatial variability. So, is it the intent from a new approach to just multiply all those numbers by 3.7, or something?

DYER: No. No, I'm not sure--I told my staff member, who actually follows this, to stay at work and work today. So, I'm--I'll try my best here, and maybe if I'm wrong,

somebody from the audience will correct me. They never have hesitated to do that in the past.

If you'll remember, though, one of the major things that came out of this in the Flynt model was the nine infiltration maps, which showed the spatial variability. And, there will be nine infiltration maps in the new MASSIF model also. So, there will be a spatial variability.

HORNBERGER: That's based on separate work?

DYER: It's separate work, but primarily it's going back to the same data.

HORNBERGER: Okay. Second question has to do with data. So, the 13.9 millimeters per year that you mentioned is certainly within the range, but if you look at all of the data bases, the data based estimates, it's sort of on the higher end of that range. And, my question is as you move forward to incorporation into TSPA, I think that there were three cases, low, medium and high, to take account of uncertainty in net infiltration, and multiplying 4 millimeters per year by 5 might make sense. Multiplying 14 millimeters per year by 5 is maybe questionable. So, are there going to be changes in how you do that?

DYER: Well, there's a couple of things. We've got--this is a reasonably conservative estimate that will be the basis for TSPA. But, there will be a--I'm trying to remember what we call it now--it's not a realistic, but a better

estimate of performance assessment also, where we may be able to use other estimates of infiltration. So, if somebody thinks that there are conservatisms that in the fullness of time, we would be able to remove and can make a defensible case for that, we could take other numbers into that performance assessment estimate.

HORNBERGER: And, finally, as I recall, and I may not be recalling exactly correctly, but it was a pre-integrated decision as to net infiltration, which relied at least in part on the use of the three dimensional mountain scale unsaturated flow model, which was then more or less finally tuned to the--

DYER: Right.

HORNBERGER: --the 4 millimeters per year, and the Chlorine-36, and what not. So, going to 14 millimeters per year, you said okay, the downstream effects are now the unsaturated zone model has to be adjusted. Do you have any indication that those adjustments are going to make sense?

DYER: Well, I mean, that's one of the challenges of the Berkeley team. I know Bo was intimately involved in this, but his team has picked it up. And, making sense of this change in the infiltration and propagating it through UZ is something that's in progress now.

GARRICK: David?

DUQUETTE: Duquette, Board.

Slide 4, please. And, this really refers to 4 and 5, but, we don't have to see 5 as well. You've given the Board about ten years worth of work in these two slides, just to review some of this data, and presumably, it's all going to be to support LA. Can you, and not necessarily today, but can you provide us with a time table as to when these--I mean, there are about ten items here that are presumably going to change in your TSPA models. Can you give us some indication of when those reports will be ready, and when they can be reviewed by the Board?

DYER: Yes. I'll have to go back and look at it, but Ward talked about the schedule. Every one of these is scheduled and resource loaded on that schedule.

DUQUETTE: And, you'll, if you haven't already, and maybe you have, you'll provide us with those dates when we might expect to see those?

DYER: We can do that.

DUQUETTE: Thank you.

GARRICK: I think Mark, were you--you were next.

ABKOWITZ: Abkowitz, Board.

Russ, I'm going to--my usual perch, which is somewhere between 30 and 50,000 feet, and want to try to tie together your role in the senior management team as it was defined by Ward. And, I've got three sort of big picture questions that I'm trying to continue to monitor.

The first one is who owns this Preclosure Safety Analysis?

DYER: Preclosure Safety Analysis is owned by the Office of the Chief Engineer. That's Paul Harrington.

ABKOWITZ: Okay. So, questions we have about work going on in that area, we will be able to defer until that presentation?

DYER: Correct.

ABKOWITZ: Is there a collaboration going on between your office and that office, since the issues are integrated?

DYER: Yes. There are some areas that are of common interest to us, seismic for instance. We take a common data base, and then it's used by both the preclosure and the postclosure. So, there are areas of common interest where we have a lot of exchange.

ABKOWITZ: Is thermal management an area of common interest?

DYER: Yes, it is.

ABKOWITZ: And, how is that being discussed? My impression is that in the license application work, the TSPA-LA has pretty much stuck to a thermal management strategy, if it can be defined as one, from many, many years ago, and all this additional work that has been shown to us, including today, are really just manifestations of what can be expected based on that thermal management strategy being the way in

which the repository will be designed and operated. Is that correct?

DYER: What we have tried to do is to expand what I'll call the analyzed range, if you will, to give us much more flexibility, what we might wish to do eventually. So, instead of just having a point solution, expanding the range through sensitivity studies, or additional analyses, to give us a much broader range.

ABKOWITZ: But, it's my understanding that the sensitivity analyses are being done around different expectations of behavior in the mountain, based on a single point thermal management strategy. Is that an appropriate understanding of what's happening?

DYER: I'm going to have to get back to you--

ABKOWITZ: By thermal management strategy, I'm talking about the constraints on the heat in the package and the WINE load, how it affects the drift separation and all the things that relate to thermal aspects that govern the design of the repository, and the package, and those interactions.

DYER: I was of the impression that we were trying to move the point where we could be much broader, I mean, to expand our options and the flexibility in the operational side of the repository.

ABKOWITZ: Who would I address the thermal management question to then?

DYER: Well, you can address it to me, but I'm going to have to do some homework and get back to you. And, you could ask Paul whenever he gets up here, too.

ABKOWITZ: Okay, thank you. One final question. Some time ago, the Board came to understand that DOE was going to develop some supplementary tools besides TSPA in developing its safety case. And, I believe that it had--there were sort of four offspring, and I can't remember the names exactly. I think there was a supplemental model, there was a realistic model, margin analysis. There were--I have it in my notes somewhere. Can you tell us the current status of those efforts?

DYER: Yes. They're different names for the same thing. It is a--it's gone by a number of different names, and that's the one that I couldn't remember the name for. I think the current name is the performance margin analysis. Can somebody--yes, okay. People are shaking their heads. That's going to be part of the validation effort for TSPA, and this will be one where you're not necessarily constrained by what can be documented to the nth degree, but really what is the, I'll it the best estimate for the individual investigators as to how a particular process would work, and what would be the expected range of a set of parameters. And, we are proceeding with that.

Now, there is another effort on TSPA that is a--the

Total System Performance Assessment that we have now grew over time, and it essentially grew as an amalgamation of bottoms up things, and there's a need to step back and develop a tool that really from the tops down, that's more of a system tool, and Sandia is charged with developing that. But, that's not a near-term thing. That's going to take us years to do that.

ABKOWITZ: Thank you.

GARRICK: All right, I have Ali, Howard, and then Thure, and then I have a question from the audience, and I think Andy.

MOSLEH: So, the things such as waste package early failure models, and seismic--you're developing seismic hazard curves for the surface facility.

DYER: Correct.

MOSLEH: Will you also be working on, or are you working on the corresponding fragility curves for facilities?

DYER: Correct.

MOSLEH: That's part of the--

DYER: Yes.

MOSLEH: I see. Okay. And, then, you're also doing something about the early failure estimates, the waste package early failure?

DYER: In what way?

MOSLEH: In the estimate of a fraction of those that

would be defective.

DYER: Well, yeah, we're trying to better document and justify the components of the model now, and that is a component of--early waste package failure is a component of the waste package behavior model.

MOSLEH: Well, what I remember from maybe some discussions in the context of TSPA was that those were basically best estimates, best guesses, but we were never presented with information--a basis for those estimates. So, I was wondering if that's an agenda item in your office.

DYER: I know there's a basis, but I must admit I haven't followed it that closely to know where the mis-match might be between what we've documented and what the Board's understanding might be.

KNOWLES: If I might add? We do have the early failure analysis.

GARRICK: Would you identify yourself, please?

KNOWLES: Oh, I'm sorry. This is Kathryn Knowles. I'm with Sandia. We do have the early failure analysis AMR, which is in process. It uses a fault tree analysis to develop the number of waste packages that might fail through early failure mechanisms. And, that is on schedule to be completed I believe by summer.

MOSLEH: Okay, thank you. And, then, is it correct then to assume overall on the list of things that you have

identified, in terms of enhancements and models, that most of these would not be part of the license application--I mean, TSPA-LA, but would be supporting documents?

DYER: That's correct. I mean, they're part of the technical basis that underlies TSPA, but they provide critical feeds to TSPA.

MOSLEH: Okay. And, then, in time, the idea that these would be merged and incorporated into the performance margin study--

DYER: Well, the performance margin analysis is a parallel analysis, but it's analysis that takes a slightly different approach than TSPA. And, if you'll remember, there's been questions about TSPA, about the conservatisms in TSPA, and it's an approach that tries to mitigate some of those conservatisms. And, if we run TSPA and we run a performance margin analysis, what differences do we get and what contributes to those differences. That's what we're trying to understand.

MOSLEH: Okay, thank you.

GARRICK: I think I'm going to wedge in a question from the audience here just to make sure we get it.

I have a question given to me by Michael King, the hydrology consultant to Inyo County. He has really three questions. The first one is could you briefly explain what organization is doing the regional groundwater flow model for

the program, or what model is being employed?

DYER: The regional model, if I remember right, was done by a consortium that was mostly headed up by the U.S. Geological Survey. We were a participant in that consortium, and we might have been the primary financial benefactor for it, but it was a consortium of the Nevada State Engineer, the various federal agencies, DOE, I believe the Nevada Test Site was involved in that, so it was really a consortium or task force that produced that product, which was documented a year or two ago in a USGS report. I can't remember whether it was an open file, or what kind of report it was.

GARRICK: He also asked how far south of the repository does this model cover?

DYER: The regional model?

GARRICK: Yes.

DYER: I don't know. Drew, or somebody, can you-- Claudia?

NEWBURY: This is Claudia Newbury, DOE.

The Death Valley Regional Flow Model takes into account the whole Death Valley region, so, it actually goes south of Death Valley into Grape Vine Mountains on the south side. It covers--

DYER: It goes down to Franklin Lake playa, I'm pretty sure.

NEWBURY: It goes past there.

DYER: Yes.

NEWBURY: It includes Death Valley. So, it includes parts of Nye County and Inyo County, goes far north of the Test Site, and large areas on both sides.

GARRICK: His final question was will this new information be in the draft Supplemental Environmental Impact Statement, and will it go out for public comment?

DYER: Well, the information is publicly available. The report was published a year or two ago, I believe, and the onus is on us to acknowledge the existence of that information in the EIS. It should inform the analysis in the EIS.

GARRICK: Okay. Howard, I think you're next.

ARNOLD: Arnold, Board.

I, too, was interested in the early failures. If you go to Slide 5, you do cover it, in answer to Ali's question, that third bullet there does talk about it. My question relates to Slide 13. Why all of a sudden in the second picture, the entire inside of the waste package is slumped down to a pile of rubble?

DYER: Well, there would be some continuum, and what we've done is to take just snap shots in time, but it's not a linear time step. If I can put some times on these, this is probably the state in the underground from time of emplacement to maybe 50,000 years. This might be 50 to

400,000 years. So, hundreds of thousands of years. This is somewhere between 100,000 years to almost a million, and this is from about three-quarters of a million, on out. So, we're talking fairly long time frames here.

ARNOLD: As I heard from Sandia, you're redoing this whole subject.

DYER: Yes.

ARNOLD: Yes, okay.

GARRICK: Thure?

CERLING: Cerling, Board.

I have two questions back to infiltration because that affects everything, including, it seems like, the seismic studies. And, one, getting back to the issue of revised upper estimates of infiltration, are these--and, you said that they were conservative estimates, and, so, I'm wondering if part of the difference between the new and the old, is that a difference in the definition of the way that one does conservatisms, or is it the exact same analysis done--or the same definitions of conservatism with a different analysis? I'm just trying to understand part of these differences.

DYER: I think the people that did this work would say these are more realistic.

CERLING: But, still a conservative estimate?

DYER: Yes.

CERLING: Well, then, my follow-on question is I think on Slide 4, you say that there will be new infiltration studies, and these include studies that will be collecting actually what one of my colleagues in modelling calls real data, or are the new infiltration studies going to be additional modelling, or are there, in fact, some new studies planned to collect data to distinguish between these estimates?

DYER: Well, this is what exists now. There have been new infiltration studies. Most of them have been either gathering information out of the literature, there's been a little bit of field work, but not much, and these are some of the things that have been downstream impacts, if you will, from that.

Now, there are a number of programs associated with infiltration that have elements for future study, but what we're going to have to look at is where is the uncertainty, and from a systems approach, what are the important, the most important things we need to look at. And, right now, we have very little work going on at the site.

GARRICK: Let's see, we have Andy, and then Bill.

KADAK: Kadak, Board.

I'd like to ask about the seismic and the volcanic hazard analysis. As I understand it, the site has a seismic criteria of 10^{-6}; is that right?

DYER: I think that's right, but I'm going to call on Jon Ake. Well, is that your question or--

KADAK: Well, that's my opening question.

DYER: Okay. Let me get my seismic guy up here. This is Jon Ake.

AKE: Jon Ake, DOE. For preclosure safety analysis, we needed to have a hazard curve for the surface facilities area that extends down to at least 10^{-6}. Actually, a little bit below that.

KADAK: And, the reason for that is why?

AKE: In keeping with the, and responding to the interim staff guidance, that I'm sure you are all aware of, of last year, to do the performance assessment and show that we comply with 63.111.(b)(2), I believe, is the subsection, you know, it requires us to be able to do the convolution of the component fragilities with the hazard curve, down to at least 10^{-6}.

KADAK: I guess that's really where I'm going with my question. The lifetime of these surface facilities is how many years?

AKE: Nominally, a hundred years, 50 to 100 years.

KADAK: And, why is it that you need the 10^{-6} standard?

AKE: To be able to show, given the criteria spelled out in Part 63, that we have no more than one chance in 10,000 over 100 years, if you will, or 50 years, whatever the

lifespan of the facilities are, that we have no event sequences that violate our dose limits in that time period.

KADAK: Okay. Well, go to the below grade. What's the below grade standard? In other words, postclosure?

AKE: Postclosure is the same thing. It's one part in 10,000 over the repository performance period, which used to be 10,000 years.

KADAK: So, what's that number now?

AKE: Essentially, we're doing it by--well, in--that's a difficult question to answer.

KADAK: I guess the point I'm trying to make is when do you start believing your numbers?

AKE: When do you start believing, or stop believing?

KADAK: You mentioned 10^{-8} is a criteria for FEPing out, I guess is the word for these things, and I'm just wondering when you get out to numbers that are so low, and the recurrent frequency of seismic events or volcanic events is so long, you have to include events that are way beyond even experience, and are you going to be designing a facility for something that you can't even say can possibly even occur? Which, obviously, is going to affect how you design the facility.

DYER: Yes.

AKE: I'm going to say no comment.

KADAK: I didn't mean it as a joke. I meant it as a

real good scientific question for people to try to think about when they establish standards. And, this includes the Nuclear Regulatory Commission and whatever reg guide you refer to. And, if those of you who have heard McGaffigan's text of the talk that he gave a couple of days ago, he pretty much says the million year standard has no science to it. And, at some point, someone is going to have to call it.

AKE: I appreciate your comments, but I think it's outside of my area of responsibility to comment on.

KADAK: I didn't address it to you, but to the group. And, my final--sorry, John?

GARRICK: It has to be final.

KADAK: Is this sort of combination of conservatisms, where each group makes some conservatism, and then tries to pass that on to the next group, who also makes its level of conservatism, which then results in who knows what you have as a level of conservatism, is there anybody on the project tracking the complexity and combination of conservatisms to be able to say we have lost it, in terms of understanding how much conservatism we have really applied?

DYER: Well, we have made a concerted effort to look at the propagation of uncertainty, where it's coming from, what is aleatory, what's epistemic, how it's being treated, and there is a pretty robust program looking at trying to reduce that, tracking that uncertainty and managing that

uncertainty.

KADAK: I didn't say uncertainty. I said conservatism. We have an example here of infiltration, where you've quadrupled in some cases the water flow into the repository.

DYER: right. And, I think the argument that the authors of that paper will make is that that result has less uncertainty associated with it.

KADAK: Okay.

DYER: You may think it's more conservative, but it has less uncertainty.

GARRICK: Moving right along, Bill, a quick question.

MURPHY: I have two very specific quick questions, but first of all, I'd like to thank you for addressing the questions I posed to Ward.

The first is with reference to the Nevada data for Technetium 99 and Chlorine-36, I haven't seen these results before, but on the face of it, an interpretation could be that the Chlorine-36 pulse has already passed through, but that the Technetium 99 pulse is still hung up in the mountain. Has that possible interpretation been explored?

DYER: Not really. That's obviously a possible interpretation, but we haven't taken it very far.

MURPHY: My other specific question has to do with the statement that sensitivity analyses indicate that fast and transient flow paths carry about 1 percent of the water.

And, I'm concerned, or I wonder if that sensitivity is appropriate to other climatic regimes? Would that be the same case for the glacial transition climate?

DYER: I'm trying to remember. Yeah, whenever you look at other data sets, like some of Zell's data, which is more of a cumulative measure--I don't know. I don't know.

MURPHY: Neither do I.

GARRICK: Okay. David Diodato, did you have a quick one?

DIODATO: Diodato, Staff.

Russ, this is about the PVHA, and it's a question--more of a statement. On Slide 18, at the bottom, it shows a June 2007 roughly deliverable for the final hazard calculations. Now, the Department of Energy has been--is to be commended for their efforts in terms of supporting really a state of the art investigation of volcanic hazard at Yucca Mountain. It's put together a solid team, and Kevin Coppersmith is in the audience. So, I wanted to look at that June date, and then back up to the bullet on Slide 15, where you say the PVHA update will confirm the licensing basis for. I think a lot of the scientists participating in this effort will be surprised to find out, I mean, do you know the answer already of what they're going to find? There's a risk here that you're undermining a little bit in terms of the credibility.

DYER: I agree. This is a presumptive statement.

DIODATO: Yeah. Okay, thank you.

GARRICK: All right, I think we're going to take our break now. We're about six minutes behind schedule, so, let's reconvene at 10:36.

(Whereupon, a brief recess was taken.)

GARRICK: All right, our next presentation will be by John Wengle, and he's going to talk to us about the Science and Technology activities. John?

WENGLE: Thank you.

First of all, I'd like to begin by saying that I appreciate the opportunity to present the program to everyone. And, I also, of course, want to thank the Board for their continued interest in the program, as well as their strong support of it.

As you probably realize, the program has faced many challenges in the past, and that undoubtedly, it's going to face other challenges in the future. But, with that said, we think we've put together a pretty impressive body of work, and we're really pretty excited to tell you about it again today.

Next slide, please. In preparing for this presentation, what I did was I re-read all the previous S&T presentations, and paid particular attention to the Board's comments and concerns about the program. And, if you do

that, I think you find that essentially, the Board's interest in the program, concerns about the program, break down into three broad areas. The first area is simply stated Resources. How much money do we have? Where are we sending it? How are we allocating it? How do we handle that whole process? Do we have sufficient funds to accomplish what we need to do?

The second area of interest revolves around what I call the success metrics of the program. And, here, I'm really thinking of sort of a two-level metric. One, are you in fact doing world-class science, and are you publicly disseminating it? Are you getting the information out there to a broad audience? And, two, the Board has sometimes referred to this as I guess the degree of integration between the science and technology program, and the baseline science program. In other words, to what extent are your results actually going to be used either in the technical basis for the license, or, more broadly, to inform the safety case for the license? And, we'll cover that under the--those three areas.

Finally, the Board is obviously interested in the technical work we do, and I would emphasize that my presentation today will not be an exhaustive discussion of our technical work, and that's primarily for two reasons. One, several months ago, Mark Peters was here. He did spend

a rather lengthy time updating the Board technically on where we stand, and that, frankly, coupled with the what I now call the ever continuing resolution, there's no question that that has had a substantial impact on our work, on our technical work. And, while if I can employ maybe a maritime analogy, as you're pulling into a dock, you see all the signs that always say slow speed, no wake, we're not throwing much of a wake at the moment. So, that's, again, a reason I won't go into exhaustive detail about our technical program.

And, finally, we'll summarize a bit.

Okay, first of all, the historical S&T Program funding. The program actually began in late fiscal year 2002, received a first increment of funding in '03, rather small, modest amount, $2 million. Then, rather abruptly in '04, we see that the funding increases fairly dramatically, $17 million. And, what that really reflects is at the end of '03, there was a competitive call for proposals issued. You may remember we received something on the order of 210 proposals, and we elected to fund about 40 of them, and that's primarily--you see the jump up there.

In 2005, we bumped up to about $19 million. And, again, that really reflect two things. One was a formal call within the source term and natural barriers arenas for new proposals. We received about 120 proposals, competitively scored them, resulted in the award of about 15 new efforts.

As well in '05, the Advanced Technologies thrust began in earnest, and, of course, that accounts for some of that kick-up.

In fiscal year '06, this is rather interesting, although our total budget was a little over $21 million, we actually started the year at $13 million, and we did file two requests for additional funding, one for $8 million for our Advanced Technology Program, one for $6 million for our Science Programs. Both were approved. The $8 million for Advanced Technology was funded, and actually, almost unbelievably, two days before we were due to release the Science money, Congress announced a rescission and we lost the money. So, that effectively takes us up to the present day.

Next slide, please. This shows historical funding by thrust, and really, I'll concentrate here pretty much from the 2006 period. You can see essentially the Science Programs, the Source Term, the Natural Barriers Program, Materials Performance Program were funded at about $2 1/2 million a piece. This was certainly below what they needed, but we were able to partially mitigate the funding decrease here by the fact that the '05 funding to these programs had been delivered, again because of a continuing resolution, relatively late in the year. So, by using the carry-over funding from '05, we were able to mitigate the worst impacts

as we moved into '06.

The Advanced Technologies Program, of course, jumps out, a little over 13, $13 1/2 million. And, really, that was for two primary reasons. The way we've set up our Advanced Technologies Program, the projects are phased, so that as we moved beyond the feasibility stage, we actually begin to do what I would describe as technology prototyping, or technology demonstrations. They cost a lot of money. And, in '06--we'll talk a little bit more about this when we get to the Advanced Technologies Program--but, we did begin to demonstrate our reduced pressure electron beam welding technology at half scale, and we also coded six half scale simulated waste packages in our structurally amorphous metals program. So, certainly, that accounted for an increase in funding there.

Now, obviously, the Board is interested that, you know, there appears to be something missing on this chart, namely, the fiscal year '07 budget. That's not been formalized yet. Obviously, the project is struggling through the impact of the continuing resolution. We do expect that that will be narrowed down within a fairly short time now. Will it be at $21 million? Realistically, no, it won't be.

We know with the pressures, the funding shortfalls due to the continuing resolution, the pressure from the licensing side of the House, we know it's not going to be at

$21 million. But, will it be sufficient to maintain a fairly robust Science and Technology Program? I think so. And, that's what we're going to aim to do.

Next slide, please. You've probably heard a number of people mention the importance in the Science and Technology Program about bringing new blood into the program. And, this is not just because quite frankly we get sick of looking at the same old faces. It's not because, as I've heard the rumor, that I have a bias against the national laboratories. In fact, quite the contrary. The national laboratories clearly have some of the very best people in these fields working. But they only have some of them, they don't have all the very best. And, some of those other people are out in academia, they're out in the private sector, and if you care to, you know, if you really want to walk through and do the totals, you'll find that this reflects somewhere in excess of 50 organizations, nine of which are commercial entities, 31 universities, eight national labs, and five what I would describe as other organizations, could be the USGS, could be the Atomic Energy of Canada, that sort of thing.

And, I'd emphasize, by the way, that this is already out of date. Every time I look at this, I think of and remember the other organizations that aren't mentioned on here. For example, the Defense Advanced Research Projects

Agency. Most of our international collaborations, with one exception, are not mentioned on here. We have collaborations ongoing with SKB, with the Institute for Transuranium Elements in Germany. We have work with CEA. We have work with En Risa (phonetic) in Spain, Subitech in France. So, the list goes on and on. I suppose if you total all that up, we're probably looking at an organization of 60 plus, 60 plus entities.

And, again, this I think is particularly important because it enables us to, again, to play off a theme of Russ and Ward, intellectual continuity of the program. We do want to attract the very best, and in order to do that, we have to reach out to as broad an audience as we possibly can. So, this gives you some idea of essentially where our money is going.

Next slide, please. Believe me, I'm not going to subject you to this slide for very long. I think everybody on the Board probably knows the mission and vision statements of this program at least as well as I do, if not better. And, I don't particularly care about that aspect of this particular slide. But, what I do care about is that you pay attention to the drivers of the program. And, I'd ask you to note for the first time the addition of a fourth driver for the program, which is to enhance safety within the repository.

Why is that important to me? Well, aside from obvious, you know, the obvious reasons it's important, it's also important because I believe at some level, it evidences the larger project's move and embracing of an organizational commitment to continuous improvement. That's the culture. And, that is very important from a Science and Technology Program perspective.

Frankly, we can proceduralize the interaction between this program and the baseline program. We can do that in minute detail. But, until people sort of feel in their guts the importance of continuous improvement for the project as a whole, we are not going to be able to realize our ultimate goal, which is, where applicable, to incorporate the data from the Science and Technology Program into the safety case, for example, for the license. So, I think that's a very significant, really, a very significant addition to that list of drivers.

Next slide, please. How do you improve the culture? Ward spoke about this briefly. But, what we have on here at the moment is actually one of his particular initiatives on this line, and what he's actually done, he's developed a list of what he calls cultural behavioral attributes that he wants to essentially see inculcated within the project.

And, he's gone a step farther, and he's actually

taken these things and he's literally imported them, or exported them, I guess you'd say, into the performance appraisals of everyone on the project, so that in a very real sense, people will be, if you will, financially incentivized to show this--to essentially show this kind of behavior. And, again, that's very important to us for the reason we state on there. We want to move from a situation where perhaps the Science and Technology Program has not been wholly embraced, to one where--to an organization that in fact welcomes technical challenges to the baseline, and is actively seeking to inform the safety case in the license with our work.

Next slide, please. We have always placed a great premium on wide dissemination of our products, and this is really for three reasons. Once again, returning to the theme of intellectual continuity, we want to attract the best and brightest. In order to do that, we sort of have to be--we have to be competitive in the marketplace. We need to create a buzz in academia and in the private sector and in the national laboratories that our program is worth participating in. So then, obviously, in order to do that, we need to get our work out there where it can be openly discussed.

The second reason that product dissemination is important to us is credibility. We actually believe, and it's, if I can say it, a plank of the Science and Technology

Program that we abhor dark smokey back rooms. We do our best work out in the sunshine, and what we're really trying to do here is enjoin a serious intellectual scientific debate about the repository, and we want to do that in the open literature. And, we believe by doing that, that in the long run, we're going to enhance the credibility of the overall program.

And, finally, the third reason. The third reason is a little bit more difficult and, frankly, I'm still working through it. But, I do believe that even if not one iota of our work is ever actually incorporated into, for example, the technical basis for the license, I still believe that we can have an influence on the overall process, because we can inform the intellectual debate, we can change the context within which this whole discussion is about to take place. And, I'll cite an example of that a bit later when I get to the Materials Performance thrust area, because I think there's a particularly, at least a potentially very good example of that there.

Again, if you care about numbers, to date, we have published some 90 technical papers, a simple, and actually beyond a simple majority of which have appeared in peer-reviewed journals. We've got 81 presentations, 41 abstracts, all of which are available on the Science and Technology website.

And, again, what we're looking at doing here with these products, our role is essentially to produce world-class science, conduct the research, produce the products, and then we need to hand them to particular entities within the project for formal evaluation, namely the lead laboratory and the design authority.

Next slide, please. And, I would emphasize about this slide that we are not yet--we have not yet instituted this process, and it's certainly fairly early in our thinking about it. But, we do want to formalize the process by which our data, our results are actually evaluated by the lead laboratory and by the design authority.

And, essentially what this requires, the very first thing it requires is that our pre and postclosure managers have to have a real time familiarity with the results of our program. They have to have a real time familiarity with our research directions, what we're doing and why. And, actually, I'm not terribly worried about that, because to date, our informal interactions with the baseline program have really been very robust.

As most of you know, we conduct mid-year reviews of all of our programs, and certainly we've had plenty of folks there from, you know, the TSPA folks, the baseline science folks, so certainly there is a general interest in and familiarity with what we do.

But, what we are doing in this is we're looking to actually formalize that, where we envision a formal review taking place, probably on an annual basis, with members of the lead lab, and the design authority organization, and we will work very systematically through our projects, and of course as well as individual project, the collection of projects, because often our impact won't necessarily be from an individual project, but will be from within essentially the collection, if you will, the synergistic effects of projects on each other. And, we envision that out of that will come a formal report prepared by the lead lab and the design authority that will actually document the potential impacts of the new information that we're offering. And, I envision that to be essentially a public report, and it would be, to a certain extent, almost an accompaniment to the S&T annual report.

So, on the one hand, you'd have what we're doing, and on the other hand, you'd have a report from the people that essentially are our customers that we're doing the work for, as far as what they believe the impact of that work to be.

Next slide, please. This is essentially a very similar, certainly the top part is very similar in the kinds of things that the lead lab or the design authority would be looking at. The bottom part adds a little different twist to

it, though. And, that is the fact that there is a second formal mechanism within the OCRWM program to document situations where we see data, we see results that appear to be at variance, you know, with our current understanding, with our current models, and that's the Corrective Action Program.

Now, as Ward pointed out, it may be that the CAP program needs some fine tuning, and needs a bit of work. But, nevertheless, there does exist a formal mechanism through which changed information can be resolved. And, effectively, what happens is a condition report is filed, or generated, is classified as to importance, and then a group is brought together, and either a root cause analysis or a causal analysis is done, depending on the level of significance, and ultimately, corrective action is put in place to resolve it.

And, I guess what I would emphasize here is depending on the impact, that corrective action could run all the way up to and include an amendment to the license.

Next slide, please. I put this slide up to show that the interfaces between the S&T Program and the lead lab have been formalized. This is something that Peter Swift and I had talked about fairly early. We wanted to make very certain that there was single point accountability as we interacted.

So, for example, within the Natural Barriers arena, Yvonne or Doug Duncan or myself will know that the person we need to deal with is Stephanie. So, we have, again, single point accountability. Just to anticipate, there was another column originally on this chart devoted to the design authority, because we have those same connections drawn out there, but, frankly, it became too much of an eye chart and I removed it. But, again, we do have that level of integration with the design authority as well.

SPEAKER: What's the other column again--

WENGLE: Oh, it's the Regulatory Science and Integration Group. Essentially, it's the Baseline Science Program under the Office of the Chief Scientist. It's the group that Claudia Newbury manages.

Next slide, please. Now, we'll move into a bit of the technical work that we're doing, and, once again, this will be at a fairly high level. But, within our Source Term Program, there are really three reasons that we're working in the Source Term Program.

First, essentially all the radioactivity that we're concerned with is tied up in spent nuclear fuel and the borosilicate glass logs. So, the first barrier to radionuclide release at the repository is going to be the source term.

Secondly, over very long time frames, the final

evolved state of the source term will also be the primary barrier to radionuclide release. So, we again want to understand what that final evolved state is.

And, finally, the third reason, if I can return once again to the theme of intellectual continuity, within the United States, OCRWM is perhaps the only organization that has a real need to understand the corrosion of spent nuclear fuel in borosilicate glass. I know that NSF funds a few bits of isolated work here and there, DOE's Office of Basic Energy Sciences funds a project here or there, but, to my knowledge, no one has quite the concentrated focus or the need for a concentrated focus as we do.

So, again, from the point of view of sustaining an intellectual community of scientists, and obviously potentially people to contribute to this program, I think we are in somewhat of a unique position there.

We also know that many factors are going to affect the release of radionuclides from the source term, temperature, radiation field, redox conditions, pH, near-field materials, it's a terribly complex process, and obviously, no one on the Board needs to be told that. But, we do believe that we have identified at least three very important process areas that we're looking at, the kinetics of waste form corrosion, the potential incorporation of radionuclides of interest into all duration products, and, of

course, the interaction of waste form and waste package interactions.

And, also, if I can borrow perhaps out of context, an idea of William James, we also join to put some water into this blooming, buzzing confusion, and that's our fourth area, which is essentially a model building effort.

Next page, please. On this particular page, what I particularly want to point out, the source term has been very active internationally in terms of establishing collaborations. We are, for example, a member of the MUCADO project, Model Uncertainty for the Dissolution of Spent Fuel. This is a European commission program. We're also a member of the NF Pro. This is, again, a group of 40 waste management organizations within the European Union devoted to enhancing the understanding of the near-field. We have ongoing work at a number of universities, including Manchester University in the United Kingdom.

We have collaboration agreements with Subitech in France, CEA in France, En Risa in Spain, the Russian Academy of Sciences. So, again, we're trying to leverage limited resources in the best manner we can, obviously, recognizing that there are some limitations here. The situation, obviously, the environment of concern typically in other repositories is not quite the same as ours. We are unique in looking at saturated, or unsaturated oxidizing conditions.

So, obviously, that bounds to some degree the extent to which we can benefit from the international collaborations.

As far as work to date within the source term that I find particularly exciting, and please, let me emphasize here that I'm not intending to denigrate other work we have ongoing in the source term arena, but particular projects that strike me as of great import, I think here of Pat Brady's work on the potential uptake of technetium onto iron oxyhydroxides. I think I also couple that work with the structural, or crystal chemistry work of Peter Burns at Notre Dame, where he's actually looking at the incorporation mechanisms for neptunium into ural (phonetic) minerals.

And, I think, in turn, if you couple that with Udo Becker's work at the University of Michigan where he's actually looking at the quantum mechanical energetics of that incorporation, that begins to give you, I think, potentially a very profound understanding of how this process may actually take place and when it may actually take place and how frequently it may take place in repository relevant conditions.

But, with that said, I also want to emphasize that this work is not perhaps ripe yet. You will note some of the deliverables we've identified here in Fiscal Year '07 and '08, and I would now probably push those out to '08. I want to emphasize that we think of those in terms of phasing.

We're not going to have completely determined all the processes of spent nuclear fuel dissolution in a year, but we will have a, if you will, a block of understanding that we've achieved to that point, which we will bring forward. Obviously, these are going to be much longer, much longer time to complete our understanding of them.

Next slide, please. If we move to the Materials Performance Thrust, obviously, the engineered barrier system is a critical component of our defense in depth strategy, and clearly, the performance of the materials used in the engineered barrier system are obviously critical to performance of the repository.

We know that corrosion is going to be the primary determinant of the performance of the waste package, and we know ultimately that corrosion processes will determine when our packages will be penetrated, and the shape, size and distribution of those penetrations. Obviously, very important questions.

We also know that we're looking at a very complex, much like the source term, a very complex corrosion environment. We've got a situation where our packages may be covered in dust. The dust may be wet. We're going to be likely looking at humid air conditions, we're going to be thermally and radioactively hot, we're going to have periodic wetting and drying, we're going to have natural convection

effects, we're going to have salts deliquescing on the packages, potentially at bulk boiling temperatures. That's a very challenging corrosion environment to completely untangle and to understand, and what we're doing is targeting three areas within that.

We know, for example, that passive metals, in terms of their general corrosion rate, it's a state passive. They will--the corrosion rates are very low. They'll be around for a long, long time. And, I'm thinking here in particular of work we're doing out at Berkeley. Tom Divine, he's put together sort of an in situ raman experiment, and he's actually effectively, I think, watching the evolution of the passive film over time.

And, while again, that's far from a complete understanding of what's going to happen over the time periods we're interested in, I think it is an important first step toward enhancing our understanding of that process.

Damage evolution by localized corrosion, or crevice corrosion. We know that there is an absolutely deep and robust literature on the initiation and propagation of crevice corrosion. However, the literature on potential stifling and arrest mechanisms is considerably thinner. In fact, you could argue that I suppose our program is potentially a leader in that area. I'm thinking here in particular of the work of Joe Payer and Rob Kelly, where they

have actually looked at the potential for a crevice to open up as it evolves, and, thus, exposing the, if you will, the critical corrosion chemistry to the wider environment, essentially stifling or even shutting the process down.

Now, in citing that work, I do want to mention that we have recently received the Board's letter in response to the Corrosion workshop, and I, you know, certainly will take that very seriously. In particular, your concern that this corrosion work, particularly the stifling and arrest work, may in fact be more an artifact of a particular laboratory experiment, rather than actually representative of conditions in the repository. And, that is something that Joe and I will think, you know, very seriously about, and certainly respond to you in a fairly careful manner about that.

And, finally, and our last area, we know that corrosion performance of any metal is due to a combination really of a couple of factors. One, the inherent corrosion resistance of the metal, coupled with the actual environment. And this particular area actually looks at, in particular, the evolution of the moisture in contact with the metal surfaces of the waste package. We need to enhance our understanding of that.

Next slide, please. Really, what I want to point out here, once again, back to the theme of intellectual continuity, we currently support 20 graduate students in this

program. If you couple this with the work that we support in our other areas, we've probably got support out for 40 to 50 graduate students in our program. I think that's a pretty significant intellectual community working on problems of interest to this program, again, in terms of thinking about how we'll maintain this.

I think that's all I really want to do with that slide. Next one, please.

Our Natural Barriers Thrust area. We currently have, depending on how you look at it, four or five major research areas. We are looking at seepage processes, particularly emphasizing the development of coupled models to better understand that. And, here, I'm thinking in particular of two projects we've got going on.

One is George Danko's work at the University of Nevada at Reno, and George is looking at essentially developing a new thermal hydrological near-field model, which will account for the impact of natural convection on seepage. Among other things, George believes there may actually be reduction in seepage due to evaporative effects, the axial movement, if you will, of vapor along the drift. And, that, I think, is potentially very, very exciting work, although it's, in terms of timing, it is still probably at least a year to two away from fruition.

The second project in the seepage area that I think

is particularly interesting is Derrick Ellsworth's (phonetic) work at Penn State. This is a--it's a rather complex experimental and modelling effort, but essentially what he's working on developing is an integrated, fully coupled thermal hydrological mechanical chemical model, in which, among other things, some of the early results seem to indicate that we may see the drifts--essentially the fracture pattern around the drifts may be healing, due to mineral precipitation coming out of the drifts. It's a very interesting, again, very difficult piece of work, and again, we are only about--only a little over a year into that work, so we have at least a year to two before that work will bear fruition.

Within the drift shadow arena, we have three projects ongoing there. And, in the UZ and SZ transport, we have a number of different projects going on there. Jim Seasdale (phonetic) at the University of Nevada at Las Vegas is looking, for example, at redox conditions in the groundwater to effect fine examples of reducing environments rather than oxidizing. To date, he's not, although that's still in the early phases as well.

Next page, please. The program has been I think particularly productive in terms of, again, in terms of its papers published. I would note that the last bullet is rather ambitious, I believe, based on the funding that we provided to them in Fiscal Year '06. I actually think the

majority of work here will not complete until Fiscal Year '08, likely early in Fiscal Year '08, but nevertheless, critical because we'll want to begin to think about new starts in that arena.

The next page, please. Our Advanced Technologies Thrust. We're currently looking at five projects, currently performing five projects within this thrust. I guess the first one we would start with is our structurally amorphous metals project.

Currently, as I think I have mentioned, we've coated six, what we call half-scale simulated waste packages. This is not a bells and whistles waste package. This is essentially a steal sewer pipe with a welded cover. They're about eight feet long, and they're probably, oh, a couple, three feet in diameter. And, essentially, we have coated them with a thin layer of SAM, either two by five formulation, or 1651. And, we have used three separate spray houses to do that. Frankly, we wanted to understand the robustness of the application process for this material, so we went to Caterpillar, we went to Plasma Tech, and we went to Sandia, each of whom maintain spray houses.

Currently, the packages themselves, the half-scale packages, have been through salt bog testing, came through rather well. They're now out at Livermore, where they are generally being torn apart, either to do mechanical testing,

measuring the strength of the bond, drop testing, a whole series of damage tolerance testing. That work is all ongoing. Our long-term corrosion studies on structurally amorphous metal are also continuing, as well as our nuclear criticality experiments.

And, I think--at least, I suspect in Fiscal Year '07, what we're likely to do with SAM is to a certain extent, take a breather. We've pumped quite a lot of money into this project in Fiscal Year '06, in an attempt to really drive it, and to figure out whether we had something. I think what we need to do this year is to sort of marshal our data, review that data very carefully, and obviously as publicly as we can, we're thinking through it now, how we might want to conduct, if you will, a peer review of this data, and then take it to the project probably late in the fiscal year to essentially determine interest in moving forward, and in what areas they might be particularly interested in moving forward on.

Reduced pressure electron beam welding. We've entered phase two of that work. Phase two is essentially the development of a half-scale size unit, where we will look to essentially do four simulated closure welds. Two will be with stainless steel. Two will be with Alloy 22. That work is due to complete probably, again, around the August time frame. At that point, we'll consolidate the information,

take it to the project.

At this point, I am probably leaning against recommending that we go to a full-scale development for this work. I don't think we will need to. I think we'll have the data that we need as far as being, you know, able to make a decision what we want to do with this. And, frankly, a full-scale development of a reduced pressure electron beam system will run to the tune of $5 to $7 million, and that's probably a bit beyond our resource availability in the near future. But, the work has proven to be very, very promising.

In terms of subsurface operations, we are looking at the possible use of silica-based cements in the repository. Most of you know we can't use ordinary Portland cement in the repository. It causes pH problems, mobilizes plumes of radionuclides. So, we are looking at, again, silica-based cements. We have selected a formulation. We are moving forward with leachate tests, actually, we're well into leachate tests. We're also moving to design essentially a process model to help us better understand the long-term behavior of this material in the repository.

That work is ongoing, although, again, at a fairly reduced rate at the moment. But, we are targeting the Third International Use of Cements in Geologic Repositories Conference as a venue to get this out. That will be, it's an international conference in France later this summer, and we

are particularly anxious to be there, because we do want to get access to much of the information that the French have.

The French have done quite a lot of work in this arena, but haven't published very much of it. So, we do need to I think get access to that. Again, very promising work.

Engineered backfill. We did a feasibility study, oh, about a year ago, looking at the possibility of using engineered backfill to mitigate potential seismic and igneous intrusion scenarios in the repository. At this point, that work is largely completely. We had Sandia Lab do essentially an experimental look at thermal conductivity. We wanted to make sure that as we put backfill around, we didn't essentially create a thermal blanket around the package.

Obviously, if you use very fine grain material, you will do that. We found, however, that by using a coarser grain material, cobble sized, say one to two centimeters, we find we don't have a particular problem with thermal conductivity, with generating too much heat inside the package.

We would have, if this project ultimately moves forward, we would obviously have to look at environmental impacts, or potential environmental impacts, in terms of corrosion performance on the package, associated with backfill. But, at least at this point, we're looking at wrapping that project up and putting it on hold at least for

now.

And, finally, our seismic hazard program. It's a little bit odd in a way that this is in the Advanced Technologies Program, but it started off initially as a potential way to reduce the cost of some of our facilities construction out there. If you don't need to have a six foot thick wall, it obviously, you know, you can put a building up for a bit less money.

This is run out of the Pacific Gas and Electric Utility. They, in turn, have subcontracted out most of the work to SCEC and PERF. If I remember correctly, the Southern California Earthquake Consortium. And, PERF, I believe is the Pacific Earthquake Research Foundation, essentially Northern and Southern California, split between them.

We're looking here particularly, I think John spoke to this earlier and Russ spoke to it earlier, we're looking particularly at the tails of our seismic analysis, the very low probability, very high consequence, really extreme ground motions you get when you carry these studies out to a million years, and beyond. And, I think it's probably fair to say that most seismologists consider that level of ground motion to essentially be physically unrealizable. And, this work is essentially going after that, to see if we can bring enough data forth to develop enough of a scientific basis to make that strong argument.

Next slide. Finally, in summary, I think the first couple bullets are somewhat self-explanatory, and I don't really feel the need to, you know, spend a lot of time going through those. I think we have generated additional insight, and I think our technology work has generated certainly several potential technology enhancements.

We continue to value the diversity and quality of our program participants. As you have seen, we really have, I think, a pretty extensive reach, given the relatively modest resources that we put to this program. I do think, however, as we enter into Fiscal Year '08, that it's going to become particularly critical if we can figure out a way to do it, to issue calls for new proposals.

Once again, as I mentioned, it's a competitive marketplace out there. If you want to keep the buzz about the program alive, you've got to be able to offer real funding to both graduate students and established investigators. And, that is something we are going to look very, very actively over the next few months, figure out our cash flow analyses, and that sort of thing, because we're very anxious to put together new starts in '08, if we can do it.

Finally, the last point I wanted to make. It's an impressive point. In terms of intellectual continuity, I may have seemed at times almost obsessed with that theme in my

presentation, but to be perfectly frank with you on both a personal and professional level, the tragic death of Bo certainly affected me very deeply, and it really got me thinking very strongly about this issue. I do believe that the Science and Technology Program is going to be a principal source, it's going to be a principal pool of those candidates, those scientists and engineers that we're ultimately going to need to recruit onto this program.

And, I know HR people refer to--they use the dry term of succession planning, and I don't want to say that replacing Bo is going to be easy. It's, in fact, going to be impossible. But, with that said, when I look to do succession planning, it presumes that I have a pool of qualified candidates available. If they're not there, then succession planning, by definition, becomes impossible. And, I think from that standpoint, that the Science and Technology Program, again, given the diversity and quality of its program participants, is absolutely a ready pool.

We've got 50 graduate students out there doing not simply master's work, not simply Ph.D. work, but work that actually means a difference from the point of view of the energy security of the country. And, I think that's the kind of hook that I think we can use to attract those people and bring them into the program.

And, with that, I'm done.

GARRICK: Thank you, John. David?

DUQUETTE: Duquette, Board.

This is more of a recommendation than it is a question. As you know, the Board has been pretty supportive of the S&T Program over the years, pretty much from the beginning, and several of us in this room were on the Board when it was initiated. If you put up Slide Number 8, please, there are several product dissemination things that occur, one of those being your annual science review program, and so on and so forth, the peer review journals, and so on and so forth.

WENGLE: Yes.

DUQUETTE: Last year, we forced ourselves an invitation to attend your meeting on the amorphous metals.

WENGLE: Yes.

DUQUETTE: That invitation didn't come back this year, nor are we normally advised of those program reviews. I think it might be wise from your point of view, as well as from ours, since we're supposed to be the Technical Review Board for the program, if you would apprise us of those, and issue invitations. We probably can't always attend, but I think it would make sense.

Likewise, we can't monitor every journal that your PIs publish in, and it would be a courtesy, I think, to the Board to send to the Board Headquarters in Washington

reprints of papers that are published that are supported by the program.

WENGLE: Absolutely. We have no problem at all accommodating that. I think that makes a great deal of sense.

GARRICK: Ron?

LATANISION: Latanision, Board.

Let's go to Number 18, just as a backdrop for this question. You mentioned that in terms of the structurally amorphous metals program, you may just take a breather in 2007, and regroup a bit, examine data, and so on. But, John, I've always been concerned that the data I have seen on corrosion related testing has been performed in what I would characterize as non-representative, environments that are not representative of the repository. Has that changed? Because, frankly, there's no assurance whatever that the corrosion behavior you see in Environment A is going to be anything like what you might expect with deliquescent dusts or seepage water. You know, we really need to do that.

WENGLE: Yes. And, I will say one of the things that we have done toward that end, and certainly Joe Payer can add to this, but we've asked Joe within his corrosion co-op to take a careful look, if you will, at the fundamental bases of the performance of structurally amorphous metal vis-a-vis corrosion. And, that is certainly a shortcoming, I think, at

least to this point in our understanding of the material. No question about it. Joe?

GARRICK: Let's see, Mark is next, and then--

PAYER: Excuse me, may I just respond? I'm sorry. Joe Payer, Case Western Reserve.

Ron, there has been a significant broader, I think you're referring to most of the--many of the early tests were done in calcium chloride, and so forth, and, so, there's been a significant amount of tests done in a much broader range of chloride solutions, and looking at a broader range of industrial type environments, to put these alloys so that the typical material selection folks can say okay, that acts like this material, or it acts like butter. And, I can assure you they're acting more like nickel chrome poly alloys.

LATANISION: Just to respond to that. Latanision, Board. I think Dave Duquette's comment is the operative one. We haven't seen that data, and, you know, I think Dave and I were both very impressed by what we did see at a briefing that was held at the Board's offices in Washington some time back. But, that, frankly, has been the last contact we have had on this of any real substance. And, I think it would just be useful for us, given what Joe just described, and what seems to be emerging, it would be useful for us to be aware of that. It might actually make a very good presentation at one of these meetings.

WENGLE: Yes. And, again, I will take certainly that comment very seriously. We do need to, and, Dave, your comment, we do need to make sure that we--our liaison with the Board needs to be a bit more robust than it's been. No question.

PAYER: Joe Payer, just one last, along those lines also, there's a special symposium being sponsored at the MS&T meeting this fall in Detroit. There's going to be some talks at NACE. So, we're at a stage where some of these results now are mature enough to get them out into the literature, and, Dave, your suggestion about getting those to the Board makes a lot of sense.

WENGLE: And, particularly with the structurally amorphous metal program as well, we have overcome some of our hurdles associated with intellectual property, and we are a bit freer now to get that work out and talk about it.

GARRICK: All right. Mark?

ABKOWITZ: Abkowitz, Board.

John, thank you for the presentation, and, clearly, your passion for this program is coming through loud and clear, and I appreciate your review of all the different pieces of work that are going on.

And, yet, at the same time, the S&T Program always seems to be at risk. And, so, my question I guess is that in the absence of what the Board has seen as a well articulated

performance confirmation program to date, and given the nature of the work that appears to be going on in the Science and Technology Program, has there been any discussion about making S&T a mainstream element of a performance confirmation program? In which case, not only is there a more stable role for this program, but it actually feeds directly into answering questions that the performance confirmation program is supposed to answer.

WENGLE: That is an interesting question. The short answer is that there has been thought, but I think the decision has essentially been made to keep us separate from the performance confirmation program. Now, I will say it's a fairly dynamic environment at the moment. I've begun to interact pretty extensively with Frank Hansen at Sandia, who is their performance confirmation manager, as well as with Debbie Barr, who is the PC manager within Russ's office. So, I think this is a--I think it's still a fairly dynamic area, to be frank with you. Clearly, there are some obvious ties between the two programs.

We know, for example, within performance confirmation, as I actually sit down and begin to develop their detailed needs, for example, for censoring and monitoring technologies, that's going to be an extraordinarily difficult task. They've got a lot of monitoring to do, heterogeneous types, in rather different

environments.

There are going to be certainly technical challenges associated with that that S&T can help with. Just as I suspect your larger point, a good bit of our technical work, particularly our science-based work, can change the context within which the performance confirmation program functions. So, I do agree with you that we absolutely have to have tighter links between those two programs. Absolutely. That's an area that we've got to think a lot harder about.

GARRICK: Andy?

KADAK: You made a comment that you didn't think that-- Kadak, Board. Sorry. You made a comment that you didn't think the S&T program was going to be needed for the license application. I would like to suggest that perhaps you rethink that assumption. And, in line with that possibility, the QA requirements--

WENGLE: Yes.

KADAK: --for university work, which is a little different than NRC licensing work, as is typical laboratory R&D work. So, if there are things that you believe programmatically might help, and I've seen several, you might want to think about applying a more rigorous QA program to the data collection and analysis. And, in particular, I would think--I'm not sure what the nuclear critical

experiments are, but--

WENGLE: Essentially, what those experiments are, we're looking at the possible application of structurally amorphous metals, again, the formulation two by five, which has a fairly high boron content. We're essentially looking at spraying that over borated stainless steel.

KADAK: Okay. I also see some opportunities in the silica-based cements. Things get complicated. And, a number of other ones that would suggest that you have some real opportunities. And, I think the last time you reported, or somebody reported on studies of in-drift vapor transport.

WENGLE: Yes, George Danko's work.

KADAK: Right. And, I think that's going to be very important in the license application.

Final question. Relative to the silica-based cements, are you working with Oak Ridge on this, or are they part of your program?

WENGLE: Oak Ridge is our lead lab on this. Les Dole is our lead PI.

KADAK: Okay, thank you.

GARRICK: Thank you. Any comments from the Staff?

(No response.)

GARRICK: We're in excellent shape. We're back on schedule. Any other comments? We can take a question from the audience at this point. Yes, Judy?

TREICHEL: Judy Treichel, Nuclear Waste Task Force.

The question I sent up about the EIS was that the title of Russ's presentation was Ongoing and Planned Activities, and things that could change, results that have previously been done. And, I wanted to know if the new and changing information that Russ was talking about would be incorporated into the draft EIS, Supplemental EIS that's going out for public comment, and would people be able to see and be able to comment on the new and changing stuff?

DYER: Russ Dyer, Department of Energy.

Yes, there will be a number of what I'll call technical basis documents that become available or have been updated. Those will be accommodated in the EIS. The technical information will be there. And, the documents themselves, those that DOE produced, will be made available. For the example that I think you're talking about, the regional groundwater model, was not a DOE document. That has been developed and published by the U.S. Geological Survey. But, our models, our analysis will incorporate that new state of knowledge, if you will.

GARRICK: I do have a question, another question from Mike King, who is the hydrogeology consultant to Inyo County. But, I think it's probably a question that should be addressed to somebody else, perhaps Russ. It says, "Does DOE recognize the upward gradient in the lower carbonate aquifer

at Yucca Mountain as a barrier to radionuclide transport? And, if so, what is the plan to preserve that natural barrier?" I think, Russ, you're probably the gentleman to answer that.

DYER: Yes. Russ Dyer, DOE.

Certainly, we're aware that one borehole that penetrates the paleozoic tertiary interface there shows an over-pressured zone in the paleozoic. That's consistent with both the regional and the site model. Whether we consider it a barrier--I'm sorry? Okay. We're aware that it's over-pressured, but the--all of the flow that comes out is all, as Claudia said, is in the tertiary aquifer coming down. So, at least as far as we take the modelling, we're only dealing with the tertiary aquifer.

HORNBERGER: Russ, before you leave, though, I think the context of the question is that if you live in Inyo County, you might be worried about contamination of the carbonate aquifer. And, so, you want to preserve that upward gradient. And, just because you're modelling the tertiary aquifer, doesn't mean that the question isn't valid on its own.

DYER: Okay. I'm scratching my head trying to think of what we might do that would jeopardize the carbonate aquifer. And, aside from boreholes that have been drilled into the aquifer that go from the tertiary to the paleozoic units, and when you plug and abandon the hole, you've got to seal that

up. So, I believe that's accommodated already, and we certainly have no plans to get down that far associated with the repository.

GARRICK: All right. Well, thank you very much. We've had a very good morning. We're right on schedule, and we'll recess until 1 o'clock.

(Whereupon, the lunch recess was taken.)

AFTERNOON SESSION

GARRICK: Okay, I wonder if we could come to order,

please?

Our first presentation this afternoon is going to be given by Paul Harrington. He's going to talk to us about the ongoing and planned activities of his office. Paul?

HARRINGTON: Good afternoon. Since I've last talked to you, we have actually made some very significant changes in the repository design. As you've heard before, we've shifted to a canister based approach as opposed to handling primarily bare fuel assemblies, and we've changed the facilities to suit. That also requires then a change to the safety analysis to address that.

Next, please? I'll go through a summary of the design changes, include graphics on the layout of the site, the waste handling process and facilities. The changes to the packages and canisters themselves, we've actually removed, eliminated several of the older waste package designs that were based on bare fuel assemblies. And, then, talk about the subsurface facilities. There are very few changes there really. A status of where we are with the design. I'll also touch on the preclosure safety analysis relationship to the design, and then the summary.

Next, please? A series of acronyms. They are in your sheets there. The main ones that will be of interest are the new buildings, the initial handling facility, IHF, the canister receipt and closure facility, CRCF, the wet

handling facility, WHF, and the receipt facility, RF. You haven't heard of those before.

Next, please? We'll use transport, aging and disposal canisters. Those will obviously reduce the handling of individual fuel assemblies at the repository. Our operational goal is to have 90 percent of the commercial waste received at the repository in these TADs. These are disposable, so the repository operation would consist essentially of removing that TAD from the transportation cask, putting it into a waste package if it meets the thermal emplacement criteria, or if it does not, put it into an aging overpack to send out to the aging pads to cool until it does meet the criteria. But, the handling of bare fuel assemblies are primarily eliminated.

There's a recognition, though, that it cannot be fully eliminated. Some facilities simply won't have the capabilities to load TADs. There may be other reasons to expect that we will receive individual fuel assemblies, either in transportation casks as bare fuel assemblies, and we have designed the facility to also be able to receive and unload non-disposable canisters.

Because of that, we've reconfigured the waste handling process and the facilities to suit, and changed the suite of waste packages. And, we added the IHF as a facility to accommodate the Naval high level waste, or SNF, and high

level waste receipt, and I'll talk about that. That has some unique characteristics, specifically, we, because of the waste streams that we run through there, do not need to credit ventilation systems. Obviously, we'll have ventilation systems, we'll have HEPA filtrations, but because of the nature of the waste in those buildings, those will not end up being classified as important to safety.

Next, please? The site layout. This is the north portal. We have always clustered the emplacement structures around that north portal. We still are. The aging pads are essentially unchanged, but we have revised the layout of the facilities at the north portal.

Next, please? Okay, there are a series of three CRCFs, one receipt facility, one initial handling facility, and one wet handling facility. The placement of those is to support a staged operations and bringing on line--or staged construction, rather, and bringing on line in operational phases.

Next, please? Same general location for the waste receipt, handling, aging, support facilities. The IHF location down near the portal allows early construction of that without interfering with subsequent construction of other facilities. Now, we're reassessing some of the schedules for construction of the individual facilities. We're looking now at construction of IHF, the first CRCF, and

the WHF, the wet handling facility, simultaneously. We'll continue to evolve that schedule.

The CRCFs, canister receipt and closure facilities, handle all of the canisterized waste except for the Naval SNF. There is a relatively few number of Naval canisters. One of the changes since we've last spoken is that the Navy is going to slightly change how they treat their fuel prior to shipment down to the repository. So, whereas, in the past, we've talked about having 300 Naval canisters, now it may be as many as 400, but it's still a relatively small amount compared to the others.

The Navy is also going to use a much heavier and longer transportation cask for shipment of those canisters. So, one of the features of the IHF, dedicating that to Naval, as well as the high level waste glass logs, is that we will have to have that capability for a heavier, longer cask, in only one building, instead of spreading it across several.

The receipt facility takes transportation conveyances and pulls the canisters from them and puts them directly out onto the aging pads. We have an expectation that many of the canisters that we receive will be hotter than our current emplacement scenario would allow for. So, the aging pad is to accommodate that. So, rather than running those hotter canisters through the CRCF and tying it up and preventing that facility from being used at that time

for emplacement operations, the receipt facility will allow the hotter canisters to come into a facility where they can be off loaded and sent out to aging without tying up, using up the operational capability of the CRCFs.

The wet handling facility takes uncanisterized fuel, either coming in as individual assemblies in a transportation cask, or in non-disposable canisters, if we do receive those. That has the capability to unload those canisters, transfer them--or, unload the canisters, transfer the fuel assemblies to the TAD, disposable canister, which would then be taken over to the CRCF for placement into a waste package.

The new emergency diesel generator facility and low level waste facilities round out the suite of main surface facilities. Certainly, there are the other support facilities, as we have had in the past, but these are the waste handling associated facilities.

Next, please? Again. As I said, the TAD canister eliminates the majority of the SNF handling. The remaining bare fuel assembly handling that has to be done is now to be done in a pool in the wet handling facility.

Next? A discussion of which waste forms go through which facilities ultimately to emplacement. Naval SNF, as I mentioned, goes through the initial handling facility, and to emplacement. There won't be a need for any sort of staging

or aging of that. It will be straight through.

High level waste glass logs can go either through the IHF or through the canister receipt and closure facility, and then to emplacement. The DOE spent nuclear fuel will go through the CRCF and then to emplacement. Commercial spent nuclear fuel in TADs can go to the receipt facility, if it's too hot for emplacement, out to aging, and then back to the CRCF, or if it's cool enough to support direct emplacement, to the CRCF, and then underground. CSNF that's not in disposable canisters will go to the wet handling facility, and then if we load a TAD that exceeds the thermal emplacement criteria, it will go to aging. Or if not, over to the CRCF, then for emplacement.

Next, please? One of the requests was for capacities of the facilities. This is metric tons heavy metal, annual capacity for each of them. The IHF, primarily Navy and high level waste, is about 40 MTHM per year receipt and emplacement. Most of that is driven by the high level waste. The Naval fuel, there's only 65 metric tons of it spread across almost 400 canisters. So, the loading per canister is really relatively low. The remainder of that is high level waste, about 4 of that 40 is actual Naval fuel.

The CRCF, about 1200 MTHM per year, both receipt and emplacement capability. Wet handling facility, that's the unloading of the canisters, or transportation casks in

there, about 340 MTHM per year. It does not have, again, an emplacement capability. It loads TADs that then go to CRCF for placement into the waste package, and ultimately emplacement. Likewise, receipt facility can receive about 2300 MTHM per year in transportation casks, but again, it does not have a direct emplacement route. It goes out to aging for the canisters that exceed thermal criteria, or underground, or over to the CRCF, rather, for waste package loading for those that don't.

Next, please? Again. Okay, this is the initial handling facility. The dimensions of this building, the main part of it, are about 160 by 170 feet, just to give you a sense of scale. The operations, a transportation cask on a rail system, or truck, can come in through here. There's an overhead crane that will pick it off the transportation conveyance, up-end it, and put it into a cask transfer trolley. That's the word I don't remember.

Okay, that transfer trolley takes it in a vertical orientation, it's an air pallet mechanism, and moves it over to a transfer cell. Above this area, there's the canister transfer machine that's very similar to existing technology for transfer of canisters. It will, that canister transfer machine, will translate over above the transportation cask, open a couple of shutters, shielding gates, grapple down on top of the canister, pull the canister up into that shielded

canister transfer machine. The gates close.

Then, that canister transfer machine translates over above an empty waste package that's been loaded into the waste package transfer trolley. Shutter gates will open. The canister transfer machine will lower that canister down into the waiting waste package. Shutter gates will close. A lid gets put on that waste package transfer trolley at that point.

Then, that trolley moves over to this station. This is where closure of the waste package is done. The lids are installed there. The welding is performed. The non-obstructive examination is performed. The stress relief is performed.

When that's ready, then it comes over to this point. The cask is rotated from a vertical orientation down to a horizontal orientation, and a tongue within the shielded device is moved out, it's a movable bed plate, exposing then the waste package on its support pallet to be picked up then by the new emplacement vehicle.

We have also changed that. We now have a single vehicle that will receive the waste packages in the surface facilities, and take them clear to their emplacement point. It's called a transport and emplacement vehicle, TEV.

You may remember the previous design, we had two vehicles, one was the waste package transporter that took it

underground to the mouth of the emplacement drifts, and then there was a transfer of that to the emplacement gantry that took it down the drift, and then put it in place.

The whole theme through this redesign has really been simplification. We have reduced the number of lifts wherever possible. We have simplified the grappling. We have provided more positive control to minimize the potential for slap-downs, anything other than a vertical orientation drop. We have provided shielding during the waste transfer process, almost exclusively. The only place where the waste package is exposed at any point is the transfer from the waste package trolley to the TEV. There is a gap in between those two components, so that we can do inspection of the waste package surface as it's moved from one to the other to make sure that we meet the criteria that are being established for waste package allowable surface imperfections.

We also, and this is a change from before, keep the transportation cask in its Part 71 license configuration with impact limiters on until it gets inside of the buildings. This building, we're not relying on accredited ITS ventilation system, because of the nature of the material that's run through there, it's very robust. If we have a drop and breach of a package, we will not exceed the Category 2 dose criteria.

The other facilities, where we run the commercial fuel through, I'll discuss this in a moment when we get to them, we do need to credit the ventilation systems, the HEPA filtration. So, we keep the transportation cask in its Part 71 license configuration until we bring it inside the building. In the previous design, we had removed impact limiters in an area outside of that confined space.

Next, please. The cross-section through there. This is the canister transfer machine, picking a canister out of the transportation cask in its trolley. It will suck it up into that, translate over, and then lower it down. Suck it up is not a good term. It grapples and hoists. This is the closure area for the waste package. Then, the rotation from the vertical orientation down to a horizontal orientation. The translation, the tongue, as I referred to it, moves in and out of the shielded part of this, and then movement into the transport and emplacement vehicle. This vehicle actually comes over, grapples, lifts, and moves this out. This vehicle is shielded on all areas, including a movable shield underneath it.

The point of doing this was to facilitate recovery from equipment failure. Now, most of the operations in the previous set of buildings were done in hot cells. We would have to have used remote tooling to try and recover from those. The intent here was to simplify equipment failure

recovery.

GARRICK: Paul?

HARRINGTON: Yes.

GARRICK: You made the point about simplification being an important guideline here.

HARRINGTON: Yes.

GARRICK: Meantime, of course, you've got the seismic criteria that prevents you from being as simple as maybe you'd like to be. Can you say something as you describe these facilities about what is a direct result of the seismic criteria? What kind of--can you summarize the impact that the current seismic requirements have on the design?

HARRINGTON: Okay.

GARRICK: Those walls are very thick, and very reinforced.

HARRINGTON: Yes, they are. And, that would be the primary effect, I think, of the seismic criteria. We have three design basis ground motions. Design basis ground motion one is a 1,000 year return period. Design basis ground motion two, DBGM 2, is a 2,000 year return period. Those, we are designing to code allowable stresses. We will evaluate the facility to a beyond design basis ground motion.

What we're using as the design basis for facility design for all of these is the DBGM 2 level. It's the higher level. It's a little under .6 G horizontal and vertical.

Development of that number is done by the science side of the organization. We will implement it. But, yeah, it has led to robust walls. We also get to make use of that, though, in terms of shielding.

We have looked at the potential for introducing issues and component qualification, only get to equipment qualification, for environmental concerns. And, the DBGM 2 value that we'll have to qualify equipment to is actually a little bit less than has already been used in some of the commercial nuclear facilities. So, I don't see that as likely being a problem for us in the future. The relatively high ground motions are primarily driving us to thicker walls.

GARRICK: Andy?

KADAK: Kadak, Board.

Are you saying that some--I just heard that perhaps the vertical motion was greater than 1 G? Is that just a--

HARRINGTON: No, I didn't say that. What I said was horizontal and vertical are slightly less than six-tenths of a G now. That's the DBGM 2 value that we're designing the structure for.

KADAK: And, what's the one that is beyond design basis?

HARRINGTON: That right now is about 1.3 G. And, that's the subject of ongoing discussions with NRC. We're not done with that.

KADAK: I heard about that number, and I'm just wondering how you got to that number?

HARRINGTON: That's in evaluation of a 10,000 year return period, but because that's still the subject of ongoing discussions with NRC, it may change some.

KADAK: Hopefully.

HARRINGTON: Okay. Next, please. This is a layout of the wet handling facility. Within the wet handling facility, we do the transfer from either transportation casks with individual fuel assemblies, or if we do receive non-disposable canisters, that happens in the pool here. The transportation cask comes in here. It's up-ended, put into a prep station, one for rail, one for truck casks. Those casks, if it's a cask that has bare fuel assembly in it, then it would go into the pool for unloading. If it's one that has a canister, then the canister would be put into the pool for unloading. We would put an empty TAD canister into the pool, and then transfer from the transportation cask or the non-disposable canister into the TAD.

There are aging racks with a capacity of around 80 PWR, and 120 BWR elements, because there will not be a one for one correspondence between transportation cask capacity and TAD capacity. The TAD, after it gets loaded, gets moved out. The water level is dropped. It's welded closed. Handling of it is generally done inside a shielded transfer

cask. That's how we move that TAD around in that building. There are no trunions or grapple points, or anything like that on the TADs themselves.

After the TAD is loaded, sealed, it's been dried, it's then taken in that shielded transfer cask either out to the aging pad if it exceeds the thermal emplacement criteria, or over to the CRCF for placement into the waste package if it does not. The size of this is roughly 270 by 210 feet.

Next, please. This is the main production building, the canister receipt and closure facility. Transportation casks come in here, either rail or truck. A transportation cask is up-ended by crane. The front end of this is very similar to the IHF. It's put into the cask transfer trolley, that's moved over to an unloading port. This facility has two parallel lines. The canister transfer machine operating above this area transfers the canister from the cask over to an empty waste package, again in a waste package transfer cart. It's taken over to a closure cell. The waste package is closed, inspected, taken over, down-ended, and picked up by the TEV.

This also has the capability of sending aging canisters--or sending TADs out to the aging pad, but we really expect to primarily do that in the receipt facility so as not to tie up throughput capability of this. This is on the order of 330 feet by 262 feet.

Next, please? Cross-section through there. It's essentially the same as the IHF. Cask receipt, transfer to the trolley, transfer of the canister by the canister transfer machine to the waste package. Closure of the waste package, down-ending, and out.

You will see a much reduced number of lifts of handling from the designs that you've seen in the past. We actually borrowed this design from large positioning tables that are used for fabrication of heavy weldments. We had looked in the past at doing this rotation from vertical to horizontal, first by a crane, then by some hydraulic rams. This is a component that manufacturer uses for movement of very large components during fabrication, like Caterpillar, tractor frames, heavy stamps and mills. So, we'll borrow that sort of technology. It's a geared movement around the pivot point.

Waste packages in TAD canisters, a couple of slides--I'm sorry--I skipped the receipt facility. This is also similar to part of the front end of the CRCF. Receipt of waste packages, transfer into aging overpacks, and then movement over those aging overpacks out to the aging pads. That is a very similar technology to existing commercial. This is on the order of 280 feet by 240 feet.

Let's go on over. I realize I'm a little past 1:30. I'll try and go quickly. TADs for the majority. This

reduces the waste packages from 10 down to 6. There's a graphic on that in a moment. We added shield plugs to the TADs to simplify the closure operations. The Naval canisters have always had shield plugs in them that reduces the rad field for their canister closure operations. We wanted to learn from that, and do that across the board. So, we've added shield plugs in our TADs, but there are some waste packages that will have a series of small diameter canisters in them, specifically the DOE high level waste, and spent nuclear fuel ones, so we'll, for those, include a shield plug inside of the waste package above the individual canisters.

The point of all of that is to reduce the rad field at the waste package closure station, so that while we don't intend to have to have manual operations, if we do have to have some manual operations to get in to do a weld repair, or something like that, on waste package closure welds, it will facilitate that. That's on the order of an 800 MR per hour field at that closure station.

Next, please? The majority of the TADs will get loaded at the utilities. Some of them will be loaded at the repository, i.e. those that we load in the wet handling facility, that's into TADs. We've already said these things before. Can't over-emphasize our intent of simplifying repository operations. Shield plug, I already addressed.

Next, please? These are as before, with the

addition of the shield plug to the waste package on top of the individual canisters. This replaces the previous sets of waste package designs that had individual baskets for the 21 PWR or 44 BWR.

Next, please? Subsurface. No major changes.

Next? What we did primarily was took this Panel 1, and shifted it a little bit to the south to improve the access coming in the north ramp from the emplacement--from the loading areas into the first drift in this Panel 1. Earlier, the way this was configured, it didn't flow from one end to the other. You would have had to have backed up a little bit. So, all we've really done is shift that Panel 1 a little bit to the south. The rest of it, the basic ventilation scheme, the amount of tunnelling, all of that is really unchanged from before.

Next, please? We have--where are we with this? Okay, there is a lot of work to do and not very much time to do it. I fully recognize that. We have completed the basic facility layouts. What I put up there are certainly not general arrangement level drawings yet with completed wall thicknesses, for example. We have chosen wall thicknesses based on precedent for design of these sorts of facilities, with these sorts of seismic loadings. We're currently doing evaluations of those structures to make sure that they meet the stress allowables under the codes. We'll be using ACI

349 for the concrete structures, for example.

The material flow through the buildings are done, so we have completed for CRCF the first phase of that structural analysis. It's a lumped mass stick model. The other facilities are in process now. We'll do the structural analysis in two phases. What we're referring to is Tier 1, is this lump mass model, and then we'll do a Tier 2, finite element analysis model.

Now that we have the basic building layouts done, we're doing the rest of the structural layout, the systems design, the ventilation systems. That will drive the electrical systems, the other utilities. We're working hard to do the mechanical handling.

Now, our intent for this is to provide enough design of this facility and its components to support a preclosure safety analysis. The requirements for the preclosure safety analysis--oh, we are going to be doing a much more detailed PCSA than we had intended a year and a half ago. Specifically, we'll need to do evaluations of the probability of failures of these components, not just of the active components, the cranes, the trolleys, the transfer machines, the EGEN, the emergency generator facility, but also even the structure itself, the concrete structure.

So, to support that, the design organization is doing more complete design work to then feed to the

preclosure safety analysis group to do fault trees, some FMEAs for the structures themselves, for example, instead of simply providing a general arrangement of the structure, and committing to design and construction in accordance with ACI 349. We'll need to do the structural analysis of that to support development of a fragility analysis. We'll have to convolve that with the seismic hazards analysis to demonstrate a reliability of that structure.

So, as you can see, this is quite a bit more detailed than I had spoken to you would in the past. That's where we are now.

So, I'd be happy to take questions.

GARRICK: Well, you were certainly correct in that you were going to give us some new and different information. We appreciate that. Okay, Henry?

PETROSKI: Thank you. It's good to hear that you're incorporating so much known technology, as much as possible. What are you going to do about unique technology in these facilities?

HARRINGTON: We are really trying to stay away from having any unique technology. We will certainly have unique implementation of technology. But, probably the most unique component might be the transport and emplacement vehicle. Nobody has built one of those before, let alone licensed it. But, it is nothing more than a large weldment with a lot of

standard commercial components in it. So, as we develop our design and PCSA analysis of that, we'll have to look down at the component level, the reliability of the drive motors, of the shafts, bearings, those sorts of things, of the controls on it. That is existing technology. Ours will just be some unique implementation of it. But, the, for example, fuel assembly transfer in the pool, we'll just go buy an existing design for that.

PETROSKI: Are you going to go through a demonstration for the implementation of the technology that you addressed?

HARRINGTON: We are doing already some prototyping. There's a prototype waste package that's already been fabricated. We intend on prototyping some of these other non-standard type components. We had had a plan for previous, and now that we have shifted to this design, we're reassessing what and when.

PETROSKI: One more question. You talked about 90 percent of goal, of having--

HARRINGTON: Yes.

PETROSKI: How realistic is that goal? And, on what basis do you reach a 90 percent goal?

HARRINGTON: We recognize that there are dry casks out there, and the total inventory of that, if utilities, based on what they have today and where they may be going in the near future, may exceed that, this facility will have the

capability for receiving and disposing of DPCs. The 10 percent value was chosen as an expectation of what we reasonably may be able to accommodate. But, the thing I would want to stress is the flexibility. Okay? I've talked about three CRCFs, and one WHF. If we find over time that the proportion is appreciably different, and running one WHF potentially over a longer period than we're planning on now, still wouldn't accommodate what we might need to, then we certainly can add another WHF. That's a decision that can happen in the future. We're providing the design to be able to accommodate that, whichever way it goes.

PETROSKI: Thank you.

GARRICK: Mark?

ABKOWITZ: Abkowitz, Board.

Paul, thank you for the updated information. It's certainly helping better understand where the surface facility design is going from the standpoint of the details you've provided today. I just had two questions. The first one is you made reference in one of your last slides about the preclosure safety analysis, and I guess my question is is that being confined to the surface facility only?

HARRINGTON: Oh, no, no. The preclosure safety analysis is described in 63.112, and in there, we have to look at the entire facility. So, that gets out to the aging facility. It gets to the underground. It is the entire facility.

ABKOWITZ: Does it get to the transportation system and the waste acceptance at the utility sites?

HARRINGTON: No. Let me explain why. 63.112.63 is for the repository. The transportation system proper is not part of the repository. What I do have to do is in my system, evaluate what comes into the repository under Part 63. So, yes, I do have to do evaluations of materials as it comes onto the repository, but the waste acceptance at the utilities, that will be done outside of the PCSA. One of the things that we do have to address is the potential for a misload, potential for a mistake, so we've had those sorts of discussions with NRC.

ABKOWITZ: Abkowitz, Board.

So, then, in essence, the more that you can transfer the handling risk to the utilities, the more the risk of your facility evaporates, but the risk to the entire system may still be present, just transferred somewhere else; is that correct?

HARRINGTON: I would not have worded it that way. I think there's an overall reduction in the risk. Implicit in your question, I think, was the statement that the risk stays the same, it's just transferred away from DOE. In the system before, utilities would have a certain risk associated with loading the transportation casks. At the repository, we would also have a much larger risk associated with unloading

those transportation casks and transferring to the waste package. In this system, the utility action of loading a waste package--of loading a TAD, rather, is I think a little different than the risk associated with loading a transportation cask. Our risk at the repository is much reduced because I've eliminated a significant amount of risk associated with handling a quarter million individual fuel assemblies. So, overall system risk I think is really reduced.

ABKOWITZ: Okay. Well, let me just, I might try to phrase my question slightly differently then.

HARRINGTON: Okay.

ABKOWITZ: If you can demonstrate--if it turns out the overall system risk is reduced, say, by 50 percent, but risk at the repository is reduced by 80 percent, that's okay with you?

HARRINGTON: That would be okay with me.

ABKOWITZ: Even though it means the risk somewhere else in the system may have increased?

HARRINGTON: Well, if--I've gone probably as far as I ought to with that.

ABKOWITZ: Okay, let me change to my second question then. Could you comment on how the surface facility design might change if there is no rail spur to Yucca Mountain, or if the construction of such a spur is delayed significantly,

such as five to ten years?

HARRINGTON: If there were no rail spur ever, we'd obviously have to use truckable casks. So, the capacity per TAD would be much smaller, there would be a much greater number of them. If the rail spur were delayed by five or ten years, that's a decision we would have to make as to whether or not to change the system to accommodate a truck based system for a relatively short period, or simply delay some part of the operations to wait for that. I know what my preference would be, but that would be a much more global discussion.

ABKOWITZ: What would your preference be?

HARRINGTON: Oh, mine would be to delay. If we tried to develop a very short-term appreciably different solution, there's a lot of time associated with that in and of itself.

ABKOWITZ: Okay, thank you.

GARRICK: Did you want to clarify something?

MC CULLUM: Yeah, I just wanted to address the previous question from the--

GARRICK: What's your name, who you--

MC CULLUM: Oh, my name is Rod McCullum, Nuclear Energy Institute, and I just wanted to address the previous question from the utility standpoint. We've had significant interactions with the Department of Energy and there are several utility vendors that are working on designing TADs

now. Those TADs will be operated, loaded, under the same requirements that the existing DPC or transport package would. We do not see any appreciable additional risk of loading TADs at our facilities, as we would loading what we're loading now.

ABKOWITZ: Thanks.

KADAK: Kadak. Do you think you could meet the 90 percent target that they're assuming here?

MC CULLUM: Well, that's a different question, and I guess I would just prefer we cross that bridge when we get to it. Right now, it is true that, and as I have spoken to the Board before, we're up to about 15 percent of our fuel is in non-TAD canisters right now. That might go as high as 20 percent when they get to having TADs on the market. How we deal with that 10 percent difference, I don't know. You know, again, we'll cross that bridge when we come to it. I know Mr. Sproat alluded to that's something the Department is considering. That's also something that has to be discussed between the utilities and the Department that I can't discuss on an industry-wide basis. But, we do not see that as a barrier. Again, you know, if they can take 90 percent of our fuel, and it's just that 10 percent we've got to argue about, that's a heck of a lot better off than where we are today.

KADAK: And, just as a follow-up. Relative to the TAD loading criteria, there's a certain number of assumptions

made as well about how much has to go to the storage pads. Has the industry taken a look at those assumptions relative to thermal loading to see is the much reduced capacity of the aging pad the correct assumption?

MC CULLUM: We haven't specifically looked at that. Again, what really is limiting on the loading and the shipping of the TADs is, especially with the high burnup fuel, are the transportation restrictions. TADs will be easier to transport because they have reduced capacity. You look at the throughput rates that are established by, you know, DOE's schedule, assuming they do a good job of getting their facilities on line, we have done some studies, I think we talked about some of that when I went before the Board last May, in terms of aging, we haven't specifically looked at this latest capacity, but again, that's a bridge we'll cross when we get to it. We see sufficient capacity to get started and get well along our way here, and that's what we'd like to see happen.

GARRICK: Howard?

ARNOLD: Arnold, Board.

Paul, have you wrestled again with the issue of a surface specification, or surface finish spec on the waste package itself? And, not only the clean new one, but also whether--what gouges are allowed, and so forth?

HARRINGTON: We are wrestling with that now. That has

been identified as an issue that we need to close on. We haven't yet closed on that.

GARRICK: Ali?

MOSLEH: I'm not sure how this safety analysis, what the form or shape it is in, but judging from the words you're using, you know, they use equipment reliability. I gather it has some probabilistic flavor to it. If that's the case, are you also considering including or incorporating process model and possibility of human error?

HARRINGTON: We have. Human error is one of the areas that NRC is particularly interested in. So, whereas earlier, we had, for example, on the crane drops, taken the NRC values, which were 10^{-5th} probability per lift, that was not broken out to separate what part of that came from human error versus equipment failure. NRC clearly wants to see the human error contribution to the probability values for event sequences.

GARRICK: Andy?

KADAK: Kadak, Board.

Have you had your plans for your above ground facilities, on surface facilities, reviewed by utilities who do a lot of fuel handling now, and perhaps others who have had to handle heavy objects, such as radiated casks, see whether the system that you've identified can work? That was question number one.

Question number two is what's your throughput from the time you receive a cask, or to the time it's either going into the hole, and the storage pad?

HARRINGTON: We have not had utilities review the facility design. But, we have gone to some specialty companies to look at specific parts of this. The closure, the weld closure system, for example, the down-ending system, the trolleys, we have gone to organizations to have them provide input to us. Some of them are more willing to do that than others. One of the things we're actually finding is a reluctance of some organizations to want to get involved at this stage of the project, and potentially preclude themselves from other work later on. We also have on staff people who have had a lot of that experience in commercial nuc. utilities, or heavy industry elsewhere.

The second part was throughput, how long does it take to come in. If a canister or TAD were coming in the front end of the CRCF, and then going to disposal in a waste package out the back end, I think that's on the order of about four days. Is that right? Okay, thanks. Two to three days. And, the receipt facility, that's much less. There's no waste package closure associated with that, it's simply a transfer, so that would happen in less than a day.

KADAK: And, in the metric tons of heavy metal you talked about processing per year, I added up and may have

added it up wrong, but it's 3800 per year, and I'm not sure, is that consistent with your contract expectations or obligations for consistency of acceptance?

KOUTS: This is Chris Kouts of DOE. There are no specifics in the contract related to the acceptance rate that the Department has to take. And, that's the subject of litigation at this time.

HARRINGTON: I would answer it as these are facility capacities. We want to make sure that the facilities are large enough to take what we need to take, irrespective of the ongoing work that Chris referred to.

KADAK: Okay. As you look at that table, Chris said there was no requirement to accept it at any rate. Is that understood from what you said?

HARRINGTON: Sure.

KADAK: And, I can't remember 1900, then escalating to 3100; is that--maybe Rod, can you clarify that?

KOUTS: Chris Kouts again, DOE. There is no provision in the standard contract addressing rates at which the Department has to receive fuel. What you're referring to were probably program documents from the past, but those are not requirements in the contract. And, believe me, that's not only my opinion, but that's every judge who has ever read the contract also.

KADAK: I'm just trying to figure out what your design

objectives are here, and I don't understand what they are then.

KOUTS: The design objectives, Chris Kouts again, DOE, we have apparent systems requirement document that's controlled by the Director of the Program. We have basically a five year ramp up to 3000 tons, state acceptance rate, in the system. So, what Paul was referring to in terms of the maximum capability of the facilities is certainly consistent and it meets our systems requirements document that currently exists.

GARRICK: Okay. I just have a couple of questions. Have there been any operation simulation studies made on this new layout?

HARRINGTON: Yes. Chris is going to talk about that in his total system model when he gets up next. That comes from addressing how long operations take throughout.

GARRICK: And, then, a little different spin on an earlier question by Andy. How different would the facilities be if the thermal criteria would change such that it was essentially--that it essentially eliminated the need for aging?

HARRINGTON: The facility itself would probably not change much. What would change would be an elimination of a need for a receipt facility if you really didn't have to send canisters out to the aging pad. That's the point of the RF.

But, the other facilities, the basic transfer of a canister from a transportation cask to a waste package, I wouldn't change that. The wet handling facility, we're still going to need the capability for that. That would stay the same.

GARRICK: You mentioned earlier that you thought that the risk, depending on where you established the interfaces, would be reduced with this layout over the other one. Does the same thought extend to the--you expect the safety analysis, the updated safety analysis to be more favorable?

HARRINGTON: Yes. The preliminary work that we've done shows that the previous event sequences that we have that were Category 1, which was driven by the large number of individual fuel assemblies that we've had, we don't have those any longer, because we don't have that large number of individual fuel assemblies. So, we don't believe that we will end up with any Category 1 event sequences. We'll have some Category 2s certainly, but it doesn't look at this point as if we will have any Category 1s.

GARRICK: Okay, thank you very much. Are there any other questions? Questions from the Staff? Yes, Carl?

DI BELLA: Carl DiBella. On your Slide 11, in an early part of your talk, you said you were going to have to build three facilities simultaneously at the beginning, and I caught IHF, but I didn't catch what the other two were going to be.

HARRINGTON: Oh, IHF, wet handling facility, and the first one of the CRCFs.

DI BELLA: Can you give a ballpark cost for those facilities?

HARRINGTON: I cannot. Rather than hazarding a guess, I mean, I have seen estimates on the old set, I haven't seen a cost estimate for the new buildings. So, I can get that to you, but I don't have it here with me.

DI BELLA: Can you give a ballpark cost for what the old facilities would have cost?

HARRINGTON: I don't remember, Carl. It's been a year and a half, and I'm sorry, I just don't remember.

DI BELLA: Are we talking billions?

HARRINGTON: It was like 300 million, 400 million, 600 million. Those are the numbers that we were I think rattling around with. But, I don't want to hazard a guess for these. I need to just get that and give it to you.

GARRICK: Okay, any other questions? All right, I think we'll move onto our next presentation, which will be from Chris Kouts, talking about the waste management planning, and integration.

KOUTS: Thank you very much. It's good to be back here in front of the Board. I think the last time I was in front of you was in May of last year. So, I'll give you an update of where we are with TADs, as soon as we get the presentation

up.

Some of the questions that were asked earlier, I'm going to try to address in my talk. Dr. Abkowitz's question about risk, and any other throughput questions, and so forth, I'll try to address, some of the things that we've evaluated in our total systems model. I'm getting pings, but no--here we go.

All right, the Board asked for an update on where we were with TADs, also operational integration from receipt to emplacement, and the total system model analysis that is ongoing, and will continue.

Moving right along with TAD background. In October of 2005, as you may remember, the Department announced its decision to move to a primarily canister based approach for the acceptance of commercial spent fuel, the variety of benefits that that brings to certainly DOE facilities, and I would argue also the utilities. We talked about risk. I think we have to quantity what risk is, but in terms of the development of the TAD, we made sure that anything that we would ask the utilities to do is not inconsistent with what they're doing today. So, we're not asking the utilities to undertake any new operations at their facilities.

But, essentially, what the TAD does is it certainly supports the standardization of the handling of spent fuel from the reactors through the transportation system through

the repository, and into the repository. It lets us utilize the fuel handling experience that exists at nuclear utilities today. It simplifies certainly our operations and our facilities, as you've heard Paul talk about. It reduces our low-level waste production and worker exposure, and it reduces the complexity and the cost of our facilities.

I'd want to emphasize this, that when you talk about integration within this program, certainly the TAD in and of itself will do a tremendous amount of integration within the utility industry, and within the Department's development of facilities, and it's going to be a very key interface point that will be important to the handling of fuel on site, through the transportation system, and at the repository.

In order to do this, we have to make sure that the TAD complies with all applicable requirements. The TAD is going to have to be certifiable, if you will, under Part 71 for transport, Part 72 for storage at reactor sites, and certainly under Part 63 at the repository.

Our development approach has been to use industry experience to the maximum extent feasible, which we're in the process of doing. And, I might emphasize this fact. The Nuclear Waste Policy Act also directs the Department for all transportation activities, related activities, to utilize to the maximum extent we can, private industry.

So, looking at how we tried to implement out canister based approach in the Nineties, in the mid-Nineties, and some of you may remember that we had a different acronym for a multi-purpose canister. We called it an MPC back then. Today, we call it a TAD. Some people think it's a tad better than what we did before. But, when I was given the opportunity, if you will, to implement the TAD concept, I looked very hard at what our experiences were in the past.

And, one of the reasons I think--there were a variety of reasons why the MPC effort failed, one of which I think it was premature. I don't think we understood very much at that time what the underground requirements for Yucca Mountain were. We were guessing at that point. Today, I think we have a much better understanding of what our waste package needs to look like, and we built those into a performance specification which we issued last year.

And, why the development of a performance specification was key is that back in the mid-Nineties, we decided to go with essentially one corporation to do the design. That was not met with riotous applause by the other organizations in the industry that also felt that they had a share of the market. So, what we wanted to do this time, besides encourage competition, was to give everyone an opportunity who was, in our opinion, qualified, to try to have an opportunity to design TAD. So, we developed a

performance specification, which we issued on November 29th on our website. And, that performance specification essentially, and I'll talk about that in detail later, encompassed all the what we feel are specifications that we need, not only for long-term disposal, but also for handling this device on our sites.

We prequalified essentially the industry. Prequalification in our mind was essentially that they had to have an active certificate under Part 71 and Part 72, and there are actually five vendors that are at work here. One of the other vendors has teamed with one of the groups here. But, these are the four that we currently have under contract developing proof of concept designs.

What's proof of concept? Proof of concept is basically by early March, we will know how just the specification works. We'll get a sense from these four vendors as to whether or not all the specifications that we want to put into the TAD, does it all work with the transportation, does it all work with the storage device that can be used at Yucca Mountain, and a storage device that can be used at utility sites. So, we are anxiously awaiting that opportunity to review those reports when they come in.

And, based on that, assuming the vendors are successful, we will begin to move forward and energize those vendors to take this to a safety analysis report to be

submitted to the NRC before we submit an application to the NRC for Yucca Mountain, which would be no later than June of next year. So, this is on track, and I should also say that--and I went over this with the Board earlier last year--but, prior to the time that the vendors actually go in to the NRC, we will review their designs, we will make sure they're consistent with our specifications before they submit it, and the Department will maintain that involvement in their designs throughout the certification process, and even through the fabrication and deployment process that utilities may choose, if utilities choose to utilize these on their sites.

I've already covered that. We'll monitor the review process. This just goes on to say that if there are changes during the NRC review process, then we'll have to review those changes, and make sure still that the canister itself is consistent with our specification. And, that will also, again, apply through the fabrication and deployment process.

Now, let's talk a little bit about the specification itself, since that's somewhat new since I briefed the Board last year, since we issued it in November.

As the slide indicates, it delineates the requirements that DOE will rely on in the license application for compliance with both Part 63, under Part 63 for both

postclosure and preclosure. And, in order to also facilitate handling at the repository, there are a variety of other parts of the specification that we use also to make our life easier at the repository from a preclosure handling standpoint.

For instance, consistent handling device that all the canisters will have, and that's something that we're building in, and that was, if you review the specification on our website, you will also see that.

Let's talk a little bit about the specifics of the specification itself. It's 21 PWRs, 44 BWRs. That's totally consistent with our waste package design that we've had in the past. This is typically a lower capacity device than the utilities typically use for storage on their sites. Nonetheless, this is what works in the mountain, so this is what we're going with. That's not to say that at some point in the future, as we learn more, that we can go through several generations of this, where we can go to a higher capacity TAD, but this is our first shot, and we think this will work because it again, is based on what we are going to have in our license application.

The length is 212 inches. Diameter, 66 1/2 inches. About 54 tons in weight. Maximum dose at the top of the TAD will be no more than 800 millirems. That's an average dose rate, excuse me. And, that's essentially due to the fact

that both the utility sites and at our facilities, there may have to be human intervention on the top of the lid, and we want to keep that radiation field down to a minimum, which is why we went to an 800 MR exposure. And, we had a variety of discussions with private industry about this, with the utility industry, but this is essentially what we came up with.

Borated stainless steel, let me talk about this for a moment, because I think historically up to this point at least, most of you who followed our waste package design might remember that our criticality control for long-term in the waste package was nickel gadolinium. And, you're probably asking yourself, well, why did this change. And, I think this is a really good case study about how interrelated preclosure and postclosure has to be for especially something as the TAD.

In the original waste package, we had carbon steel, and carbon steel was in there for essentially cost production aspects, and in addition, it gave us some long-term radionuclide retardation based on the oxides that came out. And, I see our chief scientist nodding his head there. When we initially looked at this, putting carbon steel in the TAD, we heard very loud and strong from industry and the utility industry that we can't put this in our poor because it doesn't work with our pool chemistries, and it creates major

problems.

So, we had to remove the carbon steel. When we removed the carbon steel, we had to then look at okay, what does that do? Well, that changed the in-package chemistry for the waste package. It basically gave it a slightly higher pH, which meant that we didn't have quite a hostile environment where we had to go to such an exotic poison as nickel gadolinium. So, that's why we were allowed to go to a borated stainless steel, which is more of a conventional poison that's typically used today.

Now, this is important because, as you know, nickel gadolinium, basically, the largest source of that is in Mongolia, and I don't think we wanted to be trekking over to Mongolia in order to get nickel gad into our waste packages. So, besides stopping our trips to Mongolia, this was also somewhat of a cost reduction for us, that actually the TAD brought about.

But, again, the interrelationships, and we had a lot of discussions within the program about the specification, both from a preclosure and postclosure standpoint, and this was one of the major changes that was made.

Canisters are going to be seal welded. We toyed with the idea of having bolted closures, but basically, seal welding I think is the best way to go. We have a common

lifting fixture that I mentioned earlier, and if you want to review our specification, you can see the aspects of that. And, handling and aging at the repository will be in a vertical orientation. And, organic, pyrophoric, and any RCRA materials are prohibited. So, that gives you a sense of that, of what's in the TAD spec, and I do commend that to your review if you haven't looked at it already.

Now, it's marked as preliminary. If you go to our website, you will see it's preliminary. When we get the proof of concept designs from the vendors, we may have another round and make some revisions to it. But, after that point, when they are marching on towards developing SARS to submit to the NRC under 71 and 72, we will consider that to be fairly final.

Yes, doctor?

KADAK: Just a quick question. On the specifications, how different is that specification from what you might consider a typical storage task internals?

KOUTS: Well, certainly the size of it is different, 32/68, but 32 PWR, 68 BWR is typically the sizes that are used in the industry. We can't have organic, so, therefore, in terms of the--there's not a neutron shield that basically is an organic neutron shield which many of the utilities use. That's different for us. Besides that, I don't think--I mean, certainly, the size and weight are different, given the

capacities, but I don't think there are that many other differences besides that. Those are the ones that come to mind.

We had, just to highlight this point, we had four meetings with vendors and utility industry. I want to go back to a comment made about our inability to interact with utilities or the industry based on the litigation.

Based on my experience in the program, there was no problem holding these meetings. Yes, we have to make sure that we--we are going to touch on issues that are not related to the litigation, but any technical issue that we have, there's been absolutely no problem getting technical information from the industry, and I don't see that as a problem. And, that's been going on for the last ten years. So, I know the Board harbors this view that somehow we're inhibited from getting the information we need to implement the repository. I have not experienced that personally, and I don't think anyone on the program that I've talked to has. So, I'd be interested in hearing where you are hearing that, because quite honestly, I don't see that problem.

LATANISION: Latanision, Board.

Let me say that we heard it from this--in our meetings with the project staff. So, we're not making it up, Chris, it's--

KOUTS: Well, I'll tell you, I have not seen it. What

we do try to do within the program, and maybe this is the source of confusion and why that comment is generated, but we like to know what interactions are transpiring, so we know who's talking to who. Okay. Because I will tell you, quite frankly, that the experience, due to the litigation, is that they will have lawyers, they will have people, consultants, who are testifying in court attend these meetings, and try to get comments out of the project, or project people, and use that against the government in court. But, these aren't issues related to the litigation. It's not issues, technical issues related to the implementation of Yucca Mountain.

LATANISION: Latanision. Well, that's good news. I hope that that is the case, and it will remain the case, and far better than we expected.

KOUTS: But, I do think that what you're hearing is that oh, my gosh, no, it's such a problem to set up the meetings. The issue is more we need to know what the meetings are about, if they're technical meetings, they can go on, and they have gone on. It's only when in certain instances where there will be certain individuals in the room who we know are testifying against the government in lawsuits, and their purpose at those meetings is not for the purpose of exchanging technical information. It's to try to gather information against the U.S. Government in the prosecution of these lawsuits.

So, to the extent that any technical issue is involved, that's not a--there is no problem with interacting with the industry on that. When it gets to issues associated with the litigation, absolutely, and the Justice Department has to be involved. But, we--this should not inhibit in any way, you know, the interaction, the technical interaction that we have with the industry.

Dr. Kadak, did you have a comment on this?

KADAK: Kadak, Board.

Just a clarification. The reason, about two years ago, we started meeting and tried to organize meetings with the industry and DOE in the same room, and prior to that, there was very, very little communication. But, since that time, and people have been communicating, as you suggested. But, the excuse was used by the DOE, and also by the industry, they don't want to talk because of the litigation, and we tried to break that down about two years ago, and if that was successful, that's terrific.

KOUTS: Well, again, if it's a technical interaction, absolutely. But, sometimes, quite honestly, they're not just technical interactions, and we just have to screen that and make sure that that's right, and those interactions can occur.

ABKOWITZ: Abkowitz, Board.

I can't let this moment pass. Is it then possible

in your mind for the utilities and the DOE to discuss variations in waste acceptance strategy, such as who is in the que and what--how old the fuel is that they'll package, and in what order?

KOUTS: Well, that's very interesting, because that is a contractual issue.

ABKOWITZ: It's also a technical question.

KOUTS: Well, and I'm going to get to that, because I think the total systems model has--gives us a lot of insight into that, and I think what we're finding with some evolution in our thermal requirement is that essentially we have a tremendous amount of flexibility in terms of what's at the pools, and the order that we need to take it under the standard contract.

And, for those of you in the audience, and for those of you on the Board who don't understand that, the contract is very, very specific about the order in which a right is given to accept fuel into the system. And, that has to do with the oldest fuel first priority, and in the development of the standard contract, although I wasn't there at the time, it's hard to believe that it predated my involvement in the program, that was a significant point of agreement within the industry about how that ought to be allocated. And, it's basically, if you're going to change that, that has to be a group discussion with the entire

industry, because if you're going to jump in front of somebody else, you're taking somebody else's rights, that has that other person involved.

So, I think that what I think the Department has to look at is meeting its obligations to the extent that there are other options, there are always other options, but that's a group discussion with all the utilities, and I think that's a rather premature discussion at this point in time. But, I think we're going to get to at least some of the analyses in the total systems model that I think are very promising, that basically indicate that the que is fine in terms of our ability to accept fuel and meet our thermal goals.

Okay, moving right along, I know the Board wanted to hear about integration from reactors to emplacement, and I think as I mentioned, I think the TAD is bringing that about, and I think we're learning a great deal in terms of the development of the specification, interaction with the utilities on this, and with the vendors, and I think it is going to bring the integration that the Board wants, and that the Department wants.

And, I think the beauty of the TAD is that it's gotten the program together to address all the different areas that we have to address, which cut across preclosure, postclosure, transportation, and dealing with the reactor sites. So, from that standpoint, I think it's been

successful.

Thermal size and handling requirements are in the TAD. That all came from, again, our preclosure and our postclosure needs. Our transportation planning will be all based on TAD procurements, to the extent that we understand the percentage that we're going to be bringing into the system. And, let me get into the TSM analyses that we've done historically and that we're doing today.

Most of you, since I've given a couple of presentations on the total systems model, I won't belabor this slide, other than the total systems model is a unique tool. It gives us an ability to understand essentially how one part of the system affects the other part of the system. If there are issues at the repository, how that propagates back through the waste acceptance que, and also how different waste acceptance may come through and affect the repository in terms of whatever fuel that we select at the site. So, it's a very useful tool.

I think one highlight from this slide is that our understanding of the thermal needs of our postclosure have evolved, and it's not my understanding, but it's basically the underground understanding, and I think we have learned a lot more about ventilation in the drifts, and how much heat that's going to be taken off the waste packages. I think we have learned a lot about end effects, the possibility, if you

will, that we can put hotter packages at the ends of the drifts because you have a lot more mass, if you will, that's absorbing the heat.

And, I think we can move away from the historical seven package segment that we've looked at in the past, and have different emplacement strategies that allow us a lot more flexibility, and basically can have the potential impact on reducing our need for storage in the future.

Let's kind of go through the history lesson here about what we did in 2005, what we did in 2006, and what we're doing in 2007 with the total systems model.

In 2005, you might remember that we were just making the decision at that point on TADs, and we did kind of a feasibility analysis that, you know, can we achieve our acceptance rates? Will we exceed our 21K aging capacity, based on very early concepts of 1.45 kilowatts per meter, and 11.8 per waste package, and can we get it all done within 50 years? I mean, those were kind of the big issues. Can it work? And, I think the TSM said yeah, it can work.

And, then, in 2006, we supported the CD-1 process, where we began to look at different facility configurations about how best to deploy this. We looked at capabilities of wet and canister handling facilities, and what kind of configuration should we look at? And, the total systems model was very much involved in that analysis. We also were

instrumental in helping make the decision about how many closure cells we need, which is basically about six to support our emplacement rate.

And, Dr. Kadak was asking about the 90 percent goal that we have, whether or not we can meet that. And, that gets all into when you look at a 70,000 ton repository, which is 63,000 tons of commercial fuel, and 7,000 tons of DOE spent fuel and high level waste, you can get to a 90/10 split, but you're basically taking the materials from the pools. You know, I won't get into the contractual issues associated with accepting the other devices that are out there, which is the subject of litigation.

However, whatever happens with DPCs in the future, assuming that they do come in the system, we'll probably take those at our own rate. So, to the extent that we're taking fuel from the utilities, we'll be taking it from the pools. So, from my perspective, when we analyze this with the total systems model for the 70,000 ton case, the 90 percent feasibility goal is very achievable. But, that also gets back to heat loads and the kind of heat requirements, and how much aging we have on site.

And, let's talk a little bit about that in the next slide. First of all, I just want to throw a plug here in, again, for the total systems model, because the tool does give us the flexibility. Instead of looking at a box or a

TAD facility, we can get down to process lines, and then how you want to group those process lines is all dependent on how many facilities you want to build, and it gives you the ability to kind of mix and match the kind of facilities that you need on site. So, that's why this is a very powerful tool.

Now, let's talk about thermal. One of the things that we're doing this year with the total systems model, and we have some of this work underway--I think the Board has expressed in the past that we're too locked into the 11.8 and the 1.45 kilowatts per meter. And, by the way, that's not a point solution, that's a not to exceed amount. So, it's anything under that works for us. But, I think what we're trying to look at this, and we have--the repository, as I said, has evolved in their understanding of ventilation underground, and also end effects. So, we can look at different configurations, if you will.

And, so, now the algorithm is not necessarily 11.8 and 1.45, it's more what do we need to get a 96 degree mid-pillar temperature? Okay, what do we need to get a 200 degree drift wall temperature? What do we need to maintain 350 degree C. cladding? And, those are the parameters, if you will, that we're trying to work around, which gives us a lot more flexibility in terms of operationally about what we can put into the mountain, and our flexibility, if you will,

to actually pick a waste package, or pick a TAD out of the storage fuel, and use that as the blending device, if you will, in the repository as we emplace.

So, Dr. Kadak, you had a question?

KADAK: That was a huge change, what you just said.

KOUTS: Yes. And, those analyses are currently underway. I haven't seen the results. I think they have a lot of potential, if you will, to affect our understanding and our ability to emplace perhaps a lot faster than we thought we could in the past, and perhaps keep the size of our storage fuel down. But, again, I haven't seen the information, and I don't want to be admonished by the Board staff about I'm not going to put up a slide here that says, you know, Valhalla, we've reached it. I don't know. I haven't seen the data yet.

But, I think we're looking at different parameters, and I think we're trying to remain flexible, but we're not leading the effort, we're essentially trying to--we're following through with what is being done and the thermal understanding of the site, and I think the model helps us understand how that propagates through the system.

So, with that, we're continuing to use the systems model to do a variety of things for us. I think it's, again, a useful tool, and I'll go right to my summary, which is TAD design development is underway. The spec is out there. The

proof of concept phase will be done at the end of--in the March time frame, end of February, early March. It's certainly being incorporated into the license application, as you heard. And, the TSM continues to be a key tool in helping us understand how the system will operate in the future.

I'll be happy to answer any questions.

GARRICK: Thank you. Thank you. You not only met your schedule, you brought us back into schedule. So, you did a fine job. All right, Ron?

LATANISION: Latanision, Board.

We haven't heard anything much about waste package closure in terms of welding and thermal stress relief handling. Howard asked a little while ago about surface finish, et cetera. Those are the kinds of practical implementation level questions that a metallurgist would be concerned about. Can you tell me where we're at with all that?

KOUTS: That's, I think waste package closure is a Paul Harrington question. I mean, I can--that's beyond my depth. I think that's really a Paul question.

LATANISION: That's a preclosure issue.

KOUTS: I don't know if he's in the room. Is there anyone that--and I think Kurt Lockman (phonetic) has also left. But, I think they're the best people to answer that

question for you.

DYER: This is Russ Dyer, DOE.

It's actually both a preclosure and a postclosure issue. And, I know in the postclosure side, we have an analysis and modelling report looking at how we model and we treat that in the postclosure performance assessment, and that's work that's underway. We don't have the results of it yet. But, it will be complete here fairly shortly. But, it's not just one entity that's concerned with this. I mean, it goes across the program.

I was just asked to talk about something that I know nothing about. Up at Idaho National Laboratory, we're doing a prototype on the waste package, and there will be lessons learned that come out of that, and that's about as far as I can take that discussion.

GARRICK: Andy?

KADAK: Kadak, Board.

First, let me just summarize what I think you said that I heard was very positive. One was that the loading of the TADs will be such that you're not going to limit the loading requirements to 11.8 kilowatts.

KOUTS: That's correct. The only limitation right now on the TAD is what could be transported, which would be essentially 22 kilowatts.

KADAK: 22 kilowatts. So, that gives the utility a lot

of flexibility in blending, and you might be able to find sufficient so-called fresh fuel within the spent fuel to pools to be put into that canister, which is good.

KOUTS: And, I will state that the 22 kilowatt limit is what's been licensed today. I mean, that's not to say that that limit couldn't go up with new designs that have different, you know, heat requirements.

KADAK: And, the--once you get to the repository, you will be blending the canisters in such a way to meet the old 11.8, or am I to assume that you're going to blend them in such a way so that you don't reach your peak limits, whether it be waste package temperature or fuel temperature or drift wall temperature?

KOUTS: Right. We're looking at trying to maintain what we absolutely need for postclosure, which is the 96 degree mid-pillar temperature in the pillar, if you will, the 200 degree drift wall temperature, 200 centimeters, and not to exceed the 350 degrees C. limit for clad integrity. So, we're still maintaining what we need in the postclosure, but we're looking at it from a different perspective. How can we maintain those parameters, which are ultimately what we need, for our safety case, if you will, as opposed to the 11.8, not to exceed 11.8, and the 1.45.

KADAK: So, those are sort of there, but not there?

KOUTS: Right. But, again, it comes from a better

understanding of our ventilation model, and the amount of heat that can be taken away from the packages, and also the end effects. The end effects are a big deal, because you have the capability to put the hotter packages at the end of the drifts, and, therefore, you can emplace hotter materials because the heat is being taken away faster because you've got more rock mass. But, again, this is--you know, we're modelling essentially what the underground people--I shouldn't say that--the postclosure people are developing in their further understanding of thermal response in the mountain.

KADAK: And, when do you think the first TADs might be available for use in number?

KOUTS: The earliest that we feel that they could be available commercially in the industry is about 2011. And, if you look at the numbers, and I happen to have them here, roughly in 2011, there will be a little over 14,000 tons in dry storage in some devices. By 2017, it will be more like a little over 24,000. So, assuming that we can penetrate the market, and assuming utilities, that we can incentivize utilities to use these, as opposed to the DPCs, we have a potential to impact that 10,000 metric tons, if you will, that will be deployed between--at the utility sites between 2011 and 2017.

KADAK: If I can, Mr. Chairman, one final question?

GARRICK: Sure.

KADAK: If the utility had, say, a multiple purpose, or dual purpose container, you're saying that is not your choice of acceptance. But, let's just say hypothetically that it could fit into your waste package, and it could meet your thermal loads, would you--I mean, would you put it in the waste package?

KOUTS: Well, that's an interesting question, because our director has requested that I specifically look at existing DPCs and their potential for disposability. My sense is near-term, probably not, but again, this program will be in existence hopefully for a very long period of time.

KADAK: Well, why would you say near-term, not, because near-term, they're available to go?

KOUTS: Well, yes, near-term, they're available to go, but they don't meet our requirements right now for the TAD spec. They're not 2144s. They don't necessarily have the same criticality configuration we have, which is 11 millimeters of borated stainless steel around--and, it's not configured. Some of them have organic material in them. That, again, is unacceptable from a postclosure standpoint.

KADAK: Let's say we get rid of all those--

KOUTS: I know, you say to get rid of those, but they exist. So, that's not to say at some point in the future, we

can't look at that, perhaps we can analyze our way through that and demonstrate that. But, the time being, I don't see any of those, first of all, fitting within our envelope that we currently have, in our current waste package envelope. It's certainly not covered in our TSPA, so, anything you're talking about is probably a longer term issue. We'll get the repository operational, we will revisit the issue, assuming all the contractual issues are worked out, and we'll see if we can do it. I don't know.

You know, we may learn a lot more. We may have, you know, gained better understanding. We may have better analytical tools. But, at this point in time, we're going to look at that, but as I look at these, at the existing devices, none of them certainly meet our TAD spec, and, you know, we'll have to look again how far off they are and what the issues are associated with them, and also whether or not they fit our handling envelope.

GARRICK: All right, I have Mark, Howard and David. So, Mark?

ABKOWITZ: Abkowitz, Board.

Chris, I wanted to echo the sentiments that my colleague over here, Andy, has mentioned about what looks to be some very positive developments. As you know, the Board's been pushing system oriented tools and, this looks like a good one. We hope the TSM has kind of reached a certain

culture of acceptance within the organization, and that the kind of work you're talking about is going on.

The first question I had for you had to do with the work that's starting to go on in thermal. Let's suppose that use of this model, when you bring the thermal side of it into it, demonstrates that there's some things that could be done very differently that would be beneficial to the project, either in terms of safety, costs, or some combination thereof. Won't it be too late to incorporate that knowledge in the way in which you're proposing this repository to in the license?

KOUTS: No, I don't think it will be too late at all, because I think that as we gain further knowledge about how we're going to operate operationally within--this is really an operational issue. It's still meeting our thermal goals, if you will, but it's achieving them without holding certain other parameters constant. I mean, again, we're an evolving program as we learn and go forward. I've said this many times, you know, how we operate the repository on day one is different than how we're going to operate in year 20 or year 10. We'll learn and we'll go through a normal evolution process with the NRC, because that's what the whole license amendment process, or the adjustments to the operations of the facility will be. So, I don't see this--I see this as very encouraging that we're discovering this now, and I think

it will inform us as we go through the process, and help us operate the repository in a more efficient and effective manner.

ABKOWITZ: Let me move on to one other question I have. Let's just assume that the vendors come up with some satisfactory designs and we go through this whole process. I think it's pretty much assumed that relative to other containers, that this is going to be an expensive storage device for the utilities, and will hold less capacity. So, you mentioned that because you don't have any regulatory control over how they, whether they use TADs, you mentioned incentivizing, I was wondering to what extent there has been discussion with the utilities in terms of that question? And, also, to what extent there are limitations in using TADs at a lot of sites, because of the crane requirements?

KOUTS: Let me answer the first question. In terms of incentivizing the utilities, those discussions are ongoing within the Department right now, and I think that we will address that in the near term, in terms of how we will view TADs. And, I don't want to get ahead of the way the Department is, but those discussions are underway, and when we reach that point, we'll certainly brief the Board on that.

In terms of handling the TADs on site, the TADs I think there are very few sites that I don't believe will be able to handle TADs. And, of course, we have to see the

proof of concept designs, and we have to get some feedback from the vendors, but our goal is to try to make these as universally acceptable as we can. So, to the extent that there may be some avocations in the final spec before we go forward, hopefully, it will address any interface issues that we have. But, we'll be informed by that when the vendors come in with their design reports toward the end of February, early March.

GARRICK: Howard? David?

DUQUETTE: Duquette, Board.

I think Mark had most of it. But, the--that's underway, do you have a contract with anyone yet to try to build one of these, a model of one, or a dummy?

KOUTS: Are you talking about the TADs themselves? We have existing contracts with the four vendors that I put upon the screen before. So, yes, we do have people underway right now. They're certainly not building demos of them. We're thinking about we'd certainly like them to partner with the utility, the member of the utility industry, as we go forward, and that's something that we're looking at. But, I think by the next time I brief the Board, I may have more information to impart to you on that subject.

DUQUETTE: Do you have any feeling for when the first demonstration TAD might be built?

KOUTS: Well, I'd like to think that we don't have to go

through a demonstration phase. I would say that I'd like to see these commercially deployed in the 2011 time frame. That's what we see as, assuming we energize the vendors to move forward, they submit their SARs, their safety analysis reports, on 71 and 72 early next year, then you look at the time that it typically takes to be certified by the NRC, and then again to get this deployed at a reactor site, we're looking at approximately four years. And, that's, you know, we'd like to see them deployed at that time frame. So, I don't see us going through a demonstration phase. We'd like to see them commercially deployable, and that's why we are working directly with the vendors who work with the utility industry to hopefully expedite that process and get them available as quickly as possible.

DUQUETTE: And, a more technical questions, but a very specific one. Do you anticipate doing the seal welding and inspection of the seal welds on site at the utilities before transportation occurs?

KOUTS: The seal welding will be done for the purposes of the TAD at the reactor sites. The seal welding for the waste package will be done at the repository.

DUQUETTE: I understand that.

KOUTS: And, in terms of our need to inspect or be there to do that, we have, as I said before, we have no regulatory authority over the utility industry in any manner. I think

that that's overseen by the NRC. All of them have qualified QA programs. But, that's an issue that we're going to have to address as we move forward. But, I left off a variety of slides which I already went through with the Board the last time, but before we receive a TAD from a utility site, they're going to have to certify to us that they have loaded it according to our needs and our procedures and our specifications, and in accordance with their QA program, which has been NRC approved. So, there will be, you know, that will be a significant certification on the part of the utility to indicate to us that they have met our requirements, and we're going to have to make sure before we accept that TAD for transport to the repository that it does meet all our requirements. You know, that certification, again, hasn't been determined exactly how we're going to do that, but that's something that we're going to require before we accept these things.

DUQUETTE: Right. Well, that goes to incentivizing again. I don't know who would provide the utility with automated welding capabilities for sealing the TADs, and then also the automated, presumably automated, inspection capabilities. Would that, I mean, I presume that DOE or someone is going to have to pay for that.

KOUTS: No, they already do that on site. There are firms that go around from facility to facility that actually

conduct this, and there are trained crews at utility sites that actually travel from site to site who have this experience to do this. So, the industry--I want to emphasize again that we're not asking the reactor sites to do anything differently than they normally do, because the ones that--typically, the devices that exist today are also seal welded. So, there's no--they're inerted and seal welded, which is exactly what we're going to require.

DUQUETTE: Thank you.

GARRICK: Okay. Any questions from the Staff?

(No response.)

GARRICK: Good. We're moving right along. The Board would not object to completing our day a little early because of some tight travel arrangements that some of us have.

All right, I think we'll take a 15 minute break, and resume with our next presentation by Gary Lanthrum.

(Whereupon, a brief recess was taken.)

LANTHRUM: We'll jump right into the presentation here, because I heard Dr. Garrick's comment about challenging schedules, and we'll see if we can get into this and get to your questions.

The outline of the things I was asked to talk about was the structure and status of the project, schedules for transportation, where we are on the route planning, both within the State of Nevada and outside the State of Nevada,

and where we are with the collaborative planning with stakeholders. And, I'll go through each of those topics.

As we've talked about before, the basic approach for developing the infrastructure, the hard assets for the transportation system, has been carried out through the implementation of two major systems projects in DOE. There's a National Transportation project, which includes the casks, rolling stock, and support facilities. And, the Nevada Transportation project, which is focused extensively on the railroad. Both of those are adhering to the original CD-1 approval, which is the Critical Decision-1, which has basically the alternative that we had proposed, was still the alternative we're pursuing within Nevada for the Nevada Transportation project.

We're still looking at conducting the repository to mainline track in Nevada by building a railroad. And, Nationally, we're still looking at buying a bunch of casks and a bunch of rail cars, and building a support facility.

Some changes about how those would be implemented have been going on, and that's what we'll cover a little bit here.

On the cask project, Chris talked extensively about where we are with the TADs and the TAD development. What I've done in this graph is to show basically in project parlance the late start, late finish for a couple of options

for actually buying TADs. Chris is responsible for getting all the casks designed to meet our needs. I'm responsible ultimately for buying the casks and then maintaining those under the certificate of compliance issued by the Nuclear Regulatory Commission.

And, the longest lead time here on this line is for a brand new type of cask, one that does not exist. You have a fairly lengthy period of design, developing the specifications for procurement, and then the actual procurement process to get the quantity needed for initial operations. And, I show the late date for having that process started is 2010. That would be if there was no desire to have these made available for the utilities to use between now and the time that we start deploying them.

Chris has started the process early, as he indicated, because there is a desire to have them available for utilities to use for their own dry storage systems between now and the time that we would be ready to pick up bare fuel.

And, there's a range of other things that--in terms of schedule. If you're buying existing casks, which we're hoping that the TADs will be by the time it's time for us to actually buy units to pick up bare fuel in, we wouldn't have to do that based on the current lead time for procurements until 2013. We're actually looking at our current schedule

for procurements. Our initial procurement is in the 2011 time frame. It's about a three year lead time for procurements based on the challenge with fabricating facilities and the availability of construction capability.

But, we also have a desire to do a fairly lengthy start-up set of dry runs, using the casks and exposing folks along the routes to how this system is going to work long before we actually have spent fuel in them being transported. And, so, we're looking at trying to have the system operational in the 2015 time frame as part of our ongoing start-up operations.

Our rolling stock, we've made the commitment before, which has not changed, to procure rail cars that meet the Association of American Railroads Standards 2043. The 2043 standard basically has some active monitoring to give added assurance that these rail cars are performing as expected while you're making your shipments.

In addition, they use state of the art suspension systems, what's called trucks, in rail parlance, and the trucks just have a--the suspension system requirements for these rail cars give them the lowest probability of derailment type accidents of any of the rail fleets that are out there.

We've done a fair amount of work since the last time we got together and I presented to you, without actually

buying any actual hardware. What we've done is we've done a more detailed analysis of the weight of the cask cars with all of the active monitoring systems, and with the performance criteria that we have. We have looked at that in the context of the TAD. We believe that the TAD weight range, when it's in its transport overpack with impact limiters, will be very close to the weight range for existing dual purpose casks, somewhere in the range of 115 to 125 tons. The actual numbers are going to vary based on what kind of proposals we get in from the vendors when those start coming in.

We have done analysis of the ISO type attachments that could be used to lock the transport skid that the casks will be mounted to to either the rail cars or to trucks. We're participating on the ANC N-14 standard for tie downs for spent nuclear fuel shipments. So, there's a lot of things that have been going on in the background that will contribute to the ultimate procurement of rail cars to support this operation.

We have also developed the risk matrix for our rolling stock, and similar to the slide I showed earlier on the procurement of casks, the procurement of these rail cars we actually have started now. In reality, the start time would be more aligned with the start time for casks, but we're partnering with Naval reactors on development of an

escort car right now. Naval reactors has a need for an escort car in the 2013 time frame, which means earlier development. The same rail car at the same standards will be used by both Naval reactors and by the RW program. So, it makes very good sense for us to partner on that. We're doing that now, and then at some time in the 2009 time frame, we're hoping to get involved heavily in development of the cask car and the buffer cars.

The standard does not apply to locomotives, and we're not right now expecting to have any procurements of locomotives to anything other than off the shelf requirements. If there were a need to develop off the shelf rail cars, that could proceed at a much later date, development of a procurement in the 2012 time frame would support the 2017 shipment date that we're talking about right now.

On support facilities, this is an area where nothing has changed since the last time we got together. We still have the requirement to have some facility to maintain the casks and the rail cars, the casks in particular to the requirements of their certificates of compliance from the NRC. There's an annual maintenance requirement. There will be ongoing, just preventive maintenance that's done. A number of the casks will require soft good replacements after each use, gasket replacements, those type of things, and just

overall management of the fleet.

A facility right now is part of what we're considering in the rail alignment EIS. We're looking at a couple different locations for possibly locating the facility, and we're also studying the regulatory framework that the facility would operate under, looking at a range of facility requirements, both for bare fuel casks and for casks that would be carrying TADs, the canister content.

On Nevada Transportation, the last time I talked to you, I believe we had started the rail alignment environmental impact statement to look at alignments within the Caliente corridor. We had selected Caliente as the corridor for implementing that connection between the repository and existing mainline track.

Since that time, we had a letter we received from the Walker River Paiute Tribe. The Walker River Paiutes, in fact, I'll catch that probably in the next slide. We'll hold off a little bit here.

We'll catch the map. The Caliente corridor starts from the town of Caliente and wraps around the top of the Nevada Test and Training Range, and I gave each of the Board members a map that has a detailed look at the alignments within--the corridors within the State of Nevada that could have been selected. We avoided selecting the corridors that came from the south, either the Valley modified or the Jean.

There was a modification of the Caliente corridor that came about to this point, and then crossed the Nevada Test and Training Range. We formally dropped that from further consideration based on discussions we had with the Department of Defense that said you're never going to cross this land. Stop thinking about it. And, so, that's not even on the map now.

What is on the map, since this is an extract from the repository EIS, there are a couple of small options for alignments that do cross the Test and Training Range. We formally also dropped those from detailed consideration, and, so, they're not part of our ongoing EIS.

There's a Carlin corridor that was up here, and what I have added is the Mina route, which essentially starts up around the town of Schurz, comes down an existing track that is owned by the Department of Defense, to the town of Hawthorne, where the Hawthorne Army Depot is. There is an old rail bed that extends from there down to the town of Goldfield. The track is gone and the ties are gone, but the old rail bed is there, and there are a number of alignment options that we have looked at to connect from the town of Hawthorne, down actually to the repository, and we have added that formally to the EIS.

We sent out a notice of intent to expand the scope of our EIS in October. We are actively engaged in collecting

the technical data to do that. And, what we are doing now is carrying forward two options for a study in the EIS, both the Mina route and the Caliente corridor. Both will be in the draft EIS when it comes out. We're hoping to have a preferred alternative from all the options that are presented from that range. The schedule for the draft right now, I believe that's on the next slide, is 2007.

We are looking at the September time frame for the draft, repository EIS, and the rail alignment EIS. The two are very closely tied together because the subject matter and the transportation, since it's in both of them.

We're looking at a 2008 time frame for the final EIS, and the design of facilities in the 2008 and '07 time frame, and start of rail construction has been announced in the October time frame of 2009, with the rail line being available for actual operations in 2014, which is well before the repository is scheduled to be operational, and yet the rail line could be a very significant contributor to ongoing construction activities at the site.

We are also working on a National Transportation Plan. It's one of the things that the Director has talked about in a number of his public engagements. There are a lot of very good products that the transportation organization has been working on, the project plans for rail, for casks, for rolling stock. We've been working with routing issues.

We've been working with the Outreach for Technical Assistance and Funding for Emergency Preparedness Training on corridor states.

Each of those individual parts has been developed fairly well, but they are not combined into a cohesive whole that allows anybody to sit down with a single document and look at how all the pieces fit together. And, we're putting together a National Transportation Plan that does just that. We're doing that in conjunction with our stakeholders. We expect to have the first iteration out for broader public review and approval in the September time frame this year. But, there will be bits and pieces that we will be working with through our transportation external coordination working group, and others, between now and then.

The elements of the plan include, again, as I said, all the individual elements required to build a transportation system. It will capture a high level discussion of the requirements. Those requirements flow down into our plans for infrastructure development. The timing and the basis for those specific projects that are part of the infrastructure development. The level and extent of the institutional outreach that we will have, including the requirements under 180C of the Nuclear Waste Policy Act for the emergency preparedness training. And, then, there will be some discussion about operations.

Obviously, just as Chris has talked about things changing over time in the way the repository would operate, the level of knowledge we have about how the transportation system will operate is going to evolve. And, so, this is going to be a living document that will be updated. Ultimately, I would expect to see actual campaign plans that will be part of our actual day to day operations to be embedded into this as subsequent add-ons. But, initially, we can talk a lot about how the operations would be conducted, if not where and when they would be conducted. And, I think that's a useful bit of additional information that, again, helps our interactions with our stakeholders.

On the routing process, Dr. Abkowitz was with us in Minnesota--in Michigan, pardon me--Wisconsin. One of those cold states, one of those cold, foggy states, last September. We had the meetings on the Oneida Reservation there, and one of the issues that was talked about fairly extensively was our plans for developing routes nationally.

In the repository final EIS, there were representative routes, but that was all of the routes that met the requirements both of DOT for highway shipments, and the Railroad Standard Operating Practice for rail shipments. We needed to down select from that to give a little more focused view about how we would implement YBC (phonetic) and other activities we're responsible for. And, the routing

topic group is the way of doing that.

We have our next formal meeting in, I guess it's next week in Atlanta, I'm sure that that place and time is right, on Wednesday and Thursday of next week, and we'll be tackling the issue of how we develop both the criteria and the methodology for routes with our stakeholders in that meeting.

Interestingly enough, one of the special projects we funded with one of our state regional groups, with the Midwestern Conference of the Council of State Governments, was they wanted to do their own route development exercise, and, so, we said have at it. Here's a bit of seed money, go off and develop your own criteria and methodology and come back and say what you learned from the process. And, we got a lot of good feedback from them. That was part of what was presented at the Wisconsin meeting of the TEC back last September.

A couple recommendations were things that would be helpful for the overall process to move forward, some updates to the TRAGIS (phonetic) model, which is used for actually collecting information that affected the routing decisions, and for some of the modelling activities that the states-- we're actually conducting training exercises for the states in the use of that model.

We do have a collaborative approach. We have a

very wide spectrum of both industry and public stakeholders, folks with a responsibility and a role in public health and safety. They're going to be involved in the process.

Towards the end, I guess I've got a discussion that talks a little bit about the schedule. What we're looking at is to have the criteria nationally and the methodology established by June of this year.

This is a slide that describes, and I've got a larger version over here against the wall that makes it a little bit easier to see, without you having to try and interpret it, let me tell you what it says. There's been a lot of questions about the impact that the selection of Mina versus Caliente would have on the national routing system. This is data that's in the repository EIS. It's being updated to include analysis of Mina, but it shows the number of cask shipments that would go through each state if in fact any of the four alternatives that were in the repository are chosen.

And, for purposes of this, Caliente and Chalk Mountain are in fact the same alternative, because the starting point is the same. And, so, the data for Caliente is the same as it would have been for Chalk Mountain. So, we've got basically the portrayal of the five options that were in the repository EIS.

The most important sound bite to come out of all of

this is whether you select Jean or Valley Modified or Caliente or Carlin doesn't really make much difference nationally on the number of cask shipments each state would see. And, even though we haven't completed the analysis of Mina yet, the approach to Mina is the same as the approach to Carlin. I'm expecting that the number of shipments by state if a Mina corridor were selected in the final EIS process would be the same as the number of shipments for Carlin. But, we'll have that data as part of the EIS that we're working on now.

That's right, we're still doing the analysis for Mina, and the information that feeds us will be in the EIS updates.

KADAK: You would think California would see a lot more.

LANTHRUM: Actually, I don't believe that, and let me run back real quickly and explain why. The existing rail infrastructure in Nevada, there is a rail line that's a UP line that runs from the Salt Lake City area down through Utah, and enters Nevada right around the town of Caliente, and runs northeast, southwest down through Las Vegas.

There is also a line that runs across the top of the state that's shown on the map that I left for each of you that is a joint use by UP and Burlington Northern. It actually comes around down this way. And, that's the line that we'd tie into, but that line up there is the same line

that the Carlin route attaches to. And, so, for all the shipments that are east of Nevada, I would expect the approach would be on this line, and, so, the numbers would be almost identical to what we see for Carlin.

And, so, I really do not expect to see any difference, and that's one of the reasons I wanted to bring these slides for you, because I know that the state of Nevada has been saying oh, thousands of new cask shipments are going to be going through California. And, the implication is on the national map, that all of the shipping sites in the Southeast portion of the country would flow across--there is actually a rail line that goes across the Southern part of the country into California, and then doubles back, and what they're saying is that all those shipments would proceed across that line. But, if you use standard rail routing criteria, that just doesn't happen.

And, again, we will have the detail analysis that specifically addresses Mina in the EIS when it comes out. But, based on the way that you get to Mina, I'm not expecting major changes.

Now, there will be subtle adjustments for the shipments out of Oregon and Washington. Looking at shipments to the approach in Caliente, some of the shipments from the Hanford site, from the Trojan plant probably would have gone through Idaho and dropped down through the Salt Lake corridor

to get into that access to the Caliente corridor. They might shift--a small number of those shipments might shift to come into California and across the enter in through the Reno approach. But, overall, nationally, the impact is going to be very small, and I think that's a very key point to take away.

Again, this is the schedule for our routing process and our work with the states. And, again, we're looking at both rail and truck routes. A lot of our focus has been talking about the infrastructure needed for rail because there's a huge investment required for rail infrastructure. We're not anticipating a large investment if we have a truck infrastructure that has to be pursued.

We're not looking seriously at heavy haul across the nation. We're looking at heavy haul from the 24 sites that don't currently have rail access to get to a rail head, and then using rail the rest of the way.

For truck shipments across the country, you're looking at legal weight, or over weight truck, and those are small casks. The existing trailer fleet can support shipment of those casks, and, so, it's not a major investment that we have to plan for way in advance, the way that we do with rail, where there's a lot of infrastructure that we have to develop.

Section 180(c) implementation. We worked for an

extended period of time with our stakeholders, again, very broadly. We have changed the approach to funding emergency preparedness training from one focused on what was originally called a needs based requirement, to a formula based requirement. We got consensus from the participants in the group, and we're hoping to have the revised draft policy published sometime early this year. The final version of the new draft is going through the internal review process, and, again, I'm confident that we'll have that published, both the new policy for implementation, and the implementation of the grants for that policy will be published.

And, there's an important nexus between the 180(c) planning and the route planning, because even though the initial shipments won't be until 2017, we have a desire to do a lot more outreach between now and the 2017 time frame. Knowing where the routes are gives us an idea of where we'd have to apply the emergency response training, and where the technical assistance would have to be deployed.

And, those are also the alignments upon which we would look at doing pilot projects, and we have a whole suite of pilot projects in our hip pocket that we're anxious to get out there and start engaging with our stakeholders on to get the confidence level raised, both from emergency responders and from just ordinary citizens, that these shipments can be conducted safely and securely.

And, overall, the conclusions are basically the conclusions that I presented to you before, is that I believe that these shipments can be done safely and securely. I believe we've got a plan that you'll see when the National Transportation Plan comes out later in the year that addresses all these individual elements in the holistic context. You can see how all the pieces fit together.

And, we would expect to be then deploying that plan to a broader set of stakeholders than the ones that participate with us through either the transportation and external coordinating group or the state regional groups, or other specialized bodies, to have a much broader public bit of education that we would pursue to talk about how all the pieces fit together, and how people would be affected by these operations.

With that, I'm open to questions.

GARRICK: Thank you. Thank you. I think we'll allow our technical lead on transportation, if he has any questions, to go first, and then we'll take David and Andy.

ABKOWITZ: Okay, thank you. I was hoping that one of them would warm up the topic. Abkowitz, Board.

Thank you, Gary. It certainly seems like you've figured out there's a lot of balls to juggle and they seem to be landing and getting thrown back up in the right order. So, that's good news.

I'd like to go to Slide 13, and share with you some information that you may or may not know about. There are two initiatives going on right now. One with the Federal Motor Carrier Safety Administration, and the other with the Federal Railroad Administration. The first one has to do with modifications they're currently making to their routing guidelines. They're expected to be out in the fall of '07, and they are going to be incorporating security criteria, routing security criteria, in conjunction with safety criteria, and they will be applicable to route control quantities, which would then mean that everything under the Yucca Program would be subject to that.

LANTHRUM: Right.

ABKOWITZ: So, I would certainly advise that if you are going to keep the schedule you have up here, that you be very close to the way in which those criteria are being developed. And, I know enough about that project to know that that information is not available yet.

LANTHRUM: In addition to that, there are two notices for proposed rulemaking that are out, one from DOT and one from DHS, that talk about routing of hazardous materials, high hazard materials.

ABKOWITZ: Right.

LANTHRUM: And, they essentially lean on the industry as being responsible for the routing process. That's something

we're taking a close look at, and we will very clearly be commenting on as the process--

ABKOWITZ: Right, that's the other one I was alluding to, which is on the rail side, which is kind of a first of a kind rail rulemaking. And, there's going to be, I've seen some early stages of that language, as you may have. It's going to be left up to the industry to demonstrate that they've performed route risk assessments, using the guidelines in the rulemaking, and they're also taking into considering quite a number of different criteria. And, the industry as a whole is actually kind of working on kind of a standardized way of doing that.

So, that's another thing to be mindful of, because I would hate to see the effort that you have laid out here, you know, reaching a conclusion, only to find that it's somewhat inconsistent with the thinking that's coming out in those two pieces of legislation.

LANTHRUM: We're paying close attention to the changes that are coming. I don't anticipate major shifts. As you are fully aware, the states can designate alternative routes as opposed to the DOT standard highway routing practices, but if they propose alternative routes that don't use the interstate system, there is already a requirement for doing what basically is a hazards analysis, or a risk analysis, to say whether they are compliant with the expectations that DOT

has established.

ABKOWITZ: Abkowitz, Board.

I agree with that. I think that the major new consideration is going to be I guess what I would refer to a iconic structures, and how close the transportation system gets to those structures. And, in some cases, whether the detonation of a shipment while on route, or whether there's the theft and diversion of it. So, there will be kind of a new element that addresses critical infrastructure and ways that are very different from any criteria we've seen up to now.

LANTHRUM: Fortunately, as I indicated, we're expecting this to be a living document, and even though there's changes that may be coming up in the somewhat near-term, I would expect even more changes over the long-term with the 20 plus year shipping horizon that's being expected.

GARRICK: David?

DUQUETTE: Duquette, Board.

You mentioned in your presentation that it was going to be possible that you would have to do some truck shipments to rail heads, and then transfer the casks at the rail heads. I have two questions that go with that. They're not really technical questions. They're more from an informed citizen type of questions.

One of them is will you require some kind of

permission, authorization, or whatever, from the communities at the rail heads? And, number two, will the transfer facilities at the rail heads have to be licensed?

LANTHRUM: There would be a fair amount of planning. I don't know that there's any prerequisite for approval for local communities, but there would be lots of community involvement. In fact, the construct of the shipments out of each of the shipping sites, whether it's a DOE site or a commercial site, is something that there's a fair amount of latitude in the site in specifying how they want to ship. And, so, there will be a lot of discussions, both with the site and with the communities as part of our ongoing routing process.

There are heavy haul transfers done in many places currently, and most places that have rail heads have the capability of transferring heavy loads from heavy haul trailers, which are very different from legal weight or over weight trailers, onto the rail conveyances. And, I would not anticipate any additional requirements just because of what is in our contents, as long as the infrastructure has the weight bearing capability, I'm not aware of any additional constraints on licensing for those operations.

DUQUETTE: Thank you.

GARRICK: Andy?

KADAK: Kadak, Board.

In terms of your rolling stock, are you doing any kind of work with PFS to see if you can use some of their already, I believe, some tested, capabilities of some of their rail cars?

LANTHRUM: Actually, the work that was done for PFS, I believe was Colorado Rail Car did the development of the prototype car for their cask, which is a depressed center car, which is very long. And, it was tested at TTCI, the Transportation Technology Center, out in Pueblo, Colorado. We're linked very closely with TTCI. In fact, the modelling I indicated we have done about the performance and suspension systems was done at TTCI. Colorado Rail developed that car is one of the companies that's being looked at for--and, was involved in the discussions we had when we invited the industry to come in and talk to us. And, so, we will benefit from that knowledge, but we haven't committed to using any particular vendor yet. But, the vendors that provided that car for PFS are on our prospectus for folks that will be involved in the procurements we ultimately do.

KADAK: It would seem that, you know, I don't know how their project is going to progress or not, but they've already done the bulk of the work, and I don't know, you probably want to--

LANTHRUM: We're aware of that. They've only done work on again the cask car. They've done no work on an escort

car. They did no work on bumper cars. And, it's a depressed center car, which is very long. One of the things we're looking at is that is there a possibility of having a flat bed car, which would shorten the car significantly, which gives us a lot more flexibility in terms of routing. And, if we wound up going that way because of the improved flexibility overall, if we can get the performance, the actual in-transit performance out of a flat bed that you can't out of a depressed center car, there would be a lot of reasons for doing that.

KADAK: Okay. In terms of the railroads, and we met with them, I guess the best thing to say about it is they weren't really enthusiastic about this business, because they were making much more money shipping coal and other things.

LANTHRUM: We're not a prime customer.

KADAK: How much of this has been worked with the railroad companies?

LANTHRUM: We've had ongoing discussions with the railroads through both the FRA, in terms of our commitment to use dedicated trains, which is one of the things the railroads wanted very much, because it simplifies the flow through their systems, and greatly simplifies moving our trains through their system. And, also, through the AAR, the Association of American Railroads, and we had a meeting just last summer with four railroads with the AAR, talking about

routing issues, because they have very different concerns than other stakeholders do about how the routing system would be used.

We're not a prime customer. We're not going to be a huge money maker for them. It would be easier for them if we went away. They know we're not going to go away. And, so, they're engaged in having discussions with us about how the system is going to work, and so far, we've made the decisions that will make our shipments, will make them as easy to deal with as possible. And, the decision we made about a year ago to use dedicated trains is one of the things they were pushing for.

KADAK: Okay. In terms of routing decisions, you say you're going to finalize routing criteria by 2007. Now, this map that you also passed out is very helpful, and I'm not a space scientist, but I'm looking at very few options.

LANTHRUM: That's true.

KADAK: And, the process of establishing criteria is, I think, interesting. But, if I'm a Trojan, I've got two options.

LANTHRUM: Right.

KADAK: And, wouldn't it be good to kind of look at each one of those with the railroad companies, really understand railroad safety, and say this is a better route than the other, to get to your point here?

LANTHRUM: There are some shipping sites that have significantly fewer options than others. As you go further east, that map is mostly Class 1 railroads. As you go further east, there is an increasing density of short lines and branch line tracks, and a whole range of other options that are not illustrated on that map. That was in the repository EIS for illustration purposes.

And, so, as you move further east, the question of what your routing options are becomes significantly more complicated. There will be some sites for which the discussion about routing is going to be very simple.

KADAK: Okay. But, I'm really trying to address the process of actually selecting routes. Clearly, you're not going to--you may have to ship some of the heavy materials on routes that are not what you call Class 1 routes, because there's no other way to get to them.

LANTHRUM: Right.

KADAK: But the Class 1 route. But, it would seem to me that if you were able to work with the communities and the railroads, and as you said, sit around a table and put yourself here at Yucca Mountain, and work out, and begin to understand what options there are, and obviously, you have to look at criteria, but you're not going to build new rail lines.

LANTHRUM: No.

KADAK: And, so, the variables are greatly reduced.

LANTHRUM: For sites like Trojan, the discussion is a short discussion. For sites as you move further east, the discussion becomes much more complicated, and the idea of developing the criteria and the methodology before you discuss specific routes becomes much more helpful. We do have both the states and the tribes to the extent they would be affected, and the industry at the table with us having these discussions. And, what we have indicated is the decision on routes will be a Department decision. We're looking for lots of input from people and we'll consider it to the extent that we can. But, it ultimately will be a Department decision.

KADAK: Are you not already rail routes that are qualified for nuclear or perhaps other types of similar materials?

LANTHRUM: There is no specific nuclear qualification for a rail route. What there are is Class 1 railroads. And, Class 1 railroads are equivalent to the interstate system on the highway side of the equation. And, what the railroad routing, since DOT requirements don't directly apply to railroads, because railroad shipments are done all on private land, the railroads own the land under their track, but the criteria that the railroad use for the normal operating practices are very similar to the criteria that DOT uses for

highway shipments. It's minimize the number of interchanges, maximize the use of Class 1 track, minimize the time in transit, and how those all come together is something that we'll have ongoing discussions about. But, there are criteria out there that are very similar in practice to what DOT has for the highway shipments.

KADAK: So, what I was really trying to get at was emergency planning around some of these routes. I was led to believe that there were already some routes that have implemented emergency preparedness for shipments.

LANTHRUM: There probably are. In fact, we're not responsible for creating an emergency preparedness infrastructure. We're required to take the existing emergency preparedness infrastructure and raise it up the level it's needed to be aware of what the interaction would be for our shipments specifically. But, all the states have emergency preparedness, because there's a lot of hazardous materials that are moved currently.

KADAK: Okay, thank you.

GARRICK: Any other questions?

(No response.)

GARRICK: Questions from the Staff?

(No response.)

GARRICK: I didn't mean to scare you with my closing comment before. Please, if you have a question, feel free to

ask it. Any questions from the room?

(No response.)

GARRICK: Okay, well, thank you very much.

LANTHRUM: Thank you.

GARRICK: I guess we'll hear our final presentation for the day from Scott Wade on Yucca Mountain Site Operations.

WADE: Good afternoon. My name is Scott Wade. I'm the Acting Director for the Yucca Mountain Site Operations Office for the Office of Civilian Radioactive Waste Management.

A little orientation of who I am and what I do within the project. I'm currently in charge of all field activities for Yucca Mountain. I was asked by Ward Sproat to step in when John Arthur fell ill in early December, and continued in that role until they ultimately fill the position.

Prior to the May 2006 reorganization of OCRWM, I was the Director of the Office of Facility Operations. I was also in charge of the site. So, I have a little bit of background on the site operations, and I'd like to share that with you today.

What I'd like to talk to you about is what are those site facilities and infrastructure that we manage at the Yucca Mountain site, give you some background and some history on their construction, some of the issues we ran into as we constructed them, and some of those issues we are

managing today. Talk about the Exploratory Studies Facility and its condition. Talk about the underground systems, in particular, the special unique issues they provide us in managing the safe operations of the ESF underground, and, finally, talk about the support utilities of the Yucca Mountain site, some of them we share with the National Nuclear Security Administration, because they administer the Nevada Test Site.

Next slide, please. Now, what are those site facilities and infrastructure? That includes eight miles of tunnel at the Exploratory Studies Facility that we excavated in the Nineties, and the support utilities that allow us to operate it. This includes ventilation, power, water system, waste water systems, fire alarm and detection system, and our underground rail system. We have facilities at both the north and south portal of the ESF.

Now, on top of these, we have the overarching utilities that we require just to occupy that site. These include water, power and roads. We share some facilities that go back to the 1960s that were developed at a previous project on the Nevada Test Site at a location called the central support area. You pass it as you enter the Nevada Test Site en route to Yucca Mountain. And, finally, the boreholes, trenches and test facilities that we monitor and administer at Yucca Mountain.

The tunnel itself was excavated from 1993 to 1998. It's over five miles in length, and consists of a 25 foot diameter tunnel excavated by a tunnel boring machine. When we excavated it, we had anticipated use for that for site characterization of five to ten years. As such, we made some decisions in the Nineties to align an as constructed configuration instead of installing some permanent utilities within it.

For example, instead of running power utilities within conduit, we ran them with durable cable that we strung along the invert wall. We also utilized the existing Nevada Test Site utilities, water and power. Some of these go back to the 1960s, and I will elaborate on them a little bit later.

Next slide, please. The Exploratory Studies Facility, as I mentioned, is a five mile tunnel, 25 foot diameter for the main tunnel. It starts with the north ramp on the left-hand side of the slide here, to what we call the main drift, then to the south ramp. We also excavated in 1998 a two mile cross-drift. It's a smaller diameter tunnel.

Now, as we excavated the ESF, it gave us access to geologic features that we wanted to study closer. That's why we excavated test alcoves. We have a total of eight alcoves, seven in the main tunnel, one in the cross-drift. And, we also have a series of niches. These are really smaller

tunnels that also gave us access to the features we wanted to study.

The current outlook, though, the current site mission is safe and reliable operations, and we plan to extend that for another, at least another five years. This presents us a unique challenge, because if you go back to the initial excavation of the ESF in the Nineties, this could be over 15 plus years. This creates degradation within some of the systems, just from use alone, and I'll talk about some of those systems and their degradation.

It also presents us a challenge, because our documentation of these systems in their as-constructed configuration varies. We have a lot more detail, for example, in ground support. We have less detail on some of the other systems. But, we are committed to safe operations of the facility. So, with everything we have, we have a risk management approach to understand what the risks are for our operations, and mitigate those risks.

We did this by first making sure that we firmly understand the extent of some of the issues we're managing, so we conducted a series of assessments in 2004 and in 2005. We have established both routine and preventative maintenance for all of our underground systems and surface systems, and for those systems where we are not in a condition that we would call preferable, we have established

additional safety mitigations to give us an additional envelope of safe operational limitations.

In this slide, it shows three pictures of the north portal area of the ESF, and I would like to turn and talk a little bit about the surface facilities for a few moments. What you see in the north portal here is a shot that shows both the muck pile, the purple area, it's part of the picture, and some of the temporary structures that we deployed as part of site characterization. These include the muck pile here, over 600,000 cubic yards of muck. This is mined rock that was excavated from the ESF, the tunnel boring operations.

You have the conveyor belt system that brought the muck to the surface. You have the various support structures that include trailers, tent structures, these are rigid frame tent structures that we have both warehousing and craft fabrication activities in, and what we call our Carnack Shops. These are basically sealing containers that are used for our craft fabrication. And, we have two permanent structures, the change house located here, as well as our switch gear building. The change house allows our craft crew at the end of shift to prepare for the bus ride home, as well as our switch gear building, which we have a 4000 volt switch located inside, and last year, we completed half of it as a site information center. It was originally sized for four--

actually, three 4000 volt switches. When we anticipated multiple tunnel boring machine operations, not having a need for that volume of electrical components, we were able to utilize the existing space for both site information center and our mine rescue center.

Shown in the lower pictures are close-ups of some of those facilities. This is, again, what we call Tent 2, and this is one of our trailers. Now, the condition of these facilities, again, they present us different problems. This tent, and the tent that adjoins it, were deployed in 1995. Again, they weren't intended for long-term operation, exposed to the environment, so we actually have degradation of the tent lining structure.

This trailer here is what we call our construction management trailer. It's one of two of them that we have located at the north portal, and they actually came from the Nevada Test Site. They have an early Eighties vintage. They were originally located in Area 3 of the Nevada Test Site. We relocated them out to the north portal in the early Nineties. So, even though you see all this surface structure, not all of them are of recent vintage.

Supporting this is 185 full-time employees, both craft and exempt staff.

Some more pictures of some of the current activities and conditions we have. Now, the craft workers,

as they do their activities to maintain the ESF, and, again, this supports the safe maintenance of the tunnel, have to do a lot of their work in less than desirable conditions.

For example, this is our electrical fabrication area. Craft workers here do most of their fabrication outdoors underneath this awning. I have been out there at times when it is in really, really difficult conditions, you know, in the middle of winter, in the middle of summer, it's less than desirable.

This is our heavy equipment maintenance shop area. These are, again, part of our row of Carnack shops. This is adjacent to the change house. Plumbers and pipe fitters shop area is right here. This area is interesting, too, because just adjacent to it, we had a fire in February of 2006 over a weekend, one of the trailers heaters caught fire. It actually burned down two trailers, one Carnack shop, and took out part of the electrical system that was associated right next to it. So, since February of 2006, we've had limited ability to do heavy equipment maintenance out there. Everything is done off of generators. So, it has given us really special challenges.

One other component, and since I mentioned the fire of 2006, fire response comes from the Nevada Test Site, from a location either in Mercury, which is in Area 23, or what they call Central Control Point, which is in Area 6. Both of

those points are origins for fire response. We're about 45 minutes away. So, even if we engaged the fire alarm at the site, usually by the time something would get out there, most of these trailers and shops would be fully consumed. So, our standard policy, going back to mitigations earlier, is if there's a fire, it's in incipient stage, we train our staff to fight it. If not, we ask them to safely egress the area, and we wait for trained fire fighters to respond.

This is an aerial shot of the ESF. I'll just hit some of those key facilities. Again, there's the muck pile. Now, as we were looking at a range of options to deal with these conditions, we looked at options both constructing new facilities, or replacement facilities in the north portal pad, or we looked at adjacent sites. And, both of those provide special problems. Either of them have advantages or disadvantages.

If we were to construct it on the north portal pad, one of the things that we did not do is complete the north portal pad to its original designed drainage. This goes back to that electrical carnage that I pointed out a little bit earlier. Other times when I've been out there, because the lack of drainage control, you can see site workers standing in puddles of water. They're safe--unfortunately, again, that's far from ideal conditions for our workers to be within.

So, actually, constructing activities and replacements to the north portal pad do not seem desirable. So, what we look at is in proximity to the north portal for a location that we could replace these facilities.

Adjacent to the north portal pad is what we call the lower muck yard. This was grubbed and graded back in the Nineties when we originally intended to extend our conveyor belt system for storage of the muck piles. Originally, this 600,000 cubic yards of muck was going to be put in piles here because we were going to extend the conveyor belt system down this alignment. We didn't end up extending the conveyor belt system, instead stockpiled the muck here, but had this as a grubbed and graded area.

What we proposed in an environmental assessment that we released in July of 2006 is to relocate all of our facilities to this lower muck yard location. This was constructing a new fire station, so we would have on-site fire response capability, as well as craft maintenance areas, heavy equipment maintenance areas to replace the area that burned within the fire, warehousing to replace the tent that's failing, as well as administrative facilities.

This draft environmental assessment was released in July. We got a lot of public comments, and we have addressed those comments and are looking to make a decision shortly on it.

Next slide, please. I'd like to turn to the underground systems within the ESF. One of the main systems we have is the underground rail system. It was, again, installed between 1993 and 1998. The condition of the rail is basically a floating gauge. In essence, there's a TBM advanced, you needed to put in a rail system so you could bring more materials to the tunnel boring machine to support its continued excavation. So, you needed a rail system.

For expediency purposes, what they did is went ahead and on top of the concrete invert, overlaid the rail system and secured it with bolt clips and bolts actually drilled into the concrete invert. Now, as a temporary feature, this is just fine. But, with years of use, considering the vibration of the trains, the actual loads of the trains, this causes the gauge to wander, and it creates continued maintenance challenges for us.

One of the issues we've had most recently, in November, we had actually a rail break. Now, when we talk about a rail break, we were doing our routine starter shift maintenance walk-down, we found this rail, we locked out the rail system and did not utilize it, and we replaced it. But, in order to support this in as-constructed condition requires a great deal of maintenance activities.

However, to make sure that we're managing this for safe operations, we've established these maintenance

activities. We've established a full training and qualification program for our craft that are doing the maintenance on both our rail, as well as our rolling stock, and we've implemented an additional mitigation, keeping the rail speed slower. That's the current condition of the rail.

Next slide. Within the ESF, as the tunnel boring machine advanced, you needed high voltage power system, and it's primarily a 12,000 volt power line. In fact, you can see 12,000 volt cabling. As you've been in the tunnel, you'll see this strung on the right rib of the tunnel. And, this is strung behind the TBM as it advanced. In order to keep the voltage up at consistent levels for tunnel boring machine operation, they deployed at that time what we call mine power centers, or MPCs. These bump up the voltage. These also provide switches and disconnect systems. They're on the right rib of the tunnel.

Now, again, this provided us certain problems. As they advanced, they didn't put these down flat on the rail because of space limitations. However, there's code requirements that our electricians need to be able to respond quickly for maintenance and emergency conditions on the electrical system, so we put on these racks that you see here. But, this creates clearance tolerance issues for our real operations. In fact, some locations within the ESF, you've got less than 12 inches of clearance between the rail

and these platforms. What we do, again, is we've emplaced some mitigation to slow the speed of the trains.

Other alternatives would be, of course, to excavate an alcove, but for right now, this provides us proportionate with our current mission, an acceptable mitigation for sake of operations.

One of the things that is new within the tunnel arose from a 2004 fire hazards analysis. Now, annually, we do a fire hazard analysis update of both our subsurface as well as all of our surface features. This fire hazard analysis, against the code requirements of the National Fire Protection Association, found that we really needed to have some systematic means of detecting any fire event within the tunnel. We made a decision then last year to go ahead and start deploying a fire detection alarm system within the ESF.

We have currently deployed it all the way down the north ramp, throughout the ECRB, throughout the cross-drift, and in Alcove 5. We anticipate extending this throughout the remaining parts of the tunnel, but it is currently operational today, so if you were to have a fire event, it triggers through a panel on the surface, which is then also remotely monitored by the fire station in Mercury. So, if there were an event, we'd be aware of it and would be notified.

This shows actually a picture of the rail I

mentioned earlier, but looking back down the north portal. This is actually the turnout for the cross-drift. What this shows is a couple of neat things. Let me talk for a moment about lighting, and then come back to rail.

Lighting system. We have lighting features strung along the entire length of the tunnel. One of the things that we had is recommendations from the craft workers that they didn't like the configuration of the lighting fixtures. They felt that they were very, very difficult to maintain. They were more subject to failure. We listened to them and we authorized the rework of the lighting system to give more space to the internal configuration of it.

So, as we deployed a fire detection and alarm system down the north ramp, we've also gone back and reconfigured the lighting system, and intend to also continue that throughout the rest of the tunnel.

Now, shown here is actually a really nice section of the tunnel. We completely reworked this switch as part of the rail system last year to give us better confidence in its operation. This is a tight turnout for a switch. Looking back down the north ramp, you also get a sense of what I was talking about on a real configuration. It is a floating gauge, just mounted to this concrete invert that you see attached there.

Ventilation system. In order to go underground,

you've got to have a certain required amount of fresh air supply. So, we have a series of ventilation fans, two primary ventilation fans at the south portal that bring approximately 300,000 cubic feet per minute of ventilation through the tunnel. We also have separate ventilation systems for our visitors alcove, Alcove 2, as well as the cross-drift. I believe this is Fan 3 in the north ramp.

One of the things we did, again, as part of assessments in 2004, we brought in a panel of experts, including experts from NIOSH, to look at our underground operations, to look at our ventilation system, and make some recommendations to us that would give us better operations. And, they strongly recommended that we needed to have a predictive means for fan failure. Now, fan failure doesn't mean fan explosion, fan fallout, or anything. It could just mean breaking of the fan, failure to start up. So, we installed temperature and vibration monitors with all the ventilation fans in 2005 and 2006. We are also looking to potentially replace Fans 10 and 11 at the south portal to give us new fans with lower noise profile, as well as optimal monitoring capability. We'll actually be able to monitor and control those fans from the north portal.

Ground support system. The ground support system is one of our best systems we have out there. It was completed according to its engineering design, with a couple

of minor differences that I'll elaborate upon. What you see in the top picture is ground support in areas of really good competent rock, what you would normally find, again, is the ring lagging in a wire mesh across the crown of the tunnel, primarily for safety reasons. In other areas of the tunnel, particularly as you get near the surface, you have less ground control conditions, so we had more steel lagging, as well as cross-lagging. And, behind here, we had quite a bit of timbering.

We did, as we came out and had assessment again in 2004 that completely looked at all of the ground support components within the tunnel. It provided us some recommendations on some additional ground control we wanted to do, mostly to avoid some maintenance costs. We had 278 Williams rock bolts in the north ramp that were installed in the Nineties that weren't completely grouted in. It wasn't a ground control risk, it just became an operational and maintenance cost because we had to send a work crew out to torsion down a restraining bolt on a frequent basis. So, we took care of those problems.

But, we still have those, what we call eight 3.01X series. One of our ground control specifications was Section 3.01X. This allowed the constructor to use alternate ground control techniques if they ran into bad ground conditions, again, as you're right near the surface of the tunnel, you're

more likely to run into these types of conditions. This allowed them to use timbering, grout, various other things to go ahead and secure the ground. What you don't want to lose is contact of the TBM grippers with the surrounding rock wall. So, they needed to take quick action, so they installed various ground control conditions behind this lagging.

Now, it's not a ground control issue, but if you put a lot of timbering in there, if you put hay, if you put excelsior in there for ground contact, it creates a fire load. So, one of the issues that we're ultimately looking to address is lowering the fire load within the tunnel, and this is one of the larger fire load issues if you were to have a fire that would consume part of temporary ground support within a 3.01X area. Again, we have mitigations in place. We have a very, very controlled hot work permit process, such that we don't allow hot work within these areas without a fire watch, and under only certain conditions.

This is a nice picture of the north portal of the ESF looking towards the north portal itself. This is the conveyor belt system that we brought the muck from TBM operations out. Again, that same 2004 assessment pointed out that the conveyor belt system, while fire retardant, was not inflammable. Therefore, it would burn. To lower the fire load, we have been systematically removing the muck conveyor

system within the underground. We have removed all of this conveyor belt system that you see here. We have removed some of it going down the north portal, but we've removed the belt all the way down through the north ramp and in the cross-drift, and intend to continue removing both the belt and support structures.

I'd like to turn to the surface utilities and surface features that support Yucca Mountain operations. One of them is a water well system. Now, Yucca Mountain gets its water from two water wells that were drilled in 1960 supporting the Space Nuclear Propulsion Agency project that was performing in Area 25 of the test site. These are wells J-12 and J-13. The NTS utilizes these same wells. We actually have a line that comes off of the wells and heads up to the north portal supply of potable and non-potable water system.

Some of the challenges that we're facing, though, is these wells were drilled in the Sixties, and they are subject to the wear and tear and aging, as with all water wells of that age. Particular here, just recently, Well J-13 submersible pump failed again after less than a hundred hours of operation. Now, we don't have to pump a lot of water under our current conditions, but that's not very much of an operational duration. And, part of it is because the well itself, its casing is failing. Well J-12 is somewhat better,

because it has been less used, however, its condition is not optimal, and the transfer pump going from J-12 to J-13 is also failing, as well as some of the pipeage.

Now, we have a maintenance agreement with the Nevada Test Site, and they perform all these maintenance activities. But, we need to make sure that we have a reliable water source to meet our current activities. And, this has presented a special challenges that we're looking at. One of the things that we may do is working with the NTS, seek to replace one of the wells with a new water well immediately adjacent, very common within well systems, that you can redrill a new well within 50 or 100 feet of your existing well.

Now, concerning our water use and water rights condition, as you may be aware, in 2002 our temporary water right permits expired for the Yucca Mountain project. We had filed for permanent water rights in the Nineties, gone through hearings with the state engineer, had been denied by the state engineer, and we continue litigation on those permits. But, because of both agreements with district court, as well as with the state engineer's office, we were authorized for a certain amount of water to support status quo. That amounts to 420,000 gallons of potable water per year. Now, this is the amount of water we were able to demonstrate to the court needed for crafts, for their end of

day showers, for facilities at the north portal, and 1.78 million gallons for routine dust control and other surface related activities. We have a network of unpaved roads out there. After storm events, we have to go ahead and regrade those. We need the water for dust control purposes, as required under our air quality permit from the state of Nevada. So, that's the status of our current activities with water.

Coming out of the Nevada Test Site, we go through Gate 510. I'm going to talk in a few minutes about the road systems on the Test Site. This is the guard station at Gate 510. It's a ten by ten foot bullet proof enclosure that is manned by Wackenhut security, the NTS's protective force. We bring all of our work crew through this gate for a couple reasons. One of it is to economize their time in transit. If we were to bring them in through other gates and other routes, it would give them a much longer work day. Secondly, is to economize our maintenance dollars.

I mentioned earlier that we work with the Nevada Test Site on shared assets and utilities on the test site, and one of the features that we have to bear a burden of funding is roads and basic utilities. So, what we try to do is bring all of our access through the Lathrop Wells gate, but this gate does not have much in the way of functionalities. If you go out through this gate, you

already have to have a DOE credential, or be on one of our site access lists. If you forgot your badge, even if you're a site worker and you forgot your badge, you can't go through the gate here. You'd have to go back to Gate 100 in Mercury, which is probably about another 45 miles--45 minutes away by road, about 30 miles as the crow flies.

So, this provided us with a problem. What we've got then, with the next one, if we look at a couple options, including creating additional functionalities at Gate 510. Now, some of the things I didn't mention that were problems for us at Gate 510 is positive site access control. If you've been out to the Nevada Test Site, it's very easy to take a wrong turn and suddenly find yourself in one of the forward areas of the test site wondering which way to turn.

I worked on the Test Site for about five years before coming to work for the Department of Energy, and it's very easy to do. In fact, over the last few years, we've had several occurrences of this, where we've had site workers, visitors, or even Fed. Ex. deliveries that have come out to the site, gotten lost, and we'll get a call from Wackenhut or others saying that they are 35 or 40 miles away on the Test Site wondering where the Yucca Mountain facilities are. So, we want to have positive access control for emergency management egress. We also want to have those badging and security functionalities.

What we propose, and we studied last year, is to put in a new structure out at Gate 510, giving us some of the functionalities that we desire for safe operations. What we conceptualize now is approximately 9,000 square foot facility located at Gate 510. What you see would be existing guard shack about the location of Gate 510 that we would anticipate, supported by a structure. Again, this is proportionate with current site mission. This is not a repository asset. This is, again, just to allow us to track out workers, our load, equipment that arrive at Yucca Mountain in a much better manner. It also allows us to have some better functionalities, including function as a backup emergency operation center.

We've gone out for a DOE direct contract on this, and are currently evaluating proposals on this. So, we'll make some decisions on this shortly.

Speaking of the roads on the Test Site, this is a picture of the Jackass Flats Road that comes from Mercury towards Area 25. It's what I would call, you know, your traditional hill and dale construction technology. In other words, they grubbed it, graded it, they did not put much sub-base on the road, and paved it. And, what you see is the degradation because of wash-out over the road over years. In order to manage this, the NTS has continued to drop the speed limits. In fact, this section of road right here varies in

speeds anywhere from 45 to 35 or less, depending upon exactly how many potholes have arisen.

What we did back in, again, in 2005, we studied all of the roads leading to Yucca Mountain. We had a road engineer come in, look at Jackass Flats Road, Lathrop Wells Road, what we call the Cane Springs Road as well, and the final connection roads going up to the Exploratory Studies Facility, and gave us some recommendations on prioritized maintenance, as well as safety recommendations on the current condition. And, the road engineer was very, very concerned about this road here, so we immediately took steps to move our work force off of this road. We sent them in through another gate immediately, and no longer routinely utilize this road.

But, this road is not terribly different than even some of the existing roads we're using. All were approximately 1960's vintage in construction, and all are suffering from various states of degradation. So, what that environmental assessment proposed in 2006 was a couple of options, including a no-action alternative, but a couple of options for giving us safe and reliable roads.

One option, this was prospective here, this is the edge of the Nevada Test Site, it comes over here. This is U.S. 95. This is the Amargosa Desert area, and the old Lathrop Wells township area. This is the road that comes

into that Gate 510 bulletproof enclosure I mentioned earlier. The draft environmental assessment looked at two options, both completely reconstructing the road all the way around its existing line up to the Exploratory Studies Facility. So, right now, as we bring our work crew in, we bring them around this way. Or developing a new direct route coming towards the ESF.

There's advantages and disadvantages with each of these. The indirect route, I remind folks a great deal of the year, including this time of the year, our work force arrives and departs the site in the dark. By the end of their shift, it's dark, and there's very little lighting out on this road system. So, an indirect route has unique hazards because of its condition. A direct route would be preferable. So, the environmental assessment looks at both of those options.

On roads I mentioned that we have a series of dirt roads, if you've been up on the Yucca Mountain crest, what you would see is a road that comes around here, and comes along this alignment up to the Yucca Mountain crest. This section right here, as an example, has grades that are extremely large, anywhere from 20 to 23 percent grades. But, we still have a responsibility to both maintain this road, to grade this road. We have various scientific activities we perform along this ridge crest. We also have a series of

boreholes we're required to monitor.

So, we looked at a couple options to get our work crews up to the crest in a safer manner. We looked could we reconstruct this road here, and there's no way with the topography around it could we get it to the preferable approximately 8 percent grade we would desire. So, what we found is if you take the existing H Road, now this is the Exploratory Studies Facility right there, this is what we call H Road that you approach the ESF on, the pavement ends about there, it is so graded up to a point of about there, if we added a 1.3 mile section, we could get a new connection to the crest with an 8 percent grade. There's a significant amount of dirt work that you would have to do with this, but there are some distinct advantages for lowering the grade.

Right now, for example, and I'll talk about it in a few minutes, we are putting up some new communication towers to improve our communication capability with the ESF. And, I've been having aggregate brought up this crest road, and it has been a real challenge for these trucks to get up this road because of this grade, also because of some tight turns right here in this location.

So, a direct route to the crest was studied in the environmental assessment. What we'd do would excavate, pave this new section here, as well as chipseal along the crest. One other advantage we would have here is this would also

give us a potential second egress from the Yucca Mountain site, because it could connect down with Solitario Canyon. So, if we needed to, we would have ability to egress to the west of Yucca Mountain.

Power system. This is a substation immediately adjacent to the Exploratory Studies Facility. A couple of challenges with that, as well. The NTS power grid, similar to its water system and road, was primarily installed several decades ago. Now, the NTS has, in a prioritized manner, gone through and upgraded all those sections on the Test Site, with the exception of the one that connects to Yucca Mountain. They brought all the voltage up to 138,000 volts, leaving one 69,000 volt section associated with the ESF. This then leaves us with a 69 to 1247 transformer that then transforms the power, and we utilize it for the transformer for operations in the ESF.

A couple of problems this presents us with. We have routine power outages. On a quarterly basis, we have three to four power outages. Some of these are milliseconds, some of these can be multiple hours. This transformer is a single point failure for us. If this transformer fails and the voltage is unique enough from 69k to 1247, we would have to have a new transformer wound. It would be an almost 42 week replacement period. So, our power would be down for 42 weeks.

We're also limited to no more than 10 megawatts of total power. We average around 2 1/2 to 3 megawatts of power, but it provides us a limitation. There's also some cost efficiencies we would like to explore. We currently buy our power through the Nevada Test Site. We would certainly like to get more competitive rates.

So, what that environmental assessment looked at is going to the nearest power provider, Valley Electric. A couple of options are bringing power up to the north portal. Again, for perspective, here is the north portal here. Here is an existing 230,000--I'm sorry--existing 138,000 volt system that runs just along the NTS border, and there is a switch that Valley Electric owns just outside the NTS called Lathrop Wells switch.

We looked at two options. One would bring power along an existing alignment up to the north portal. The other would parallel with site access road option to the north portal. What this would allow us to do is go to Valley Electric, negotiate the utility purchase agreement that would allow them to go and construct that power connection, contingent on certain service agreements, we would have to agree to a multi-year.

Additionally, it would allow us to solve other problem I have. Now, I mentioned the ventilation fans at the south portal. The south portal ventilation fans are supplied

by power that we take all the way through the tunnel. So, every time we want to do maintenance on one of those mine powers, and there's one of those big yellow boxes I showed you earlier, we have to actually shut off all the power in the tunnel, and run the ventilation off of generators. Okay, those generators are constrained by Air Quality Permit limitations by the State of Nevada, which provides us challenges in trying to maintain all of those 13 mine power centers and associated other power equipment. So, a permanent surface power connection in the south portal would also be negotiated in this agreement.

Communication system. What this shows you is in the lower picture, is the muck pile right here. This structure that you see here is shown up in close-up there. This is an analog microwave system that was employed during site characterization. That is actually a notch that we had to cut out in the muck pile, because as we were stacking muck, we actually covered the line of sight line coming from here up to its repeater on Big Skull Mountain.

This has presented a real problem for us. If you go out there and you try to work on your computers, it takes about 30 minutes for your computer to log on. Internet and even Lotus Notes connectivity is extremely slow. We cannot transmit large documents, design documents, over the system, all because of a 1 megabyte operating rig. In fact, we are

even maxed out for phone deployments out there. We have a voice-over IP phone approach. We can't even put new voice-over IP phones out there. And, again, it's a single point failure. If this goes down going up to the Big Skull Mountain, we have no means of communication with the site other than two satellite phones that we keep out there for emergency conditions.

So, what we're doing, and we're actually constructing this right now, is deploying three new communication towers. Okay, here's the north portal area. We're putting a new communication tower on top of Exile Hill, one on the Crest, and another one that goes down to Gate 510. What this will be is a digital microwave transmitter system. We're operating at 40 megabyte transfer rate. We have currently completed both this tower, physical construction, and we're beginning to wire this tower. We've completed almost all of the towers construction at Gate 510, and have just begun pad construction on the Crest tower here.

I mentioned earlier some of the challenges. This has been a real bear to construct, simply because of its location. We anticipate completing this in March of 2007, and I can guarantee you that the site work force will sigh a big sigh of relief when they have this in place.

The last item I wanted to share with you is some of those things in the central support area that we occupy.

This is our sample management facility. These are two approximately 20,000 square foot warehouses that were constructed, again, during the Space Nuclear Propulsion Agency activities in the 1960's. We rehabilitated these warehouses in the Eighties, and we currently store all of our core from our activities at the Yucca Mountain site.

We've had problems because of degradation of these structures. Now, we occupy these under agreement with the Nevada Test Site, but we do all the maintenance on them. For example, on the roof here as we go in to do maintenance on the HVAC systems on the roof, because of roof degradation, we now have to put men in baskets off of cranes as we haul them onto the roof to maintain the HVAC system. So, we're looking at a couple options to replace these. Now, I'm a big believer that you only construct that what you need for your mission, if you could come up with viable other options, pursue those. So, we're looking at potentially leasing an off-site facility to locate our core storage, but, still keeping it within proximity to the Yucca Mountain site to meet our needs.

In summary, we're committed to the safe and reliable operation of the Yucca Mountain site. There's a lot of challenges, but I guarantee, with every one of those challenges, we have analyzed our problems and come up with a mitigation. If it was not safe at the Yucca Mountain site,

we would not allow it to continue to operate.

We completed a draft environmental assessment that allows us to get into a better configuration for our surface facilities and associated surface utilities, and we're looking to make those improvements dependent upon final agency decision on that environmental assessment.

That really completes all of my presentation. I'd be glad to answer any of your questions.

GARRICK: Howard?

ARNOLD: Arnold, Board.

I used to work on that Space Nuclear Propulsion program, and you really make me sad with a lot of your comments. I used to drive that road a lot. The only thing you're missing is occasional herd of tarantulas that would come roaring across that road and make things exciting.

WADE: One of the things that you probably had to run into as well at the time is just the arid conditions out there, whether it be the tarantulas, I have almost stepped on rattle snakes a couple of times, so there's a number of things that remind me it isn't anything but a desert arid condition.

GARRICK: Given that the Exploratory Facility was supposed to have a role in the construction operations, construction activity, why would it not have a longer shelf life than you're implying by your description of how things

have deteriorated?

WADE: I don't want to leave you with the idea that everything is bad, nor that all of the systems are unworkable. They actually create, first and foremost, a maintenance cost because of the degradation of the system. We do have good documentation of ground support. We have differing levels of documentation of the other systems. Ground support would be the most critical one for repository construction activities. We would need to know exactly the ground conditions when we excavated it. The rest of the systems would have limited functionality post-repository construction authorization, would be replaced with new systems.

GARRICK: So, that was the plan all along?

WADE: Yes.

GARRICK: Any other questions from the Board?

(No response.)

GARRICK: Well, thank you very much. How about Staff? Yes?

BARNARD: Bill Barnard, Board Staff.

Scott, if you made all these improvements, how much would it cost?

WADE: I had that same question a few months ago. The estimates, the range, of course, based on local market conditions, one of the things I've really understood quite a

bit is the unique costs because of having to compete with the burgeoning construction areas of Las Vegas. So, the estimates for doing all of those maintenance upgrades, completing all those facilities that I mentioned, new site access road, new electrical system, could range around $60 million.

BARNARD: And, then, what happens if you don't get the money to make these improvements, especially the ones in the ESF.

WADE: The high dollar ones, of course, are the surface related items. The ones in the underground, we're still continuing to prioritize with our funding because of the special hazards. In fact, I should have mentioned as I went through my presentation, after the Sato Mine disaster, one of the first things we get is go back and re-examine things to make sure that we were optimizing our underground activities, and we're looking at options including potentially new deployment of refuge chambers, as well as new communication underground, but, the underground items are prioritized for funding, compared to the surface ones. The underground ones in the neighborhoods of multiple millions, not tens of millions.

BARNARD: Okay, thank you.

GARRICK: Yes, David?

DIODATO: Diodato, Staff.

Scott, thanks for your presentation. In terms of the ESF, you talked about the problems with the infrastructure there, and the rail gauge wandering back and forth, getting skinnier and wider, and then also, you alluded to chunks of track that will be missing that have to be replaced over time as the fracturing and cracking of the tracks occurs. Right now, how many experiments are ongoing underground that you're aware of? And, can you identify them?

WADE: That might be a question better answered by Dr. Dyer. There is a couple of ongoing monitoring equipment, both the laser string gauge in the south ramp, some seismic monitors in Alcove 5. Claudia or Russ, is there others you'd like to identify?

NEWBURY: In addition to the seismic work and the laser string meter, there is still work going on with the drift scale thermal test. We are still finishing up that work. That's about it that's really going on underground right now.

DIODATO: So, the opportunity that other underground experiments would be proposed, is there an impediment to those going forth?

WADE: What we do, though, is we look at--you know, I consider the Office of Chief Scientist, Russ and Claudia, as users of the--they're the customers, I'm trying to meet their expectations. So, they come forward with their requests for

activities in the underground. We then balance them off a plan maintenance activities, and try to be as economical as possible.

Going back to the rail issue, we can operate the rail system, but there's other alternatives we could look at, including going to rubber tired vehicles to allow us to complete anything that they're trying to plan.

NEWBURY: I just wanted to add that there's close operation between the site activities and Office of Chief Scientist. Drew Coleman, who was here earlier, actually was in both organizations for a while. He wore two hats. But, he does work very closely, he's the test coordination person. So, we make sure that we all are talking to each other when it comes time to deploy tests.

DIODATO: Okay. So, one more experiment question. Is there any risk of missing data or is there anything that high risk experiments that are ongoing now where you'd like to get in and collect data, where you see there could be some possibility you won't be able to get in there to get the data from the drift scale test, for example? Or is that going to be a timely thing that just keeps going?

NEWBURY: This is a personal thing, my personal opinion, and that is that I think it's really important to finish the drift scale test. We're in the cool-down phase now. We're in the phase when we were going to do the mine-back, and look

at mineral in-fills in fractures, and where the water went when we actually heated up the drift. And, I think it's very important that we finish that particular piece of work.

DIODATO: And, has that been scheduled? Do you envision--

NEWBURY: It's on the schedule, but it's going to depend on Scott making the underground available to us, and we have to do it safely.

DIODATO: Understood. Okay, thanks. Then, just one question about the water, if it's okay. I know it's the end of the day here, but I appreciate your patience and perseverance.

You talked about, you know, 2.2 million gallons per year for operations and non-potable and drinking water both. So, it's, you know, less than 100 acre feet per year of water you've got a permit for. Now, that's this present time. But, in the future, if you get a license to construct Yucca Mountain, the water requirements might be greater. Do you have an estimate of what those requirements would be? For example, the EIS number?

WADE: The final environmental impact statement looked at a range of water use, estimates based on various construction, durations as well as thermal operating loads for the ESF, and they ranged in the several hundred acre feet per year. Now, we applied for 430 acre feet per year back in

the late Nineties, and we still feel that that balanced our operational needs.

DIODATO: Thank you very much.

GARRICK: Any other questions from the Staff or the Board?

(No response.)

GARRICK: Any questions from the audience?

ELZEFTAWY: Yes, I have a question. Hi, Scott. Atef Elzeftawy from the public.

How does the state engineer monitor the consumption of the water? Does it come with land, do you give them a number, or what do you do?

WADE: As part of agreements we made through both the district court, as well as with the state engineer, we send both--we send a monthly water use report to the state engineer's office. We also send a quarterly water use report to the state engineer's office.

ELZEFTAWY: Who verifies it? Under your signature, or somebody else's signature, or the state comes and sees your meter? Who verifies that you have 10 or 5 or whatever?

WADE: Good question. One thing I wanted to explain, though, is the water that comes up to the Yucca Mountain site comes through a meter, so we have metering measurements. The state has come out and inspected this meter repeatedly. In fact, there is a state inspection of Yucca Mountain site

water system tomorrow.

ELZEFTAWY: Okay, one other question. J-13 and J-12 wells have been in operation since I saw them the first time in 1979. Have you done anything with a structure as far as new pumps, new things been going on, or was that just their goal?

WADE: The NTS still maintains the water wells themselves. The four big tanks, booster pump stations immediately adjacent to the wells, they probably have upgraded those over the years. I couldn't speak to what they've invested. We put in two booster pumps in the late--actually, in the early Nineties, to supply the water going up to the ESF. So, that's, again, a substantive upgrade we made for our support of our activities.

ELZEFTAWY: Thanks.

GARRICK: Okay, any other questions?

(No response.)

GARRICK: That brings us to a very important part--well, thank you, thank you very much--of our meeting, namely, the public comment period. But, before we enter into that phase, I want to thank all of the presenters for an excellent job of complying with the 50/50 rule, half time for presentation, and a half time for discussion. Everybody did an excellent job, and we appreciate that a great deal. Sometimes we don't take our share of the bargain, and use up all the time. But,

we appreciate having the opportunity to do that.

All right, now, we want to move into the public comment phase. I have been given three names that would like to make comments, and I think we'll just take them in the order, and the first one is Dr. Elzeftawy.

ELZEFTAWY: Thank you, Mr. Chairman. On behalf of the Las Vegas Paiute Tribe, we welcome you here in Las Vegas, the Board, the Chairman, and the Staff, and we understand that for those who travel from far east, it takes a long time to travel, and you guys spent here one day, and then you travel back. So, that's sort of messes up your biological system a little bit, but if you're lucky, like your Chairman, who lives either in St. George, or maybe--then you can have a one hour flight, or maybe a couple hour drive. But, welcome here. I think I'd like to leave that with you.

One other comment on behalf of the tribe is that they would like to suggest to the Board that you start to reach out for the local tribes in the Southwest for just a meeting with the tribal members, maybe the Chair people, something like that. That would be beneficial to them, and I think it would be beneficial mostly to you.

The reason I said that is because I witnessed the tribe councils of a couple tribes here in the Southwest who are concerned with the Yucca Mountain meeting with the Chairman of the NRC and a few of the commissioners, and that

was a very, very productive meeting. And, I also know that they meet once in a while with Russ Dyer and the DOE. They have not had any meeting with EPA, either the administrator or any of their staff. They have not had any meeting with you guys, so I think after 20 years of you being here, almost 20 years, 20 years and maybe a couple months, I think that Congress created this Board, it would be nice for you to reach out for the tribal members. They are intelligent people. They are part of this culture, and it's about time for you to do that.

And, I feel very, very, very strongly that at least the Chair would come and see and meet the Chair persons of at least five, six tribes. And, I think that's very, very, very important.

On a personal note, that's my personal questions after 20 years of watching you guys here, I wonder are we doing the same thing as the Board, like our President is doing in the middle east? I have seen the Board meetings, I've read the transcript. I am proud of what I have seen lately. You guys have done a very reasonable job. That was my expectation as a technical person 20 years ago, but I have seen the Board up and down, up and down, and it's hard to get the consensus of all the hot headed egos of all, the professors and all the Ph.D's, and it's not easy to really get together and provide a beautiful letter like we see

lately.

But, I think I give credit to all of you. Thank you for coming, and I give credit especially to the Chair, who thinks that everything about chemistry, I disagree, I think everything is about physics. So, thank you again for coming. That's a personal joke, so thank you for coming, and we appreciate all your effort, and thank you for making it easy.

Again, please come and try to meet the tribal Chair people or the council members at least, and that would be good for you. If you don't have the money, we'll be glad to talk to our Senator Reid on behalf of our tribe. Now, he's in, quote unquote, control a little bit, maybe he will see some idea of getting you some money from the side.

So, thanks again, and good luck to you, and have a good safe trip to your home, and we appreciate your hard work.

GARRICK: Thank you very much, Atef, and we certainly will take your recommendation seriously.

All right, the next name I have is Kirk Lockman.

Okay, well, he can't get out of it now. He's got to make--okay. Okay, how about Michael King? Please give your name, and affiliation, et cetera.

KING: My name is Mike King. I'm a consultant with Inyo County. Been working on Yucca Mountain since '97.

I'm responding based on the answer to the question I presented this morning on the upper gradient in the lower carbonate aquifer. Based on that, I'd like to present the following comments on this.

I assume the license application is going to highlight the value of the natural barriers and engineered barriers to the effectiveness of this repository to work. But, once you pick a site, the natural barriers are pretty well fixed, short of some catastrophic geological event that would change those. But, the one barrier that you do have control over is the gradients in the aquifer or groundwater system.

So, what's the statement, or the problem is, well, you've got--there's people coming, they're coming in hoards and they're coming--the repository near you. They're all thirsty and this area has been allocated, or at least there's a trend towards development of the Amargosa for development. Potential water resources for that development, of course, there's the shallow aquifer system, which is in the model that you're looking at.

There's also the development of the lower carbonate aquifer, which is an incredibly prolific aquifer system, and can provide an adequate source. But, that development has a certain potential of reducing the gradient or reversing the gradients into that system, which we think would then

compromise one of the natural barrier, which you're actually trying to license on. The upper gradient in the lower carbonate does provide a barrier to radionuclide transport. The water is moving up, it's unlikely that radio particles will be moving down into that system.

So, that is the one area that DOE can work on. Now, we've got experience with this in the LA County Water District where they've got a line of wells that they're pumping water in the ground to prevent salt water intrusion from impacting their water development wells. So, there, they've reversed the gradient through mechanical means, in a natural barrier system, to prevent contamination of their water supply. They've also put up buffers, and this type of thing. This is just an example that there are things that DOE can do.

So, what's the point? Well, if I ask the question about a TAD here, I could probably get a stack of papers up to the ceiling with studies and reports on TADs, on how effective they are. I don't feel that we got a very robust response from DOE in regards to this natural barrier, and I don't think there's a lot of studies that support any investigation as to if there is development, or if there's some impact on the gradient in that system.

What is that doing to the Total System Performance of this repository? Can you actually do something to protect

that barrier? In that regard, then you need to look at what are possible mitigations? Do the studies to show that, well, if you develop--then this would be the size of the buffer, the distance you need to protect that barrier.

And, the same token with the Board. We'd like to highlight that. Next week, we're spending quite a bit of DOE's money to drill wells in the lower carbonate in the Death Valley region, and you're welcome to come, but we'd also like you to take up this issue and treat it with the same responsibility of a TAD or any other activities. This is a natural barrier. We think it should be protected. We think that it has value to the project in supporting the license actually.

And, so, we're welcome to show our modelling data and our results to the Board. Dr. Bruderhoff, my partner, has just done a model where he took the regional model of the USGS, isolated the lower carbonate aquifer, and then did the transport model through that. Groundwater velocities to that system from Yucca Mountain to Death Valley were 50 to 500 year range, depending on some assumptions in the model. We think we should look at that and have some open discussion about those results and see how that fits into the Total System Performance.

Thank you.

GARRICK: Thank you very much, Michael, for your

comment. And, I apologize for mispronouncing your name. I read the "g" as an "s".

Okay, we have one more. Ed Mueller?

MUELLER: My name is Ed Mueller, Esmeralda County, Repository Oversight Program Director. And, just for the record, realizing that--this is in regards to transportation, the rail route--realizing that Caliente is still the main corridor as far as DOE's decisions go, but there's a possibility that there will be a record of decision to include the Mina Route, and we know that we have the scoping meetings for the Mina Route, and the preliminary EIS work that's going on, but Esmeralda County has gone on record as if the Mina Route was to come through Esmeralda County, come down from Northern Nevada, that it should be a through north/south rail route, and we really want to get that on the record. We feel that that's important. And, also, it must be a shared use railroad.

As far as putting a dead end railroad to Yucca Mountain from the north through rural Nevada, you don't have much support at all in the rural Nevada areas and the other counties. So, I think it's important that we consider that, that you know that.

And, with that said, when you look at the graphic that Gary had up there, the graphic indication, national routing implications of corridor selection, and he says that

the Carlin Route would be equal to the Mina Route. Well, I think if you take this chart and you show it as a through route where you could either come from the south or the north, that this whole chart would completely change, and it would have an enormous amount of change on some of these cities and other places.

So, I think that should be considered also in the planning for the Mina Route, to show it as a through north/south route, and see what that would do with this chart.

I just wanted to share that with you and hope that you will consider that in your future. Thank you.

GARRICK: Thank you. Thank you very much.

Any other comments?

(No response.)

GARRICK: I have a logistics announcement to make to the Board with respect to how you're going to get to the airport. I am told that the hotel has agreed to make two trips in our behalf, beginning at 6:00 p.m., and that you should be in the lobby and ready to go at--no? Pardon?

BARNARD: She's trying to change the time to 5:15.

GARRICK: Oh, I'm not up to date. Okay, 5:15 then. So, if it's going to leave at 5:15, they should be there about 5:10; is that what you're saying? All right, and there will be arrangements made for two trips, so that everybody will be

sure to get there on time.

So, if there's no further matters, or business to be taken up, I declare the meeting adjourned. And, thank you very much.

(Whereupon, the meeting was concluded.)