U.S. DEPARTMENT OF ENERGY

NUCLEAR WASTE TECHNICAL REVIEW BOARD

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NUCLEAR WASTE TECHNICAL REVIEW BOARD MEETING

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Room 1E-245
Forrestal Building
1000 Independence Avenue, S.W.
Washington, D.C.

Tuesday, March 7, 1989
9:30 a.m.

EXECUTIVE COURT REPORTERS
(301) 565-0064

BOARD MEMBERS PRESENT:

DR. DON U. DEERE, Chairman

DR. CLARENCE R. ALLEN

DR. JOHN E. CANTLON

DR. MELVIN W. CARTER

DR. WILLIAM COONS, Executive Director

DR. DONALD LANGMUIR

DR. D. WARNER NORTH

DR. DENNIS L. PRICE

DR. ELLIS D. VERINK

DEPARTMENT OF ENERGY ATTENDEES:

TOM ISAACS

SAM ROUSSO, Acting Director, OCRWM

JIM CARLSON

C O N T E N T S

P R O C E E D I N G S

(9:30 a.m.)

(Introduction by Chairman Deere followed by a brief presentation by Mr. Rousso.)

(9:40 a.m.)

Program History and Organization

Presentation by T. Isaacs

MR. ISAACS: Let me just say on the record welcome once again. I was about to start by telling you what is the ultimate objective of this program. I think it is important to understand where the goal line is.

That is, that we are working on a program to permanently dispose of the high-level radioactive waste and spent nuclear fuel, and that spent nuclear fuel is that waste that comes out of the production of nuclear energy from nuclear power plants, into a permanent deep geologic disposal which will effectively isolate that waste from mankind's environment for very, very long periods of time. We will be talking more about that later.

I think it is important to recognize that when we talk about high-level waste, we tend to use that term to cover both spent nuclear fuel from nuclear power plants and high-level wastes that are produced principally from activities that have gone on in the national defense area.

Most of those wastes currently are in liquid form in

tanks. That waste would ultimately be vitrified or glassified into glass logs and also put into a deep geologic repository.

The principal focus I would say is on the spent nuclear fuel from nuclear power plants. That fuel is gathering in storage pools at over 100 nuclear plants around the country today.

There is currently something over 15,000 metric tons of it and it is growing at a rate of something like 1,500, 1,600 metric tons a year and expected to be over 40,000 metric tons by the turn of the century.

It is important to recognize that a lot of those nuclear power plants, when they were built, did not foresee the fact that they would have to store spent nuclear fuel for the lifetime of those facilities, which is often 30 years or more, and therefore, their spent fuel pools were limited in size, and we expect a fairly large number of those reactors are going to run out of spent fuel storage at site and they are going to have to do something about it.

They are either going to have to expand their pools or they are going to have to come up with some concept of dry storage on site. One of the principal driving forces for this program, of course, is to solve the problem.

I think it is also important to recognize -- and I will go into this in a bit more detail -- that the law is principally driven by a responsibility by this generation to

solve the problem that this generation created.

Therefore, the emphasis on schedule and the emphasis on permanent solutions to the problem derives from the fact that we have got this waste gathering at nuclear power plants -- I am going to talk a bit about it in just a moment -- and that that waste needs a permanent solution, and we need to have confidence in this country that we can indeed develop a permanent solution.

Let me suggest what the overall policies in conducting this program are and I think they are important to recognize.

One is that the preeminent objective is to protect the public health and safety and the environment. We have got to do this program in a way in which that is the key number one objective.

Given the controversial nature of this program, and the great degree of difficulty in the conduct of this program, it is also reflected in the law and in our program that this program be conducted in a very open manner and that we provide as well as possible, not only information to people who are interested in this program, but opportunities for participation.

The balance between a need to solve this problem in a reasonable time frame and a need for participation by people who are obviously affected and interested and concerned about

this program, provides for a very difficult balancing act for the program.

I am going to go through in some detail the history of what it has been like to date, because I think it is important that you understand what we are trying to accomplish here in terms of both public acceptance, acceptability of a process by which one takes waste from around the country and essentially puts it in one or two places, along with the need to ultimately, in a timely fashion, demonstrate that the Federal Government is going to solve the problem and solve it in a timely way.

DR. CARTER: Tom, could I ask you a question. I believe DOE has authorized us to also store civilian fuel for some period of time in limited quantities, is that true?

MR. ISAACS: Yes.

DR. CARTER: Are you going to get into that aspect of the program?

MR. ISAACS: I was going to mention it a bit earlier. That is called Federal Interim Storage. It is part of the Act and the provision is for only up to 1,900 metric tons at a maximum.

That was considered to be only in the case of, shall we say, something approaching an emergency by a utility company that literally might have to face either shutting down or having some of its fuel offloaded.

In order to take advantage of that, the utility would have to requisition to the Department for that. No utility has asked for that yet, since they would have to pay the cost of that temporary storage.

So, at the moment, we are not foreseeing any utilities that will ask for Federal Interim Storage. That is a very important point, namely, that it is expected that the utilities will be responsible for the storage of their spent fuel until the Department of Energy takes title to it and takes it away, whether it is ultimately to a repository directly or to a monitored retrievable storage facility on the way to a repository, something which I will talk about in the future.

So, I talked about the fact that public health and safety is important, the environment. I have talked about the fact this has to be an open program. The other thing is that this program has to be conducted in a cost effective way and in a way that those who are responsible for producing the waste are financially responsible for the cost of the program.

As I will talk about later, you will see that the funding of this program comes from a fee of 1 mil per kilowatt hour levied against the producers of electricity through nuclear energy, and a comparable fee will be established for our defense program colleagues to pay for the program.

Having set those as the overall framework for the

conduct of our program, we have four key objectives that I think tend to focus where we are headed in this program.

One is timely disposal. I have already spoken about that a bit. Namely, that it is important that we demonstrate as early as possible that the Federal Government can indeed dispose of this waste.

By "dispose" I mean emplacement in a deep geologic repository that has been shown, demonstrated, and licensed to isolate that waste in an effective way for very, very long periods of time and in accordance with the Federal regulations of the EPA and, in particular, the Nuclear Regulatory Commission regulations, because this will be licensed by them.

Secondly, a close corollary objective to timely disposal, that is, emplacement, is the fact that we have to start taking this waste in a timely way and at a reasonable rate. It is not enough to simply take a fuel element at some point in time and stick it in the ground.

As I talked about the problem with regard to nuclear utilities, it is also an important objective that we begin to take the waste, not necessarily emplace the waste, also very early -- they are obviously connected, but there may be reasons to consider those as separate objectives -- and that we take it at a rate that will start to reduce the onus on utilities to store this waste at their power plant.

The third objective is schedule confidence. This is

a first of a kind, shall we say in a sense one of a kind, highly controversial program. It has been very difficult to build confidence into our schedules, but it should be obvious I think for a lot of reasons why we have got to start to try and build some confidence into our schedules.

Utilities have to plan and the Congress and the public need to have some confidence that this program is going to work and this program is going to solve it. So we are working very hard to institute a program that will build confidence into the schedules of this very difficult program.

Lastly, something that I tend to talk about long and hard is system flexibility. I think it is a mistake to think that in a program like this, you can push a button. This program, even if it stays on schedule, will last 80 or 90 years.

By the time we characterize this site, license it, build it, put waste in for 25 or 30 years and have a retrievability period of 50 years afterward, we are talking about a long program.

The idea that you could put a program plan in place today, push a button, and expect it to work for 90 years, is just not the way the real world works.

Therefore, building flexibility in to meet an uncertain future is a virtue to the program, and we believe it is important, and we are going to do some enhanced contingency

and strategic planning to try and understand how best to operate in that very uncertain future world.

Could I have the next slide, please.

I certainly do not want to do the obvious, but I think it is worth spending just a minute to say where is this stuff coming from.

What we are talking about with high-level waste, since in this country the current situation is that we are not reprocessing spent nuclear fuel from power plants, as had been expected when the nuclear industry first was started in the '60s and '70s, we are talking principally about the used or spent nuclear fuel that comes out of nuclear power plants.

As you are not doubt aware, this uranium comes from the ground, it is mined and milled. It is then converted into uranium hexafluoride, and through an enrichment process, which in this country is essentially gaseous diffusion plants, that uranium which is 7/10ths of a percent U235 when it comes out of the ground is enriched to some 3 percent or so, and made in a fuel fabrication facility into fuel elements.

These are cylindrical elements covered by some kind of metals, zercalloys or steel depending on the type of reactor you are talking about. The uranium is put into pellets, into rods inside of that. Those form the fuel for the nuclear power plant.

Those are then put into a power plant. They reside

in nuclear power plants for something like three years. Usually a third of a core of the nuclear power plant is changed out every three years. It comes out of the nuclear power plant.

At that point in time, it still has a large amount of uranium in it. It has produced plutonium through the fissioning of uranium and it has a number of fission products that are the result of the nuclear chain reaction.

That makes that fuel highly radioactive and through the buildup of the fission products, it gets poisoned. That is, it is no longer efficient to leave that fuel into the reactor. It was always envisioned that we would take the fuel out of there since there is still lots of uranium and usable plutonium in it, and recycle it, reprocess it, recycle it back into reactors.

Economically and for policy reasons, that has not turned out to be the case in this country. So the spent fuel rods are sitting in reactor pools at over 100 reactors around the country and continues to build up there until we have a solution to the problem.

We are not precluded from reprocessing this fuel, but there are no current plans, and our baseline in the development of our repository assumes that there will not be renewed reprocessing, but it does not preclude it.

Were there at some point in the future to be

reprocessing, we could still take the vitrified waste that would ultimately come out of the process.

Could I have the next slide, please, Jim.

Just to give you some idea of where we are, something like 18 percent of the total electricity of the United States is produced through nuclear power today. It is not evenly distributed around the country.

As you can see, some states, particularly in the Midwest and in New England, have a large percentage of their electricity from nuclear power, others less so, some states not at all.

Thirty-seven states in this country use at least some nuclear power to generate their electricity. I think it is important to recognize, therefore, that it is a national program, but that the principal use of nuclear power is in the eastern part of the country.

If I could have the next slide, please.

I mentioned briefly earlier about the cumulation of spent fuel. This chart gives you an idea. Obviously, the farther you go out in time, the more speculative it becomes as to how much spent fuel we will be handling, because then one gets into the question of whether there will be new orders of nuclear power plants or not.

There have been no new orders of nuclear power plants for many years now, for something like 10 years, and I

am not aware of any near-term plans for any utility to order one.

Nonetheless, when we look at a program like this one which will span many decades, the revitalization of the nuclear industry is certainly a possibility, and this program would have to be prepared to adjust itself to handle that, as well.

As I mentioned earlier, we have now approaching 20,000 metric tons of spent nuclear fuel in storage pools. That is expected to grow to something over 40,000 by the time a repository would be in operation.

I should mention the current schedule -- which I will return to -- is to have a repository open for business in the year 2003. Based on our current projections, if there were no new orders of nuclear power plants in this country, there would be somewhere between 85-, 90,000 metric tons of spent nuclear fuel produced by just the current existing nuclear power plants in their lifetime.

I should hasten to add that there would be, in addition to that, defense high-level waste that would be the equivalent of something like 8- to 12,000 metric tons through the year 2020 that we would also expect to take as part of the scope of this program.

DR. LANGMUIR: Tom, in that connection, how does the WIPP site fit into this picture, since that is currently where

the defense wastes are supposedly going to go?

MR. ISAACS: Very good question. The WIPP site is the waste isolation pilot plant in New Mexico, and it will not take any high-level radioactive waste.

It will take what is called transuranic waste, which is a mid-category of waste between low-level waste which can be taken care of by states in compacts and landfills or however, and high-level waste, all of which will go by definition into the repository.

So things like glubs and other kinds of wastes that have long-lived wastes associated with them, which are transuranic in nature, will go into WIPP. That is all that will go into WIPP. So there is a fairly clean distinction.

The place where it gets blurred is that the definition of high-level waste right now is by source if you look at the regulation. High-level waste is spent nuclear fuel that comes out of power plants or, if it is reprocessed, it is the first waste stream from that process.

One would then look to something comparable in defense waste. If the definition were to be changed by NRC -- and they are readdressing the definition -- that could have some impact on what would go to WIPP and us, but I think there is a fairly clear line. High-level waste goes to the geologic repository here, transuranic waste to WIPP.

DR. CARTER: Tom, I wonder, is somebody going to

address the problem of where we are now in terms of storage at the moment at the various reactor sites and the storage that is going to be needed prior to the time that the repository is in operation?

MR. ISAACS: Yes. We will be going into that in a fair amount of additional detail later. I will also tell you a little bit about it right now.

The other thing I would refer you to is the Department is just now publishing the final version of a report that was requested in the Amendments Act at the same time this Technical Review Board was established, called The Dry Cask Storage Report, which is a comprehensive report that the Department put together which addresses exactly that subject of where are we, reactor by reactor, in terms of the problems that are associated with the storage.

Let me say that right now there are projects underway. In some cases, the Department, our program is in cooperation with utilities to demonstrate dry cask storage capability at reactor sites. There are a limited number of sites right now that are starting to run into some difficulty.

However, I think it is fair to say that as we look into the '90s, and into the early part of the next century, something like half of the nuclear power plants in this country are scheduled to run into storage problems.

How many exactly and to what extent is a parameter

that has to be evaluated based on a number of assumptions about how quickly does our problem come onboard, whether or not we are able to build a monitored retrievable storage facility early and start to take the fuel, whether or not utilities go to extended burnup, that is, leave the fuel in the reactors longer.

But you can expect that under any circumstances, a large number of the power plants in this country are going to run out of room in their spent fuel storage pools even if they rerack them, so that they can take as much fuel as possible, and that they are going to have to start going to some concept of dry cask storage on sites in most cases.

Could I have the next slide, please.

Now, what I would like to go through in perhaps a little more detail than you might suspect is the history of the program. I am going to take the liberty of doing that because I think it is very important to understand the context of this program.

The tortured path that has gotten us to where we are has a lot off insights in it for how we are to conduct ourselves in the future, I believe, and I think it is important to recognize that.

Could I have the next slide, please.

Let me start by saying, as you can see from this viewgraph here, that this is not a new subject, that since at

least the mid-fifties, the concern over what was going to be done with these high-level radioactive wastes that would come from the nuclear fuel cycle was a concern that was on many people's minds.

As early as 1957, the Committee of the National Academy of Sciences reported that they felt that deep geologic disposal was indeed a viable concept and, in fact, at that point in time, they felt that disposal in salt was the most promising geologic media for ultimate permanent isolation of the waste.

That was followed in the early '60s -- I am going to hit selective parts of this history -- by an evaluation --

DR. ALLEN: At what time did we first start producing nuclear power?

MR. ISAACS: Commercial nuclear power? I think shipping port came onto line just about 1957 is my recollection. Everyone is shaking their head yes, so within that time frame.

Of course, we were also producing high-level waste at the same time, but we have to recognize the context of the cold war and the situation in which we were conducting our program at the time, and we did have those wastes being stored.

It is also important to recognize that in the 1950's and 1960's, there was every expectation that this fuel would

be reprocessed. So one made the case why go forward, rushing to a geologic repository or any other method of permanent disposal before you had reprocessed the waste, taken away the fission products, vitrified that, and put it into the ground.

I think the answer back then would have been -- why not a repository -- would have been we are not ready for one yet, but I think that was a good technical decision in retrospect.

We can all question whether or not from a sociological point of view or from a public policy point of view whether that was the correct decision, but it is easy for us to shoot from the future.

In 1962, therefore, the USGS, who has been a principal and a consistent player in this ballgame, evaluated over 200 salt domes throughout Texas, Louisiana, and Mississippi for possibility of viable sites for disposal of the wastes, so that was the beginning of a siting effort.

I think it is important to recognize as we go through this that the way this public policy in this country has gone for the last 30 years, it was not one single siting effort at any one point in time, but the sites that we came to came from a variety of movement within the program back and forth and I am going to describe that.

But the first identification was of a number of sites of salt domes that were considered, and in fact, at

about that point in time, the Atomic Energy Commission started project Salt Vault to take a look and actually did dig a research facility in a salt mine in Kansas to determine whether or not there is technical suitability and what the characteristics would be of such a site.

At that point in time, the Atomic Energy Commission later, after the project Salt Vault which was quite successful, designated a site in Lyons, Kansas as a demonstration facility for a repository, and the Atomic Energy Commission committed to a Federal repository as the ultimate solution.

There were other solutions that people have considered all along, and I will talk about some of those later, but they had committed to it. Then, for a variety of technical and some political reasons, the repository progress in Lyons, Kansas was stopped and the Department closed that demonstration.

There were a number of difficulties with the site that were found, perhaps because of the fast track that facility was on. There were also some political problems. So the repository program at Lyons, Kansas ended without much success.

At that point in time, it was recognized that the development of a repository was not going to be an easy process.

So, at that time in 1972, the Atomic Energy Commission did two things in parallel. One, it said let's take a look at a wider variety of potential repository sites and potential repository media, that it is not necessarily true that salt is the only viable one.

In fact, the American Physics Society had recommended that we look at other sites -- they felt that there were other media besides salt that might prove equally or more attractive -- and that we perhaps adopt a slower track toward development of a repository.

At the same time, the Atomic Energy Commission proposed what was called the retrievable surface storage facility which, as the name implies, would have been an at-grade facility to take the spent nuclear fuel and store it for a very long period of time, decades, while a deliberate, longer term process for developing a repository was put into place.

In fact, a couple of years later an environmental impact statement was put out by the Atomic Energy Commission. It is important to recognize that did not go over real well.

The reason it did not go over real well was a political reaction that said that focusing on a temporary solution to the ultimate disposal of high-level nuclear waste was not satisfactory by itself, that coming up with this RSSF and putting the repository on the back burner was not an

acceptable solution because this generation had a responsibility to show that it could solve the problem, number one.

Number two, if we were going to continue with the viability of the nuclear energy options in this country, we had to show that we could close the fuel cycle, and closing the fuel cycle means that you have got a way to dispose of the waste, and disposing of waste meant permanent isolation, because this waste is radioactive for thousands of years.

That is the key issue here. If it weren't radioactive for thousands of years, this problem would be a traditional engineering project and we would not be sitting around this table today.

That is the key issue in technical terms. In political terms, it is the siting issue, where are you going to put it. We are going to talk about that quite a bit.

So, the negative reaction to the RSSF's occurred at a time when the Atomic Energy Commission was then reorganized into the Energy Research and Development Administration, and because of that reaction, the environmental impact statement was withdrawn and ERDA created what was called the Geologic Disposal Evaluation Program, to once again look at the possibility of permanent geologic repositories as the principal priority of the program.

At that time, ERDA announced what today must look

like a very optimistic program to search in 36 states to site six ultimate commercial repositories and created a national program.

I don't think it should be any surprise to any of you what the political reaction was to that kind of a concept. The siting of a repository or of anything nuclear back then, as now, is a very difficult thing to accomplish.

It is the principal institutional concern that people have, the "not-in-my-backyard" syndrome is certainly at the highest level in a program such as this, and so there were great difficulties in implementing that program, great political reaction.

Following that, ERDA was reorganized into the current Department of Energy. Once again, the Department of Energy said we should go to what was then characterized as an away from reactor storage concept, very much like the RSSF concept that was attempted several years earlier and with similar results I might add.

The idea of going with a temporary storage solution and foregoing a priority focus on actual geologic disposal did not sit real well with people.

At that same point in time, President Carter formed an Interagency Review Group made up of the key officials from a number of cabinet agencies to review the entire waste management program.

At the same time, the General Accounting Office recommended that the Department, which had been largely looking at sites in salt up until that point in time, also ought to take a look at some of its own Federal reservations, where perhaps there were already large pieces of land that were under Federal jurisdiction, that were already being used in nuclear-related activities, and therefore might have already been in some senses withdrawn from the general public use and there might be some more acceptability if we went to such sites.

So the Department started to review some of its own locations, and that is how the sites at Yucca Mountain, where we are currently focused, and at Hanford, Washington, were ultimately brought into the siting process, was through that General Accounting Office.

I might add at that time that the NRC then initiated due to a lawsuit what was called the Waste Confidence Rulemaking, which was a lawsuit brought which essentially said the NRC should not continue to license new nuclear power plants if there is no confidence that there will be an ultimate solution to the nuclear waste problem.

The NRC went through a number of hearings and analyses and came out, in 1984, with a statement that there was confidence that the problem could be solved, but they are required to readdress that waste confidence every five years,

which means that this year we can expect the NRC to once again address the issue of whether or not there is such confidence.

If I could have the next slide.

Well, this Interagency Review Group recommended something that came very close to what the law ultimately put down. They recommended that we put primary emphasis once again on geologic disposal after we characterize four or five sites and two or three different types of rock types.

At the same time, a generic environmental impact statement was put out by the Department which looked at a variety of ways of solving this problem and also endorsed the fact that disposal in a stable geologic formation deep in the earth seemed to make the most sense.

This was followed by President Reagan lifting a ban on reprocessing that had been placed by President Carter, but of course, for economic and industrial reasons, there was no rush by the industry in this country, nor has there been, to reprocess fuel.

Economically, it does not make a whole lot of sense with a relatively quiet nuclear energy industry to reprocess the fuel. It becomes much more attractive if there is a growing nuclear industry in this country to reprocess the fuel to get that excess uranium and plutonium out.

There is more than enough uranium sitting around now to take care of the fuel needs of this country given the fact

that we have no new power plants.

At this point in time was when the Congress decided to start looking seriously at the development of a new law to bring together this very, very difficult problem.

I think it should be obvious to you -- and the reason I have taken this time -- is to try and show you the swings that have occurred over the last 30 years between a program that was focused on let's have a geologic repository and let's do it in a timely way, which usually led to great resistance because as soon as you say that, you have got to put it somewhere and it has to be driven to a place that is geologically acceptable.

You can't put a repository just anywhere, because you are going to rely on that natural rock formation to isolate the waste for thousands of years. That is the principal barrier.

People were very, very, very resistant to having a repository sited in their state in particular. Local people often are less concerned, frankly, than state officials are, but there is great political reaction.

On the other hands, we said, well, let's instead try developing a temporary -- temporary meaning perhaps decades or 100 years -- storage facility, and go slow and deliberately on the development of a repository.

That ultimately fell on its nose each time, as well,

because there was a political decision that we are creating the problem in this country, we have an obligation in this generation to solve that problem, and we should not continue to create the waste in this country unless we can demonstrate a viable way of ultimately disposing of it.

That very difficult nut to crack is what caused the Congress to come together and look at this problem. I think it is a fair generalization to say that at that point in time, the Senate was more focused on some kind of retrievable storage facility and a go slow on the repository, and the House was more focused on let's go with a repository on a timely way.

So, the Congress addressed this in 1981, was not able to reach consensus on the law. In 1982, in the eleventh hour of the Congressional season, they passed what has to be considered, I believe, landmark legislation. That is the Nuclear Waste Policy Act of 1982.

It, along with the Amendments Act, are the bible of this program. They are among the most prescriptive laws that I think have ever been written, and I highly recommend it to you to read. It really does form the basis of the framework for our program.

What did that law say? As is often the case -- I think it was a brilliant piece of legislation, by the way -- as is often the case in highly contentious issues, there were

a number of compromises in the program.

First and foremost, however, was the fact that it authorized a waste disposal system, and it authorized a geologic repository, one geologic repository, and it authorized a siting process to get to that one repository.

So the Congress had spoken and said that the principal focus is to develop, in a timely way -- and they put a date in the Act, they put a very, very optimistic, aggressive date, and said you shall begin to accept spent nuclear fuel by 1998 into the law.

It gave us a process and essentially nine sites were grandfathered in as candidate sites for the first repository. Seven of those nine sites were in salt and had come through this process I described earlier, of evaluating salt domes and later salt beds around the country.

Those sites were located in Louisiana, Mississippi, Texas, Utah -- and I am leaving one out --

DR. CANTLON: Michigan?

MR. ISAACS: No, that was the second repository program. Who did I leave out -- Mississippi, Louisiana -- Utah. Thank you. There were salt beds that were later looked at in Texas and Utah, Louisiana and Mississippi, and there were seven sites in those states, plus we had through that process of looking at Federal reservations, come to look at Hanford, in a basalt formation, and Yucca Mountain, which

ultimately we were looking in the tuff formation.

So, those nine sites were grandfathered in and there was a very deliberate process explicitly laid out in the law that said look at those nine sites, develop environmental assessments to evaluate those sites, put together some siting guidelines to determine the relative merits of those sites, and then evaluate them, and nominate five of the nine, and then recommend to the President that we characterize three of the sites for the first repository, and from among those three would come the first repository.

They also told us to the maximum extent practicable, pick sites in different geologic media. Since this was a first of a kind, very difficult program, diversity was a virtue, and it made sense to pick within reason the maximum number of geological rock types, and it said, in fact, and the NRC regulations took that and said don't pick three salt sites.

It seems to make sense, because if you happen to find a generic flaw, then all three sites would have dropped out at once. So it was pretty clear at that point in time that at a minimum one Federal site was going to get picked, had to.

The real question was did you pick two salt sites and one Federal site, or did you pick one of each type of rock and, if so, which.

So, the first repository was authorized, and authorized has a very distinct meaning in Congressional language. It means it is indeed authorized to go forward. It is not a maybe, it is a go forward.

As part of the political compromise, there was a tremendous amount of concern about the fact that most of the waste is generated in the East, and yet most of these repository sites are in the West, and most people felt that somehow the political process would drive the repository to the West.

So, the Congress made an interesting compromise. They said we don't authorize a second repository, but we want you to bring us some sites and we will then decide whether or not to authorize a second repository, and when you site that second repository, you should consider regionality.

Regionality was informally meant that if you are going to put the first repository in the West, you had better damn well think about putting the second repository in the East.

So we began a program to evaluate on a more regional basis, because we had a little bit more time, sites in crystalline or granitic rock for the second repository, and we started to look at regions for the second repository program.

They also put in an interesting link which remains in the law today, which says you cannot put more than 70,000

metric tons of high-level waste into the first repository and unless and until the NRC gives us authorization for a second repository construction.

Since at the time the law was passed, the expectation was that the total amount of waste produced through the year 2020 would be something like 140,000 metric tons, the expectation was in the compromise that there would be 70,000 metric tons put into a first repository and somewhat later 70,000 perhaps metric tons put into a second repository.

At the same time, that law established an office, of which I am a part, and which Sam Rousso is the Acting Director, to run this program, and it created a funding mechanism which I will talk about a little bit later. I have already mentioned a fee to pay for the program.

It mentioned the issue of Federal Interim Storage, which we have already discussed, for those utilities who might get into trouble, and it specified a tremendously comprehensive involvement of affected states and Indian tribes.

It mandates us to involve and participate with those states and affected Indian tribes that would be affected by the program, and they were interested. They were not happy, but they were sure interested in participating in the program.

We gave them millions of dollars in grants to participate in the program, and we held coordinating group

meetings to involve them in the program, and they sued us, and they sued us, and it was a very difficult process.

Certainly, I think if you had the states in front of you -- and some day soon you should have the State of Nevada and its representatives in front of you -- I would say that they would not be as optimistic, shall we say, about the process of this program as perhaps the Department of Energy is.

I think they see some grave concerns on their part, and they certainly feel put upon as part of their program.

Lastly, but not at all least, in another compromise between the idea of a geologic repository and a monitored retrievable storage facility, the Congress said while we authorize a repository and we want you to go forward, and we want you to go forward in a fairly timely way, in an aggressive way, we want you to bring us a proposal for a monitored retrievable storage facility, let's have a compromise, let's look at the need for a monitored retrievable storage facility.

When the Act was passed, most people had in mind a backup in case the repository program didn't work. We knew or we felt very comfortable that we could build some kind of temporary storage facility.

So they asked us to bring forward a proposal for the need for, and the feasibility of, an MRS, and what it would

do. And it said to bring us some sites and some site-specific designs, and bring that proposal to Congress. Congress once again reserved for itself the right to make that decision.

One thing I want to mention. It also allowed in the law that any state or Indian tribe that was designated as the site for such a facility, had the right to file a Notice of Disapproval, essentially a veto of their own state, that could then only be overridden by a majority vote within I think 30 days of both the House and the Senate.

So the Congress worked very hard to try and provide some checks and balances in the system, because they knew through history that siting this facility was going to be a very difficult one.

So we had the 1982 Act passed and we were now in business, shall we say.

Well, the Department of Energy then undertook to do a number of things. I was part of the process, that is just about when I joined the program, so I can tell you, things got very intense during the next five years.

I have often kidded with people, as I did last week, that the five years between the Act and its Amendments were about two things in this program, siting and survival.

That is kind of the way you felt in this program, is where are you going to put this thing and are you going to make this program go, because when you look at the parties

that are involved in this program -- I am going to talk about that in just a minute -- you will see that there is a tremendous number of parties, each of whom has a very sharp and deeply held conviction of where the program ought to be headed, but they aren't the same as the other parties who are involved.

When you look at the states, when you look at the Congress, when you look at the utilities, when you look at the public, it is a very, very intense effort.

What did we do? The first thing we did was we had to put together those siting guidelines I talked about earlier. Those siting guidelines were to identify what factors were important to qualifying or disqualifying a site.

And if a site was qualified, how do you determine relative desirability of sites, what makes one site look better than another, so that we could go through a siting process for both narrowing down the nine sites in the first repository to three for characterization, and take these large areas in 17 states for the second repository and start to focus those down to manageable sizes, as well.

So we started to put together draft siting guidelines, at the same time the Secretary, as required by law, notified the governors of those six states I have just mentioned, Texas, Utah, Louisiana, Mississippi, Nevada, and Washington, that there were nine sites within those six states

that were under consideration as candidates for the first repository.

The siting guidelines, which are 10 CFR 960, and are available, were finished by the Department of Energy and received what at that time was a relatively unique 5-0 affirmation by the Nuclear Regulatory Commission that they were good siting guidelines.

So we were able to get over that hurdle. Then, in 1984, the Department of Energy issued nine draft environmental assessments. Here is one place where the balance between institutional relations and schedule came.

We were not required to put out drafts for public comment or for state comment, but we felt it was the right thing to do. So we took the time to develop nine environmental assessments.

I might add that each of these was about 1,000 pages in length. They evaluated all of the known information on all of the sites.

Those nine environmental assessments were put out for draft comment, and at the same time the Department evaluated those sites based on a preliminary weighting method to try and determine which were the most desirable sites, and that was then published.

We received lots of comments. Not too many people patted us on the back, as you might imagine, for either the

environmental assessments and particularly for the weighting scheme. It was a rather simplified process.

The National Academy of Science Board took the opportunity to tell us that the weighting scheme we used to help us make the decision wasn't too terrific and that we ought to go back and do it in a more dignified way.

That is when I came onto that part of the program, as a matter of fact, and we developed what was known as a multi-attribute utility analysis. We finalized five environmental assessments for the five sites that were going to be nominated. Then, the question was, of those five, which three were we going to recommend.

The nine to five decision was pretty easy, because it said we should pick one from each of the geohydrologic settings. Since there were five geohydrologic settings -- Hanford was one of the five, Yucca Mountain was one of the five, you picked one of the two Utah sites, you picked one of the two Texas sites, and you picked one of three sites in Mississippi and Louisiana.

That decision was fairly easy to make, but then going from five to three was very difficult, and we worked very intensively with the National Academy of Science Board, of which Dr. Allen is a member, and Dr. North was a consultant, to try and develop this multi-attribute utility analysis as an aid to the decision process, because it was a

key one.

We ultimately finalized on that decision. The MUA process I believe was done very credibly. The Secretary had a hard decision to make. No decision was going to be popular. At that time, the political temperature was rising rapidly in all of those states.

The Secretary made a recommendation to the President to characterize three sites: Hanford in Washington, Yucca Mountain in Nevada, and the Deaf Smith County site in Texas.

At the same time, the political imbroglio over the identification of 12 potential sites in 7 eastern states for a second repository started to make the first repository look pretty easy in terms of politics, because they were much highly populated states and people were not happy.

I can tell you that for a fact. A number of people in this room and myself sat in meetings with the public and with elected representatives around the eastern part of this country. Nobody was real happy with the idea of being selected as even a potential candidate for a repository, for the second repository.

It was a very difficult problem and there were a lot of political ramifications. So at the same time that the Secretary recommended to the President three sites for the first repository to be characterized, he announced that he was going to indefinitely postpone continued site-specific work on

finding sites for the second repository.

One, because the amount of spent nuclear fuel that had been expected when the law was passed was going to be much less than had been expected. Since nuclear power was not proceeding with a great deal of growth, there would be much less and therefore, the timing for a second repository was not as urgent.

Secondly, the second repository program and, in fact, the first repository program cost estimates were growing greatly, and he felt there was indeed a lot of money that could be saved, and there was a lot of money that could be saved if indeed we postponed the second repository program.

Well, suffice it to say that members of Congress in the West felt that they had been betrayed. They felt that the political compromise or bargain that had been struck about two repositories was no longer the case, and indeed, we had a tremendous problem with regard to continued operation of this program.

There were numerous, very intensely held points of view both on the Hill and in state governments and among governors and in a number of other places.

Added to this, of course, was the fact that the Department had gone ahead and put forward a proposal for a monitored retrievable storage facility, as we had been required by law.

In that, the Department analyzed the situation and determined that we thought there was a very valuable role that could be played if we had a monitored retrievable storage facility built that was not a backup facility in case we didn't have a repository, but was a facility that would be integrated into the ultimate disposal system.

We felt by building a facility somewhere in the East, near the centroid of reactors, since most of the reactors are in the East, and licensing such a facility, because this facility could be sited in a much more straightforward fashion since it did not have to isolate wastes for thousands for years, but simply had to be a temporary, multi-decade facility, we could begin operation of such a facility, bring the spent nuclear fuel to that facility, do surface preparation operations at that facility early, and then, in dedicated trains and consolidated shipments, ship it across to the West, we thought there were a number of operational benefits, transportation benefits, schedule benefits.

Our proposal put that forward, and by the way, we identified three sites in the State of Tennessee which we thought were just fine as candidates, and we identified a preferred site on the site at Oak Ridge, Tennessee, which had been scheduled to be used by the DOE for the development of the Clinch River breeder reactor, but since that reactor

project had been postponed, we thought that it was already suitable for a nuclear operation, it made a whole lot of sense to us.

The State of Tennessee officially took a very responsible position in evaluating this, but was very much against designation of Tennessee and Tennessee alone as a contender.

They sued us. The proposal was held up in the courts for about a year. It ultimately went to the Supreme Court. The Department of Energy won that case and was allowed to submit its proposal to the Congress, but the State of Tennessee was not happy with the siting.

So, here we have the first repository, we had identified three sites. The second repository had been indefinitely postponed. MRS, we had identified three sites, and we had ourselves one very difficult political institutional, not to say technical, situation on hand.

Could I have the next slide, please.

It just shows you at that point in time what we thought the spent fuel system ought to look like. Authorized is really not quite accurate for this point in time, because the MRS was not authorized, but we felt that the system we ought to have was to take the spent nuclear fuel and the high defense and commercial and high-level waste -- there is a small amount of commercial high-level waste from reprocessing

that was done earlier at West Valley, New York -- and we ought to run that spent nuclear fuel, particularly the eastern fuel, through an MRS and put it into the repository.

If I could have the next slide, please.

This gives you an idea of the concept that we had proposed, namely, that the fuel would be held at the reactors until we could build an MRS facility, that we would build such a facility at the MRS to handle those kinds of functions that I will talk about in more detail tomorrow, and that they would ultimately go to the repository.

In order to prevent the concern for arising again, that somehow the MRS would become a de facto repository -- remember, when we proposed the RSSF away from reactor, both times that was not seen as politically viable, because they were seen as holding actions and not solving the problem -- the Department recommended a couple of linkages between the MRS and the repository to show people that we were not in any way going to slow down the repository program.

So the Department said we volunteer to limit the size of an MRS if one is built to 15,000 metric tons. If you recall, the amount of fuel that is expected to be produced is even today something over 80,000 metric tons, so clearly it was not intended to be a permanent at-reactor, at-surface storage facility.

We also said and we also believe that we should not

begin operation of a monitored retrievable storage facility until we receive construction authorization from the Nuclear Regulatory Commission for the repository.

Namely, we weren't going to start operating this MRS unless and until we knew we had a good site for a repository and we were under construction.

Having said that, it might be a good time to just take a short break. Can we take a five-minute break?

CHAIRMAN DEERE: That would be fine.

MR. ISAACS: When I return, I will talk then about the Amendments that came as a result of where we were at that point in the program, which was at the end of 1987, and then talk about the program itself as it is today.

CHAIRMAN DEERE: Thank you.

(Swearing in of the Presidential Appointees of the Nuclear Waste Technical Review Board.)

MR. ISAACS: I guess I have the privilege of being the first to congratulate you. Welcome to the fray.

Perhaps let me say at this point, since I have gone through an awful lot of information, let me ask if there are any questions before I go into sort of the world as we know it today. Any questions?

CHAIRMAN DEERE: You will go into a little more detail on the 1987 Amendments?

MR. ISAACS: Yes, that is the next thing up, exactly

right.

If I could have the viewgraph, Jim.

Let me just say that we will break at 11:30 for lunch and I would ask that we all keep an eye on the clock to be back here at 12:45. Since the Secretary will be showing up at 1 o'clock, I think it would be very nice if we were all back in time.

If my presentation isn't quite finished, Jerry, I will simply finish it and then we will move right into your part of the agenda as a result of that. I think I have a good shot at finishing it up.

I talked about the world as we knew it in 1987 and the difficulty, and as a result, there were over 30 bills presented on the Hill and a tremendous amount of focus placed on the program. In particular, toward the end of the Congressional season, this became the issue that was holding up the entire Federal budget while they hammered out a compromise.

It was quite clear that there would be an amendment to the Nuclear Waste Policy Act and for the kinds of reasons that I have spoken about which in some sense is reflected on that slide.

If I could have the next slide, please.

On December 22, 1987, the Nuclear Waste Policy Amendments Act was passed. It provided a radical change to

the law that we had been undertaking in the previous five years.

First of all, with regard to the first repository program, where we had recommended that we characterize three sites, the estimates for the characterization of those sites, which were to take five to seven years apiece, was that they were going to cost somewhere between 1- and $2 billion apiece to characterize.

That and the political problems I think led the Congress to decide that we would go forward and characterize one site and one site alone, and they identified yet the Yucca Mountain, Nevada site as the site that the Department was to characterize as the single candidate for the first repository program.

They explicitly told us to terminate our activities at both Hanford, Washington and Deaf Smith County, Texas. So they were very clear on the direction of the first repository program.

They also told us that if for any reason we found that the Yucca Mountain site was unsuitable, we were to go back to Congress within six months with a recommendation as to what to do.

I might add that this obviously increased the risk from a technical point of view of the program. We were no longer going to characterize three sites in this very

difficult, first-of-a-kind program, but only one, and if this Yucca Mountain site turns out for any reasons to be unsuitable, we are going to have a very difficult problem on our hands, no question.

With regard to the second repository, although there was a tremendous amount of furor and criticism of the Department, the Congress ultimately endorsed the decision of the Secretary of Energy and told us to no longer conduct any site-specific activities on a second repository program, and indeed to report back to Congress sometime between the years 2007 and 2010 on the need for such a second repository.

Obviously, they wanted the second repository program put on the shelf and, indeed, to put an additional nail in that coffin, they told us not to do any work that is designed to determine the suitability of crystalline rock as a potential host rock for a repository, crystalline rock being the rock type that was being looked at in the eastern part of the United States.

That did, incidentally, cause us some complications, since much of our international cooperative work is with countries who are looking at crystalline rock. Much of that work continues to be extremely valuable to our program even though we are looking at tuff, and I will describe that briefly.

DR. CARTER: Tom, I wonder if during your

presentation, if someone is going to sort of walk us through two things. One, the political process now for approval of a site for Yucca Mountain.

MR. ISAACS: Yes.

DR. CARTER: And also the political process for rejection of a site. I am not talking about the technical aspects, but primarily the political process.

MR. ISAACS: Let me tell you the political process right now, as I understand it.

There are essentially two tracks for the first repository, but one track looks a whole lot more likely than the other track.

That first track is that we would characterize the Yucca Mountain site. If that site is found to be suitable, licensable, that site would be recommended to the President. We currently expect that would occur sometime like 1995 based on our schedule.

If the President approves that site, that site would go forward to the Congress as the site. The State then has the right --

DR. ALLEN: Go forward, but the Congress still has to approve the site.

MR. ISAACS: Yes. It will go forward as the President's recommended site, at which point the State has the right to issue a Notice of Disapproval. Right now the State

of Nevada says they have every intention of doing such.

If the State of Nevada issues a formal Notice of Disapproval, that can only be overridden if within 30 days, a majority of both houses of Congress vote to overturn that disapproval.

Now, I might add that since the Congress already took the dirty step and the difficult step of picking Nevada, I would say that if the site turns out to be suitable, and we have spent 1- to $2 billion finding that out, that the disapproval by the State, I think most people would say it would be expected that the Congress would certainly at that point override any disapproval, because to not override it would mean that some other state is likely to get the charm.

I am being very honest with you about the political process. The second track, the reason I tell you there is a second track is that there was an Office of the Negotiator identified as part of the Amendments Act, and the Negotiator has the opportunity -- who has not been named yet, he is also to be named by the President -- to seek a volunteer state for a repository and to negotiate a benefits package with that state.

If they were to agree on it, they could bring it to Congress. Congress would still have to change the law in order to make that change. I think if you were to find a host state for a repository quickly, and that is the state that was

going to work with the Department rather than in opposition, you might very well get Congress to consider it seriously.

I think that is not a likely thing to have happen. The Negotiator will also be looking for a volunteer for a monitored retrievable storage facility, however, with either a state or an Indian tribe, and that I think has some reasonable possibility of happening.

DR. CANTLON: Are one and two mutually exclusive, but Nevada rejected, and then opt for volunteering to get the benefits?

MR. ISAACS: Yes, they could. In order to negotiate with the Negotiator, they don't have to necessarily give up their right to disapproval. If they were to negotiate with the Department for a benefits agreement, they would have to give up that right.

So that is certainly possible and the State of Nevada may negotiate with the Negotiator, so they are not exclusive. Good point.

With regard to an MRS, I told you what the Amendments Act did with regard to the first repository, so we are now characterizing the Yucca Mountain site. The second repository, there is no second repository program.

With regard to the monitored retrievable storage, they did an interesting thing. They authorized it. In fact, the Senate -- I would say it is fair to say Senator Bennett

Johnson in particular, who was the leader in the Senate of this process and without which I am sure we would not have had this Amendments Act, he was the leader and incredibly effective I might add.

We were going to have an authorized MRS or we probably weren't going to have a new law. I think that is not overstating the case from Senator Johnson's point of view.

It was authorized. He is a very strong proponent of an MRS and has been all along. At the same time, some new linkages were put in by the House, who was much more skeptical about an MRS and, in particular, by people I would say in the states of Tennessee and South Carolina, who were very concerned because they felt they were targeted for an MRS, linkages that drew much closer between progress in the MRS and progress in the repository. I am going to describe that a little bit later.

So the facility was authorized. Far more linkages were placed that constrained the MRS much more than the Department had volunteered to constrain it, and they established the Monitored Retrievable Storage Commission, which is the three-member commission currently in operation today, which will report back to the Congress by November of this year on the need for a monitored retrievable storage facility.

Presumably, the Congress will take a very close look

at what that commission decides, and even though they have authorized it, I believe that remains to be somewhat uncertain into the program as to whether or not there will be such an MRS facility.

Other key provisions that were in the Nuclear Waste Amendments Act, as you can see there, prominently are yourselves, a board of distinguished scientists and technicians to overview the scientific and technical work of our program, the Negotiator that I just mentioned, and the option for a state or an Indian tribe to form a benefits agreement with the Department of Energy.

Part of the provision in the law is that for them to have such an agreement, they have to waive their right to a Notice of Disapproval, give up their veto essentially.

Even though one might say, well, that is just window dressing in a sense, it is not in the political world, and therefore, the State of Nevada certainly has told us they are not interested in negotiating such a benefits agreement, even though such a benefits agreement has automatic provisions of money that come with it.

If the State of Nevada, for example, were to negotiate today a benefit agreement with us, they would be $10 million a year no strings attached for the duration of the development of the program, and once fuel started to come to the site, $20 million a year for the duration of the program

no strings attached.

That has not been put upon.

Could I have the next slide, please, Jim.

I don't want to dwell on this slide, because I am not crazy about it myself, but it does give you an idea of the wide variety of parties. You can study it at home at your leisure. You can't read it in your book any better than you can read it on the screen.

It just is intended to show you the wide variety of parties who have a vested interest in this. You will find yourselves in the upper righthand quadrant, incidentally, of this chart.

These by no means mean that all groups are equal or have the same degree of involvement, but it does give you an idea of the myriad of groups that are involved in our program.

DR. ALLEN: By what kind of a majority did the Act pass the House and Senate?

MR. ISAACS: That is an interesting question, Clarence. I can't recall it exactly. It passed very, very high, but there were a number of votes to get it out of certain committees that were rather close.

Once the compromise had been reached in the smoke-filled room setting, shall we say, then there was a coalescing around it. All of a sudden it was 49 states who were breathing a sigh of relief, and one state who said what, and

it was a much more unanimous vote.

I would say in the process that led up to that designation, there were a number of close votes, particularly in the Senate itself. There were two competing bills. Senators Johnson and McClure were pushing for a bill that looked something like the ultimate bill here, that was modified.

It did not designate Nevada, but it looked something this. Senators Breaux and Simpson had a different bill that would have had us evaluate these sites for some period of time and then make a selection of one. So there competing bills that went on.

I remember the key vote in the Senate was about two to one, so it wasn't close, but it was much closer -- the final bill passed almost unanimously because we were holding up the entire Federal budget at that point in time.

If I could go to the next slide, Jim.

This is just to give you an idea of the landscape of organizations that have what are characterized there as important regulatory and oversight relationships. I think it is important to recognize that they are all important to us and we see it that way.

I want to emphasize to you that part of my personal responsibility and my group's responsibility -- and I want to tell you that Jim Carlson is the branch chief within which

this responsibility resides on my behalf -- that we are in business and I am in business to support your board.

I take that responsibility very seriously and Jim and his staff do, as well. We are there to work with you, and you are a very important part of our program. Sam Rousso mentioned that and I am sure the Secretary would echo the same kind of comments.

In addition to which, of course, this facility will be licensed by the NRC. We can do the best job possible, and if we can't do it in the way that is going to satisfy the NRC, we are not going to get a license, we are not going to be able to build anything.

So that is very important and you will hear from Ralph Stein and his staff later about our intimate involvement with the Nuclear Regulatory Commission.

The State of Nevada has a number of important groups that are both funded by the Department, we do provide grant funds to the tune of this year $15 million to the State and to the local governments to participate in the program, and also the U.S. General Accounting Office and of course the Congress itself have important regulatory and oversight roles.

Although it is not on this slide, let me hasten to add that the National Academy of Science Board, on which Clarence sits, has had a multi-year intimate involvement in this program. They have been invaluable to us.

I am aware that you all will be meeting with them shortly and that board has a great deal of insight and value to the program, as well, and we value and continue to value their participation, as well.

DR. CARTER: Excuse me, Tom. What about Congressional committees, would you give us some idea of which are the key ones that you work with as far as the repository program?

MR. ISAACS: I would say that the key committees on the Senate side certainly would be Energy and Natural Resources, Environment and Public Works.

On the House side, House Science and Technology and Interior Committee would be the key ones.

Certainly, it would be fair to say that Chairman Udall was considered the father of the Nuclear Waste Policy Act, the 1982 Act, and I would give at least uncleship to Bennett Johnson for the Nuclear Waste Amendments Act.

In terms of key players on the House side, it is Chairman Udall, Mr. Sharp, and certainly the representatives from Nevada have been intimately involved, as have others. I am not trying to exclude anyone.

On the Senate side, Senators Johnson, McClure, Breaux, and Simpson come to my mind as clear people who have had a vested interest, along with again the representatives from the states who are most intimately involved in the

program.

Next slide.

I just wanted to mention briefly, because I think it is very important, that every other major country who is grappling with permanent disposal of high-level waste has chosen the same kind of concept we have, namely, permanent disposal in a deep geologic media.

Different countries have different rock types available to them. They have different schedules and different situations, so you cannot generalize too much. Some countries are reprocessing. Sweden has a plan, for example, to phase out all their nuclear power plants by 2010.

There are a number of different attitudes, but I think it is fair to say that the countries listed there have aggressive programs going on, as well, and as do those international agencies listed at the top there.

We have cooperative bilateral and multilateral arrangements with those countries, and we find those to be very valuable, because in many cases, several of those countries are underground, in research facilities, actually doing work at those facilities right now, developing testing techniques, developing instrumentation, codes, analytical techniques, and so forth.

Our cooperation at the scientist to scientist level is very valuable, in addition to which I might add that I

represent -- I am in the international program, among other things in the program, and I can tell you that at a strategic level, dealing with the leaders of those countries is also extremely valuable.

I would encourage this board before too, too much time goes by, to think about ways of having some insights provided either through a trip to certain key places -- and we would be happy to help you arrange such a thing, or certainly try to meet up with some of the key individuals who are responsible for a lot of those programs.

I am going to skip the next slide for time's sake. It is more of an elaboration on some of our international cooperative efforts, and I would be happy to certainly answer any questions now or later on that.

The next slide, please, Jim.

We don't need to dwell on this since Sam Rousso introduced the offices' principals this morning, but let me just show you the chart. I am Director of the Office of External Relations and Policy on the righthand side there.

I have two divisions under me. Is Dick Blaney here? There is Dick Blaney behind you. He is the Director of my Policy and Program Relations Division. Jim Carlson heads up the branch that is responsible for many key activities, including the care and feeding of this board.

I have an Information Services Division which deals

with Congressional, public, and media type relations. Ginger King, who is not here, is the Division Director of that division.

DR. CARTER: Tom, let me ask you just one question about the international effort, since you are familiar I presume with all of these countries' programs.

Are any of them any more advanced in the repository or a repository program than the U.S.?

MR. ISAACS: That is not an easy question to answer I would say. With regard to repository program, that is, actually permanent disposal, it is important to recognize that most of them have chosen to -- some of them are reprocessing fuel and therefore they are planning on cooling fuel and cooling their wastes.

All of the Europeans are planning on cooling their wastes for more time than we think is necessary or desirable given our public policy. I would say that the one country that comes to my mind that perhaps is on a par with our program would be the Germans who are starting sinking of their shaft at the Gorleben salt facility.

They have chosen the site, Gorleben. It is a salt site. They are actually sinking their shaft. Their schedule is somewhat comparable to ours. Most of the other countries are in various stages of siting agony and will have difficulties of their own, but they don't all operate --

because of cultural and legal situations that are different than ours -- they don't operate quite in the same way we do.

I tend to characterize it, we sort of operate the way that the British did during the American Revolutionary War, you know, we sort of stand up and march, and they shoot us down, and we keep marching and they shoot down.

They are much more sequential and progressive in their approach to things. They don't try and lay out the entire program as we do, and I think they have certain benefits as a result of this more incremental way of approaching problems like this.

But I would say that the Swedes have an outstanding research program. The Canadians have an underground research lab. We are in close cooperation with them. The Swiss, in the Grimsel Pass, have a very impressive facility into the Alps there where they are doing these kinds of tests.

Those countries I would say are also leaders, along -- and the French have identified some sites and are doing some preliminary work, as well -- and I would say those countries are the leaders along with us, but I don't think I would characterize any country as being ahead of us and in some senses I would say we are ahead.

No country has, for example, a site characterization plan that is developed anywhere near to the extent that we do, where we have actually laid out, and I will talk about what we

are trying to accomplish in our characterization program.

CHAIRMAN DEERE: I think that Canada has a goal of about the same time frame that we have.

MR. ISAACS: Yes. Several countries have time frames in about that region, but they haven't yet sited their facility, and that is a major political step to overcome.

Most of there countries -- I don't recall the Canadians' exact goal -- but most of these countries are a few years behind us to a decade or two behind us in terms of when they expect a repository to open -- 2010? 2020 for the Canadians. So that gives you an idea. They are somewhat behind us.

DR. ALLEN: They may be more realistic.

MR. ISAACS: They may be more realistic, it is possible, but we are going to make it.

Next slide, please.

This is just to give you an idea -- and you will need to learn more about this as time goes on -- but I just want to give you a first snapshot of how the Department of Energy currently does business.

With a new Secretary of Energy, we will have to see how we do business in the future, but the Department has operated with this dispersed method of operation for a long, long time, namely, that we have an Office of Civilian Radioactive Waste Management in Headquarters here, which Sam

Rousso is the Acting Director.

We have four Associate Directors -- well, actually, we have Lake Barrett for Quality Assurance, as well -- so, you see those listed down there, Jerry Saltzman, Ralph Stein, myself, and Jim Bresee.

Out in the field at Nevada, we have the Nevada Operations Office under Nick Aquilina. He has autonomy and authority to manage the actual implementation of the work at the Nevada site, and Carl Gertz, who you met earlier, has the Project Manager's job under Nick Aquilina, so he takes administrative direction from Nick Aquilina. He takes technical direction from us.

Now, after having waded through sort of how we got to where we are, let me brief you on the repository program or the entire program.

Three major elements to the program -- the next slide, please -- as I have tried to characterize as we have gone along, one is we want to build a repository, we want to build a facility that will permanently isolate the waste in a deep geologic setting for thousands of years consistent with the regulations.

Secondly, we have the monitored retrievable storage facility, which the Department felt and feels under the right circumstances is still a valuable addition to the program. This is being currently evaluated by the MRS Commission and we

have underway a number of studies ourself right now, after the Amendments Act, to take a look at what the value and the implications are of those changed linkages on the MRS to our facility.

Lastly, the transportation program, which I will talk about briefly.

Next slide, please.

With regard to the repository program, what we have here is a cutaway schematic or cartoon of the Yucca Mountain site. The Yucca Mountain is indeed a mountain. I hope when you go visit there shortly, you will be taken on a site visit.

The actual operation of a repository itself will be very much like a large mining operation. The facility would be underground, would be about a mile by a mile and a half, maybe a couple thousand acres.

At the surface off to the east of the Yucca Mountain site itself would be the surface facilities where the wastes would be brought in principally on railcars, perhaps also by truck, brought into some waste handling and treating facilities, and ultimately taken on a ramp -- maybe you could point to that, Jim -- down into the mountain itself.

Now, during the characterization period, we will not build that ramp, but we will build two exploratory shafts vertically down into the repository horizon, which is about a thousand or 1,200 feet under the Yucca Mountain site itself.

We will then carry out some drifting or tunneling to go to various places to identify the characteristics of that site.

The site is, as I said, about 1,000 feel below the earth's surface and 500 to 1,000 feet above the water table. This is an unsaturated site. The rock type is tuff, which is a type of compacted volcanic ash that was produced 12- to 16 million years ago by volcanic activity.

The above-ground facilities to the east will be about 150 to 400 acres. The repository emplacement period, once it was built and in operation, it is expected would take something like 25 or 30 years.

It is currently designed to hold 70,000 metric tons. We expect an operational emplacement rate ultimately, once we have ramped up, to about 3,000 tons a year, so that operates about 30 years in order to fill the repository.

Unless there are any questions, that is kind of the schematic of what it would look like.

DR. CARTER: Let me ask you one. I presume that the limitation on the amount of material that can be placed is primarily a political decision, the 70,000.

MR. ISAACS: The 70,000, as I mentioned earlier, was I believe a strictly political decision. In fact, the GAO put out a report where they recommended that the Department of Energy look at the ability of the Yucca Mountain site to hold

more than 70,000 metric tons, but we need to take a disciplined look at what is right given the law and the objectives of our program with regard to whether or not we look beyond 70,000.

DR. CARTER: I think that is an important point, though, that that is a political decision, not a technical decision.

MR. ISAACS: In fact, the law today does not preclude the first repository from being either 50,000 metric tons or 150,000. The only thing the law says is you can't put more than 70,000 in unless and until the NRC approves the construction of a second repository.

Of course, that decision will be readdressed early next century presumably when the Department would make its finding.

DR. LANGMUIR: Tom, has there been consideration of what would happen engineeringwise if we went to the 140,000 tons, what size we would go to here overall, would it be a doubling or something less than that?

MR. ISAACS: Yes. Let me start by saying that, as I reflected earlier, when the Act was passed in 1982, the assumption was that through the year 2020, if you took all the commercial waste that would be generated, plus the defense waste, 140,000 was about the amount of waste.

Since that time, our projections have indeed been

coming down. If you look at the amount of waste that we now expect to have generated in that time period, it is more like 100,000 metric tons give or take 10,000 metric tons.

So it has come down considerably from that point in time. The repository spacing is largely heat driven. It is driven more by heat than by amount of material. So if you look at the sizing -- and defense waste is a lot cooler waste, it hasn't been burned up as much, of course, a lot cooler than spent fuel.

So I would say to a first approximation anyway, it will be a linear relationship between the amount of spent fuel that went in there and the amount of surface area that would be required or tunneling that would be required for the repository.

Whether or not Yucca Mountain can hold 100,000 or 110,000 remains to be seen. It was not evaluated based on the need to hold more than 70,000 metric tons.

If I could have the next slide, please.

What is the objective of the repository? I think it is important to recognize that, as I reflected earlier, the key unique feature of this program is that the waste is highly radioactive for thousands of years.

In fact, if you look at the EPA Regulation 40 CFR 191, the effective period from which we have to isolate the waste from man's environment is tagged at 10,000 years, and

they have asked us to look at an order of magnitude beyond that.

So we are talking about trying to identify in a relatively short few years here, an ability of the natural barriers to isolate the waste for many thousands of years.

That is the key unique technical challenge of the program I would say, in addition to which there are regulations that are somewhat redundant, that say we have to design a waste package, an engineered barrier system that itself has to maintain the support, that is called substantially complete containment of the waste for 300 to 1,000 years, and then regulate the release at a slow rate after that point in time.

So there is a combination of regulations which we must meet, that are the combination of the EPA environmental regulations, the NRC safety and isolation regulations, that are the major focus of determining whether or not this site is suitable.

When you look out that long a period of time, of course, you have to bring in a number of disciplines which you gentlemen are experts in. That means we really need to try and understand well the geology, the geochemistry, the hydrology, the tectonics, the climatology, the potential for erosion, and so forth, over thousands of years, in order to demonstrate in a licensing environment that this site is

suitable.

We have a fairly good feeling in the program, whether or not it is shared by others, that we have an intuitive feeling that based on everything we know, this site is a good site. We would not have recommended it for characterization if we didn't.

But that is far different from demonstrating its suitability. That is what the next five to seven years are intended to do, is to demonstrate the ability of this site to isolate that waste to a reasonable degree of risk at least, let's say, because we all know there will be remaining uncertainties and remaining risk.

The other thing that we have to do is design the repository and the engineered barriers itself. The fact that we demonstrate the site is good is not enough itself. We have got to actually build the repository and build the waste packages that will go into the repository.

So that remains the principal objective of the repository program.

The next slide, please.

With regard particularly to the Yucca Mountain site, it has some attributes that were considered to be very favorable. I might add that I believe, frankly, there was a confluence of technical and political benefits to be gained that brought Yucca Mountain to the top.

Based on our environmental assessments, it did look like a very good site. It is in a very arid climate. When you go out there, you will see it is in a very arid climate. They get about 6 inches of rainfall a year, most of which either evaporates or runs off rather quickly.

The ground is unsaturated. It was the only site that was unsaturated of the sites that we were reviewing. Therefore, it is not saturated with water. The welded tuff is a strong rock. We have built in it before. We know how to build in it.

Underneath the tuff layer there is a layer of zeolitic rock which has high absorption capacity. It is between the repository and the water table, and we believe it could play a substantial in retarding the movement of radionuclide should somehow water come in contact with the waste packages.

We believe that the deep water table is also to our advantage. When you look at the engineered barriers, you find that the waste form itself, that is, the spent fuel which are all solids or the vitrified, glassified waste, if you will, tend to resist dissolution, as well, in ground water, and we think that is to our advantage.

The containers that we will build will have to be engineered, and we will have to pick materials that will resist allowing water to have access to the waste itself.

We currently have as a reference system an air gap around our containers which would be put vertically into holes. You drill tunnels and then put holes every so many feet and put these waste packages in there, put an air gap around it.

We believe that the natural heat from the waste packages and the air gap would tend to drive moisture away from the package, so that the amount of water that would come in contact with the package, which is the principal mechanism by which one can conceive of taking waste and moving it back into the accessible environment, would be minimized.

Lastly, from more of what we call a preclosure point of view, that is for the near term, not for thousands of years, but what are we going to do now, the population density out there is exceedingly low.

This is on Federal land and it is exceedingly low population density, and we expect that the impacts both on the environment and on the socioeconomic viability of the area will be minimal.

Nonetheless, we do have monitoring and mitigation programs in place for both the environment and socioeconomics to keep track of impacts of this program, and if there are any things identified that seem to presume that we might provide some significant impacts, we will mitigate them.

The next slide, please.

This is just a schematic of where the site is. It is about 100 miles northwest of Las Vegas. There are a couple of very small towns located some 10 or 15 miles from the site.

The site is all on Federal land, but it lies on land of actually three agencies. Part of it is on the southwest corner of the Nevada test site, Department of Energy land. It is also partially on Air Force land, the Nellis Air Force Range is there, and partially on land of the Bureau of Land Management.

We are right now underway trying to nail down our access to all of that land through a land withdrawal activity.

Well, what is the site characterization program all about? If I could have the next slide, please. I have already mentioned the objectives of site characterization.

I think it is important to recognize that the law required the Department, before proceeding to sink exploratory shafts -- and I might add we will sink two exploratory shafts about 12 feet in diameter and connect them underground, and that will begin the basis of intense site characterization -- that before we do that, we had to issue a site characterization plan and put that plan out for public comment, hold hearings, get comments from the NRC and the State, and then we can begin our actual exploratory shaft drilling which we hope and expect to do at the end of this year.

The site characterization plan was just issued at the very end of last year. It is a monster document. It is on its way, if it hasn't reached all of you, clear your shelf. It is about 6,000 pages long.

We believe it forms the foundation of a very comprehensive program for identifying what needs to happen in this activity.

Next slide, please.

In particular, there is the legislative requirement for the site characterization plan and the need to meet the NRC regulation. But, in addition, if we are going to carry out a 1 1/2 or $2 billion characterization program over seven years, we needed to have a definitive plan in place that identified what information was needed and what tests we needed to carry out in order to get that information.

The next slide.

We have in this plan a very comprehensive description of what we know about that site and what we need to know. We developed what is known as an issues hierarchy, and this will be described to you in greater detail later on, which starts by looking at the NRC regulations and the EPA regulations and asking ourselves what information do we need to know in order to make a solid case and a licensable case that this repository site is suitable.

Flowing down from the issue hierarchy are

descriptions of the information that is needed in order to make that case, and then a description of the tests that we need to run in order to gather the information. So it is a rather comprehensive description of what we need.

Let me hasten to add that at the same time, it has got to be a living document. We all know that when we start a process like this, particularly a first-of-a-kind process, and particularly one in geology and hydrology, and such, where there tend to be surprises, that when we go down there, things will probably not look exactly like we expect they will look and we will have to make adjustments to our test program and to our analysis as we learn.

We will be putting out six-month updates to the site characterization plan, both to describe what we learn as we do the characterization program, and also to describe what adjustments we will be making to the testing program in order to adjust to the things we find as we go down there.

DR. CARTER: What are the schedules for those semiannual updates?

MR. ISAACS: The site characterization plan itself was put out on December 28th of this year and we are hoping to get comments from the NRC, the State, and other interested people, and we will be holding hearings -- if I could have the next slide, please -- holding hearings later this month.

It calls for six-month annual updates of the

characterization plan. Our current schedule I believe is for July for the first six-month update. We would then put them out every six months after that.

So I think you could expect the first update to happen this summer. I might add that with this site characterization plan in place, we would then expect the characterization period to last some five to seven years.

We are currently estimating that we could complete an environmental impact statement by perhaps 1994 and have in place a license application and enough information to feel comfortable that if the site were indeed suitable, we could recommend it to the President as the repository site in 1995.

Now, obviously, these kinds of schedules are very difficult to project. You will find that there are lots of people who want us to move very, very quickly and who feel intense pressure that we get on and solve this problem.

You will find those who think we are moving too quickly and who will criticize the Department for not taking the time necessary. The Department believes that the characterization program that we have laid out, just like, you know, Goldilocks, it is not too long and not too short but just right.

We are going to have to wait and see whether that presumes to be the case. One of the things I can tell you is our assumption all along has been that we would not finish

characterization as such when we recommended the site, but we clearly understood that we would have to do confirmatory testing for a number of years afterward as we continue to both license the site, build the site, and operate it.

So, with that process in place, we would put forward a license application to the NRC in 1995. The NRC has been asked in the law to license the site within three years. So we would hope to have a license application in 1998.

And by developing the repository program in two phases, we believe we would open Phase I for a limited amount of spent fuel acceptance for disposal, namely for about 400 metric tons a year, in the year 2003, and that by perhaps the year 2006 or 2008, we could ramp up to a reasonable rate of something approaching 3,000 metric tons a year.

Any further questions on the repository at this point? You will hear more about this. This is the principal focus of the talks this afternoon and tomorrow morning. So I just wanted to give you a brief once-through.

If I could go to the MRS slide, please, Jim, and I can finish up here rather quickly.

As I mentioned to you, the Department felt, in analyzing the situation, that we could build an MRS facility as an integral part of the repository system, that would have great value in meeting our objectives.

If you look at the objectives that I laid out to

you early in the program, namely, that we want to demonstrate disposal early, but we also want to have spent fuel acceptance early and at a rather healthy rate, so we can start to relieve the utilities of this problem and start to demonstrate to the country and to the Congress and to the people that we are going to solve the problem.

If you believe that schedule confidence is an important factor -- which we do -- and that the flexibility to meet an uncertain future world for the next 20, 30, 40 years are important, we believe those are public policy factors that enhance the desirability of having such a facility as an integral part of the system, namely, a stand-alone facility at the surface that could accept spent fuel from utilities, store it, prepare whatever kinds of pre-emplacement operations were necessary at that facility, consolidate the fuel into unified trains which would then be shipped on a regulated basis with the MRS serving as a buffer capability, so that the repository could be simplified and would simply be licensed as a facility that would receive the fuel, inspect it, do any kinds of operations that were perhaps necessary and emplace it.

That is the Reader's Digest version of the MRS, which I will describe to you in some more detail tomorrow.

DR. CANTLON: Is the military needs for plutonium also a consideration in the MRS?

MR. ISAACS: I would have to say no. There has been

and remains, I believe, a gap in this country between the use of civilian-generated plutonium and the plutonium that would be needed for the weapons program.

This country has not chosen to mingle those for proliferation reasons among others, and I think that there is no driving force on the part of an MRS to hold that waste.

I think it is important to recognize that the law requires that any waste that be put in a repository be retrievable for at least 50 years, so there will be for at least decades the ability to retrieve waste, first, at the surface, because we will not be emplacing all this waste at once.

The last of the waste won't go into the ground until 2030 or 2040 or so. So, it will be there, available for whatever reasons. I think most people would say that you might consider the MRS more in case you change your mind on reprocessing than the use of plutonium in military reactors.

I mentioned to you that the change in the Amendments Act made some significant changes in the MRS program, and it added a number of linkages to it.

First of all, it authorized the MRS, as I mentioned, which we took as a major step forward, but it also told us that our siting, choosing three sites in Tennessee and, in particular, choosing the site in Tennessee at Oak Ridge, was revoked, and that the Department would have to go through a

new siting process.

Once again, it is a dual track. As you asked earlier about the repository, a negotiator could go and look for a volunteer, and if one were available, we could go that way, but the Department has a track even if there is no volunteer, that would require us to begin siting.

Once the MRS Commission has filed its report this year, in November, we could then begin the process of siting a repository. But there are a number of conditions on the license -- if I could have the next slide -- number one, we cannot construct, begin to construct an MRS until we have an authorization to construct the repository.

We are not allowed to put more than 10,000 metric tons of spent fuel into an MRS before the repository is in operation, and at no time could we put more than 15,000 metric tons in.

If the MRS is under operation and for any reason the NRC revokes our license at the repository, or construction stops, we have to stop operation at the MRS.

These clearly were put in there to keep the linkages extremely tight, between progress on a retrievable storage facility and progress on a repository, to keep the concern that an MRS would become a de facto at the surface repository from occurring.

Those linkages are being looked at by the MRS

Commission to see whether or not they make sense. A lot of people will argue on both sides of the issue. A lot of people would argue that these linkages -- and I think there is no question these linkages reduce the potential benefits that an MRS could play in the system --

DR. CARTER: What about the problem of keeping this in sync essentially with the repository program? I don't think that would be a political concern now, whether or not, you know this has got as many political problems almost as the repository itself.

MR. ISAACS: Yes, and I think you are exactly right, and that is why these linkages were placed in there, was to minimize the concern that politics would drive this process in a way that 20 years from today, somebody would have an MRS on site and there would then be no driving force for a repository, and that whoever accepted the MRS as a temporary facility would not be stuck with it for the foreseeable future.

DR. CANTLON: But if something should happen to the MRS, that in no way stops the repository from proceeding?

MR. ISAACS: Correct. And, in fact, the repository program will go forward on the presumption that we are going to have a program whether or not there is an MRS in it.

If I could have the next slide, Jim.

With regard to siting the MRS, as I mentioned to

you, we cannot begin siting until the MRS Commission issues its report at the end of this year on the need, and we cannot pick a site for an MRS until the repository site has been approved by the President, which as I just mentioned to you is expected in 1995 on the current schedule.

So, unless the law were to change, or unless the Negotiator were to come on and find a volunteer, we would not be able to select a site for an MRS until the mid-nineties.

That obviates some of the benefits of having an early facility in the system for starting to accept fuel from the utilities and to start to show that the Federal Government has got its hands around this problem.

So that obviously undermines some of the benefits that are there for an MRS. We continue to believe that under the right set of circumstances, an MRS can play a valuable role in the program.

Very shortly we will be testifying one more time before the MRS Commission on the results of some system studies we are doing on what the new set of restrictions mean to the MRS and what the Department's views are on the MRS.

We will certainly share those with you at the same time that we share them with the MRS Commission.

Suffice it to say that the State may still disapprove only subject to an override by Congress the designation of an MRS site. Siting I believe will be the name

of the game again in the MRS.

We are very hopeful that the President will name a Negotiator, and we are hopeful -- we are not wild-eyed optimistic -- but we believe there is some prospect that the State or an Indian tribe, under the right set of circumstances, would consider being a host state to such a facility.

I happen to think it would be a very valuable thing under the right set of circumstances, but nobody who has been with this program underestimates the political problems of siting such a facility.

It is a key concern and one that we all have to address.

DR. CARTER: Is Tennessee back in the competition, or they might be in the competition, or has it been ruled out?

MR. ISAACS: They have not been precluded from the Department considering them again, but we have got to go back and provide no -- there can be no priority given to siting the MRS back in Tennessee, no addition weighting or unweighting.

It is just like all the other states that will have to be considered.

DR. CARTER: They are competing fairly and equally.

MR. ISAACS: Yes. I would like to suggest, since it is 11:35, I have got about 15 more minutes in my presentation.

I would suggest that we break for lunch, that we

meet back here by 12:45 or 12:50. The Secretary will come and make his presentation to you.

I will then finish up in 15 minutes and at most we will be 15 minutes behind schedule. How does that sound?

CHAIRMAN DEERE: I think that is good.

MR. ISAACS: Let me also mention that if any of you need to make phone calls, Mr. Carlson is willing to lead the raiding party up to our offices where you are welcome to use our phones and anything else prior to going to lunch.

We have our cafeteria across the way here, which I will take those of you and some of the rest of us will take you over there to eat at your leisure.

(Luncheon recess taken at 11:35 a.m.)

AFTERNOON SESSION

(1:25 p.m.)

MR. ISAACS: I think we will attempt to get started. Maybe that will, like bringing out the umbrella brings rain, maybe that will precipitate the Secretary.

I am glad to see that you must have heard that my speech lapsed over into the afternoon, and that is why this is such a large audience.

(Laughter.)

MR. ISAACS: I had just finished describing and briefed the status in plans for the repository, the underground facility to permanently dispose of the high-level radioactive wastes and the monitored retrievable storage facility.

I, as you recall, explained to you the uncertainties still surrounding the MRS, the fact that the Department believes that under the right set of circumstances, such a facility could be of great benefit to the program, and the fact that we still have an MRS Commission who is going to assist in determining the need of such a facility while the Congress has indeed authorized it.

What I would like to do now is turn and talk very briefly about transportation and then go into a summary if I can.

Let me start by saying that having a safe and

efficient transportation system. Is Jim here? I need those slides. I can talk about them. If it is going to be a diversion, let's go without them.

A safe and efficient transportation system, it goes without saying is essential to the success of the program. One of the tenets that is in the law is that to the maximum extent practical, we should use private industry in the development and application of the transportation system, and we are certainly going to move in that direction.

The transportation system will fall under the regulatory authority of the Nuclear Regulatory Commission, as well as the Department of Transportation.

We will be using both truck and rail to transport the nuclear waste. We have to look at both the situations of whether or not there is an MRS.

In the case where there is an MRS in the authorized system, we would transport by a mixture of rail and truck to the MRS site. Then, it would be expected that we would move all of the waste from the MRS to the repository by rail across the country.

We would also look to perhaps moving spent nuclear fuel from the western reactors directly to the repository, and that would also be by some mixture of rail and truck.

I might add, incidentally, that barge movement has not been ruled out, but it is not expected to be the reference

system under most situations.

The system will incorporate the development of a number of new rail and truck casks. There are NRC-certified casks today that are in operation to move nuclear fuel. That fleet has operated with a great deal of success.

There is a great deal of I think confidence in the fact that such a transportation system works and can be made to work. We want to develop a new set of casks, a new generation of casks that are principally larger in size for economies of scale.

Particularly as you would move fuel from an MRS to a repository, we would like to build larger rail and truck casks, and we have signed five contracts with five different vendors who will do some design and development for us in the development of a new generation of rail and truck casks.

DR. CARTER: Tom, you will add there will be a spur on or whatever put onto the test site, and you won't necessarily take it the last distance by truck.

MR. ISAACS: The current reference design is to build a rail spur in. We are looking at a number of options right now where that can go.

I think it is important to recognize that with regard to transportation, we won't really be transporting this waste until we have some facilities, and those facilities are some 15 years off.

In the case of the repository, as you know, we are currently scheduled for the year 2003, with the linkages with the MRS, it is unlikely that we could start an MRS under the current provisions of the law much before 2003.

There is some possibilities of phasing in an MRS earlier by a couple of years. So we have some time to develop a good integrated transportation and we are going to take advantage of that time to build it properly.

We expect somewhere between 1,000 and 1,500 shipments at peak time to be used in the system. That depends greatly on the mix of rail and truck casks, since you can put substantially larger casks on rail shipments.

So that gives you an idea of the size of the system. I think it is important to recognize that while the repository in some sense is a relatively localized problem in the State of Nevada, and the MRS would certainly be a considerable localized problem for whatever state were to be given it and surrounding states, transportation is essentially a national problem.

While we have a safe and viable transport system in the country today, there is no question that ultimately we will have to deal on a national scope with the institutional aspects of safe transportation.

That means developing a good routing notification, emergency preparedness training, and the full gamut of things

that need to be done in order to make sure that the system is acceptable, safe, and that we can conduct it in an efficient manner.

That will be not an easy challenge, and so the institutional aspects of transportation will bring a national scheme to it that is not currently part of the process.

With that, let me hold my slides in abeyance.

SECRETARY WATKINS: I can't think of any more important job right now than we have at the Department of Energy of putting waste management right into production. Clearly, the letter that we were sent by six governors along these lines, I agree with and I said so in my confirmation hearings, that we have reached that point, in 35 years of sweeping radioactive debris under the pools and the grounds around, that we have got to the point where we simply cannot do that anymore responsibly.

I think that this longer term program with the competence of a review group like this looking into scientific and technical aspects of this can become critical to the understanding of the American people, as to well as the members of Congress who represent them and us in government, that we can, in fact, handle these things for long periods of time in the proper way.

My background is pretty much in the nuclear business in the Navy, and we grew up under a system that put

environment and safety and health at the highest level. It was right up with the readiness of the reactor plant to run our propulsion in the ship.

We were doing that long before environment was popular. We were doing that long before levels of radioactive doses were known very well. We knew them long before the American people were sensitized to these things, not as criteria when you would start having some physiological or other symptoms, but rather were very much upper limits, and we always stayed a factor of 10 below those.

That was our way of doing business. We took people off line when they were doing maintenance work long before they ever got to 3 REM exposure, for example. We were way down in the levels of radioactive material put into the environment.

Every year we reported to Congress what bottom samples gave us, what was in the environment that wasn't there, was man-made contribution to the environment, all of which were below environmental levels that we would normally find in society, but very carefully analyzed and reported where they were, where they were going.

We looked over into the then Atomic Energy Commission practices, subsequently ERDA, and then Department of Energy, and frankly, from the defense side in the Navy, very concerned about what we thought was a lack of due

attention to those practices.

As a consequence, the Navy stayed out and stayed separate, setting up their own advisory committee on reactor safeguards equivalent, their own nuclear regulatory commission equivalent, because we felt we were tougher on our own people on environment, safety, and health.

That was the real driving force behind Rickover's effort to stay independent, and he predicted the equivalent of Three Mile Island, then 20 years, in 1962, saying that he was determined to keep his own standards high with special focus on the quality, the training, the education selection of individuals to handle radioactive materials, to handle the operation of the plants.

So I come from all that background plus an education in graduate work and at Oak Ridge at the Oak Ridge School of Reactor Technology, which I look back on now as the period of time when we were very cavalier about the unknowns of things radioactive.

So I have a deep appreciation for what you are going to be doing over the many years between now and the time the repository comes to fruition in the year 2003.

We have already been criticized in the Department of Energy of being sluggish to slow to get started. We have been criticized severely by some of the people from Nevada as being insensitive to local interests and needs, particularly in

matters scientific.

They prefer to have their own scientific advisory group, if you will, advising them of whether or not others are saying the right thing, whether they make scientific and technical sense.

So we are going to go through some early stages of what I would say is this credibility building, and I am sensitive to their interests out there. I have had meetings with Senator Bryan, who has just come from being governor.

I have had a rather strong letter from Governor Miller. They are extremely concerned that we may be running roughshod over a state without large representation, and to a certain extent they may be right. I don't mean "we" as the Department of Energy, I mean the system as a whole selected Yucca Mountain.

So we know that and we are not going to go back on that. My job is to ensure that we manage the repository program through its characterization phase and the drilling of exploratory holes, and so forth, that we do that well, we do it sensitively, that we are going to show deference to people who have conflicting views on it, and listen to them.

I hope this group with -- I understand you will have open hearings -- will follow that path. I followed it on the AIDS Commission and it was the reason we had a decent report to the President.

We listened to 600 witnesses from all over the world. They were telling us things that made a lot of sense. They knew what they were talking about, very professional, and were able to strip the extremes off the end and get right into the nitty-gritty, and that is what I hope, as an independent group, you will be doing and advising me as you go along in your six-month reports, in a way that can be useful to getting on with this national program.

It is the key to one element of our future energy strategy without any question. We don't know what the next generation of nuclear power may mean. We are going through a very, very delicate and important turning point right now in that regard.

Witness what is going on with Shoreham in New York. The decision by the Nuclear Regulatory Commission the other day to essentially dismiss the State, County, and other officials as not showing good faith was an incredible decision.

I happen to support it. I think it is a very fine decision. But now we are in a situation with a plant operating at 5 percent power, moving towards a license within a month, totally at odds with the State position.

I mean it is really a very interesting time for nuclear power and I am not in this job to promote nuclear power. I hope I am in this job to demonstrate that somehow

this country ought to be technologically competent enough to run nuclear power in a responsible way, so that the American people can understand that we can do it.

When we have a Three Mile Island or Chernobyl in somebody else's country, or a foul-up in waste management, that you are in, that we can somehow mend those fences and demonstrate that we know how to do these things well.

So I do believe we are at a turning point, and if you all can help manage this one well from a technical point of view -- which I lean on heavily, I don't get involved that emotionally unless it is technically and scientifically sound, and then I understand it -- so if you approach it from that direction, and we can educate those around us that we are doing it responsibly, you will not have only done well for civilian waste management, high-level waste, but more importantly, you will tell us, tell the American people is there a chance for responsible nuclear power as a key element of our national energy security policy for the years to come, whether that be a high-temperature gas-cooled reactor or a follow-on advanced light water reactor that we are working on, or whatever.

So I look at your tasking as being far beyond the repository alone. I mean what I think you are going to do would be part of this larger educational process that will permit us to understand whether or not nuclear power is one of

the futures that we have in generating power, that is not going to add to the global warming issue, is not an acid rain generator, but is a nuclear waste generator, and we know that, but we know how to handle that.

I think that if we do it well, we are going to less reticence on the part of states in the future to accept their share of the burden of this as a national need, as part of the energy process.

That is kind of where I come down on it and would hope that as time goes on and you get some time in the saddle, that in the first six months, I will have a chance to sit down with you before the '91 budget deliberations and see if we are moving down the right path in our program to deal with the repository, are we dealing with the scientific and technical issues the way you would like to see them dealt with, do you think we have technical oversight and management procedures that are adequate to do this job, to pull it off on time and within budget, are we being sensitive enough to what you visualize as the real scientific and technical shortfall that we may have in our program today.

I can tell you that I am going to listen to you a great deal because we don't very often amass this kind of talent together, and when we do we want to make sure we take full advantage of it, not only in the narrow focus of the repository, but more importantly, on the broader issues that

will impact on the whole future of our ability to generate energy in this country and get out of these soaring soar imports that we see that are not going to go away.

If we are closing in on 50 percent today, by the time you finish these deliberations, in another 10 years it will be considerably higher than that unless we begin to bend that curve over by alternate forms of energy.

That does not look like it is going to happen overnight. Conceptually, it may be there in our various R & D programs, but we know that transformation from an oil-based transportation economy to either natural gas or methanol or some other alternate flexible fuel system is not just immediately over the horizon, although it is coming along, but oil is going to be there for a long time.

So we need to make sure that we aren't foolish in the way we deal with responsible development of nuclear power resources in this country.

Somehow Japan has been able to do it, the most anti-nuclear of all. I took the first nuclear ship into Japan. I can tell you those 380,000 people that were hired to come down at 300 yen a day from Tokyo were something else to behold.

Now we go in with maybe three nuclear-powered ships at a time and not a peep out of the Yamarurai Shim (ph), or other papers, so it is a different world. They have been able to manage it well.

Why are the French, who don't you read daily in the French newspapers about their radioactive waste repository, their vitrification process? Somehow they have been able to come to grips with it.

So what is the difference between our nations, is it because we are 14 in the world, in the industrialized world, in our understanding of things scientific? What is it? Why are we such an ignorant society we can't come to grips with this and put the discipline in the system to manage something that is as obvious as this is for the nation?

I really encourage you to think in these broader terms which obviously, with people with your talent, you can do, and help solve some of the bigger issues that we face in the nation.

In that regard, I am going to be putting a lot of emphasis here on the employment of our laboratories and our technical resources to inspire youngsters right down at the junior high school level to come into math, science, and engineering.

We don't have enough people with your kinds of interest in careers in these fields to support the nation's need for the long haul, both numerically and qualitatively.

We have to take some of that burden of responsibility, people like yourselves. I just talked with Glenn Seaborg yesterday, and we are going to pull together

some groups probably out at Cal-Berkeley from all over my activities to put much more steam into that engine, and hopefully, the peer pressure can get out there to say we ought to know a lot about our own human biology, we ought to know a lot about what the world is all around us.

We have to have a lot of physics instead of a disdain and hate for it somehow, begin to understand what makes the world tick. Here we are talking about the supercollider. Nobody has any feeling for whether that is of any value to anybody.

Look at all the money you are going to spend just because you want to go into subatomic particles and high energy physics. Is that really important to the nation today when we have all this deficit problem? If we don't understand what all that is about, and all its ramifications, then obviously we can reject it.

We can reject basic research as not being this year's problem. If you let it go, basic research disappears in the budget process. So we have to understand those things enough, so that we are up on it.

I hope that out of your deliberations over time, we will learn a lot about repository construction, development, how we can do it sensibly and sensitively. Do we need new devices to give us the geological projections we need to know whether this will last 10,000 years.

Are there new ways, new techniques, because I think if it isn't in nuclear waste, it is going to be in every other waste that we have got.

So I think you are on the ground floor of a very unique mission that I haven't seen really conducted before, and I am delighted you are in it, and I want you to feel that you have an open door to me anytime to come in and talk about it.

The Chairman, particularly in that regard, I would want to have as much interchange with you as you feel useful to this particular group.

CHAIRMAN DEERE: Thank you.

SECRETARY WATKINS: I certainly want to listen to you anytime and don't wait until the six-month period if your visceral feel and consensus says that we ought to tell the Secretary of Energy now what we are seeing in a few areas, not that we have all the things documented, but we have a general feel that these six areas you ought to devote some attention to right now.

It will be very useful to me and you don't have to put your name on a piece of paper and report to do that. You can let me know what your personal feel is after you have had a chance to dig into this thing.

CHAIRMAN DEERE: Thank you.

SECRETARY WATKINS: Unless you have any questions

for me, that was kind of my message.

CHAIRMAN DEERE: Thank you very much. I think those have been words of wisdom.

SECRETARY WATKINS: Good. Thank you very much.

MR. ISAACS: I would like to take the occasion before Alex leaves, if I may, because we do have a couple of distinguished people in the audience, the gentleman standing there is Mr. Alex Radin, who happens to be the Chairman of the MRS Commission that I spoke of this morning. I think it is worthy of note to let you know that Mr. Radin took time to hear part of the presentation here; and his Executive Director of the MRS Commission, Jane Axelrad is also with us.

As long as I am at it, let me also mention for the benefit of the members of the Board, Dr. Peter Meyers, who is the Executive Director of the Board on Radioactive Waste Management of the National Academy of Sciences.

With that, let me go from transportation, if I may, to how do we pay for this program. I would like to try and finish up fairly quickly, so I can get as close to the schedule as possible.

Let me talk for a minute about program funding. I did mention this briefly this morning, but let me once again address the issue, if I may.

Next slide, please.

The funding, as I mentioned, comes from a fee paid

by the generators of the nuclear waste, that is, those that are generating electricity from nuclear power. They pay a fee of 1 mil per kilowatt hour.

There was a one-time fee that was levied on those people for all the nuclear spent fuel that was generated prior to the passage of the Nuclear Waste Policy Act, in addition to which we collect that on an ongoing basis from those who are generating electricity from nuclear power today.

Therefore, up until today, we have collected something approaching $4 billion. This is real money and it is invested and we earn interest on that money. Since our incurred costs to date have been about $2 billion, the balance in the Nuclear Waste Fund is something about $2 billion today.

Now, the fact that that money sits in the account does not mean that the Department has ready access to it. That must go through the Congressional appropriations process, as with other parts of the program, but we are not funded through the General Treasury except for a very small amount of money that is for research and development purposes.

I might add that defense programs will have to share the burden of cost here. They must pay for the disposal of the defense wastes that will be comingled into this repository.

The allocation for how much they are to pay has yet to be worked out entirely. There is still some contention

about what that ought to be, as might be understandable, and that has yet to be worked out. But my understanding is the Secretary of Energy has made it known that he expects that to be handled and he expects the Defense Program to start carrying their share in the Federal budget process.

Let me now turn quickly to the future.

This puts on one chart a summation of the things I have touched on prior to today. If you look at the middle line for the repository, you will see that it shows that we issued that Site Characterization Plan, that federally legislated document, and that we are currently in the process of receiving comments on that document, which I will talk about in a moment, and that our hope is to receive comments from the State, from the Nuclear Regulatory Commission, to hold hearings later this month, and that will lead to the beginning of the exploratory shafts sometime at the end of this year.

We will also have a surface-based testing program corollary to that. The exploratory shafts and the associated facilities, as you will learn much more about, are to principally focus on the geological, hydrological characteristics of the repository site itself.

But in order to demonstrate that this site will indeed isolate wastes for many thousands of years, you really have to understand some regional considerations of hydrology

and geology and meteorology, and the like, as well.

Therefore, we have a fairly extensive program of surface-based testing, as well, to look at those kinds of features in the vicinity surrounding the Yucca Mountain site, as well.

We hope to, as I told you, get to the point where we could recommend that site sometime in the 1994-1995 time frame. If that site does prove to be suitable, we would then recommend it to the President, and if he agreed, a license application would then be submitted to the Nuclear Regulatory Commission, presuming that the State did not disapprove the site or if they did, that it was overridden by the Congress, as I spoke of, with a 1998 construction authorization date that would lead us to the beginning of a repository in the year 2003.

I think it is fair to say that those of us in the program believe that that is a very aggressive and difficult schedule to meet. I think as you get into the Site Characterization Plan and the challenges of demonstrating performance and the challenges of designing this facility, the difficulties associated with putting together the documentation and getting it licensed in three years, where nuclear power plants in this country take considerably longer to license, it is a very challenging operation.

Nonetheless, we are focused on our objectives and we

are working very hard to achieve those objectives. I would like to echo what the Secretary said, to the extent that you all can help us understand what those challenges are, what the priorities are of those challenges, and what we can do to achieve success in this program, I am sure we will all be very satisfied.

I also show on the same chart there the monitored retrievable storage schedule. It is tied, as we talked about earlier, to the fact that there are linkages between progress on the MRS and progresses on the repository.

Right now we would not be able to identify an actual site and submit a license application for the MRS until the same time we submitted a license application for the repository, namely, 1995, and therefore we would not begin construction on an MRS until about the same time frame that we began construction on our repository unless those linkages are readdressed or there is a volunteer.

The MRS Commission is evaluating exactly those things in their report. We are looking at the possibility of phasing an MRS. Namely, we want the MRS to conduct certain operational procedures, and I will talk more about that tomorrow.

But perhaps if we were able to do it in a phased way, where the first phase of the repository were simply acceptance of spent fuel, perhaps in the dual purpose

containers, so that we could actually begin the Federal system of operation, we might be able to start acceptance of spent fuel from the utilities somewhat earlier than 2003.

We are evaluating that right now. We don't have a final decision on that.

I think it is important to recognize you will hear much more about this in the next day and a half, and you will certainly hear a lot about it from others who are involved and interested in this program, as well, that we are knee-deep or perhaps elbow-deep or eyeball-deep in the quality assurance program in this effort.

In order for us to get an NRC license in this facility, the work that we do is going to have to meet the quality assurance standards of the Nuclear Regulatory Commission and, perhaps more importantly, of ourself.

As the Secretary indicated, we have got to do a quality job on this program. We don't have a choice. In order to take some of these disciplines that perhaps not as historical in doing rigorous quality assurance to people who are working in things like hydrology, geology, and geotectonics, and erosion, and such, and put together a systematic rigorous program of quality assurance, so that when we start to do work, that work is usable in the licensing proceeding, that work is documented, so that 20 years from today, when we are going through some of these issues, we have

a confidence that we could go back into the record and pull back out and have confidence that we are pulling out credible information is essential to success.

We have got to pay a short-term price now to have long-term success. That is a very difficult challenge. You will hear more about that from the program and certainly Lake Barrett will talk more about quality assurance tomorrow afternoon.

It is very important that you understand, and we are trying to draw the balance between what is necessary in order to have a rigorous, high-quality program and a rigorous quality assurance program, and going to the point where we are undermining the capability of conducting the program.

Drawing that balance is not easy, and we are working very hard on it. I would encourage you to recognize that and give us any thoughts you have.

I have already talked about transportation, so let me simply leave it at that -- I would ask you to go to the next slide, Jim.

As I mentioned, our plans are to still start the exploratory shaft next year. It will take about a year before we can begin to institute testing down where we have drilled the shaft and connected it.

We hope to have the draft Environmental Impact Statement in 1993 and the final in 1994, and if the site

proves to be good, we will then submit the license application to the NRC in 1995, and you will hear much more from Mr. Stein and company about the licensing procedure and the challenges associated with that.

If I could have the last slide, please.

Let me simply say that I have tried to indicate in what for me is a very short period of time, some of the complexities associated with this program, the fact that the comingling of technical and institutional and, shall we say, political features are not easily separable, nor are they necessarily desirable to be separated.

We, in this program, keep our eyes to the extent we possibly can, and have kept our eyes, firmly fixed on the scientific and technical credibility of the work that we are doing.

It is not an easy thing to do. We have obligations and we take those seriously, and obviously the Secretary underscored our obligations, that the impacted parties in this program, whether it be the local communities, the State of Nevada, whether many states and communities or Indian tribes that will be affected by transportation or by the possibility of an MRS, we take our obligation to involve them, and not just inform them, but allow them to participate in this program seriously.

The balance between making progress and allowing for

participation sometimes is not easy, and we believe and we hope that we can continue to work with those parties in a productive way, and I would certainly encourage you to do that, as well.

We believe that the Amendments to the Nuclear Waste Policy Act left us with a law that is quite good, quite usable, quite reasonable, and one that can allow for success in the program.

It is not without risks, it is not ideal perhaps from the Department's point of view, but it is an awfully workable and desirable law, and we plan very hard on focusing to meet the objectives of that law.

The Site Characterization Program is going to be a tremendous challenge. The ability to demonstrate that this facility will isolate wastes for thousands of years, which has never been done before, and to try to demonstrate it in a reasonably short period of time with a great number of uncertainties, and to do it in a licensing environment -- and as I mentioned earlier, the Department has never licensed anything before the Nuclear Regulatory Commission, nor has the NRC ever gone through the experience of licensing such a facility -- and to do that in a demonstrably high-quality way and to do it on a reasonable time frame is going to be a tremendous challenge.

I would hope very much that the Board will be

intimately involved in helping us to meet that challenge. As it says there, the goals of this program must be -- we don't have a choice -- technical excellence and institutional openness, and I would say institutional participation.

We have got to keep our eye on the ball, and the ball in this case is the timely disposal of high-level radioactive waste in a way that effectively protects the environment and maintains public health and safety, and does it for a very, very long period of time.

With that, I will stop and ask if there are any questions or comments at this point, and then we will be able to move on.

CHAIRMAN DEERE: No. Thank you very much, Tom. I think this has given us a fine background, and we are able to go to the next.

MR. ISAACS: Great. In that case, let me ask Mr. Saltzman to come up here and bring his staff with him.

MR. SALTZMAN: Professor Deere, I am happy to be here today and to express our appreciation for your coming here and our expectation that we will be working very closely with you in the days and months and years to come.

We are not so smart in the program in general that we can't learn from many other sources, and you are going to be a very resource of advice and knowledge and information for us.

My name is Jerry Saltzman. I am the Acting Associate Director for Facilities, Siting and Development. What I will do very quickly now is go through our organization, so that you know who it is that you will be dealing with.

For the most part, I think when we make presentations to you from our group, we will be dealing probably from a branch chief level, the people who are closest to the people working on this effort.

First of all, let me show you our own organization. It has two principal divisions. We will not be talking to you today about the one on the right, the Socioeconomic and Institutional Planning Division.

In that division, which is headed up by Mr. Gale, who is in the audience here -- why don't you stand, Barry -- they do socioeconomic impact analysis, socioeconomic and environmental monitoring.

We have two major plans called the Environmental Monitoring and Mitigation Plan and the Socioeconomic Monitoring and Mitigation Plan that they are responsible for. They will enter into consultation and cooperation agreements with the State of Nevada, if this is something that the State of Nevada wants.

They work on intergovernmental relations, public hearings, such as the three that are coming up this month in

Nevada, briefings, and deal with the institutional aspects of the siting process for the MRS, which is in the future.

Turning now to our general mission, we have the primary mission in the Office of Facilities Siting and Development -- sometimes you will hear us called by the acronym OFSD, that's us -- for the characterization of the Yucca Mountain site and for the siting of a monitored retrievable storage facility.

We provide the management oversight and technical direction for geoscience and engineering activities carried out in Yucca Mountain. We develop the programmatic guidance on policy and procedures for site characterization, and you will hear quite a lot about that today.

We provide the technical oversight for the design and construction of the exploratory shafts, the surface-based testing program, the waste package design, and the design of the barrier system and seals. All of these will be covered in more detail shortly.

We also provide the technical and programmatic management for the design, development, and construction of the repository itself which will be at Yucca Mountain if that site is found suitable.

Finally, away from the repository we provide the management oversight for the preliminary and site selection for the MRS facility assuming in this case that the MRS

facility is one that is sited based on the work done by DOE.

If it is done by a Negotiator, we provide the management oversight for the technical evaluation of the sites that are identified by the Negotiator. So slightly different efforts depending on which approach is taken in terms of coming up with an MRS site, but they are very complementary.

Turning now to the other line, the Siting and Facilities Technology Division, it is made up of three branches, and the three branch chiefs will be here today.

The Division Director is not here. I just thought you might be interested in seeing his background, as well as the background of all of our branch chiefs, and I will get to them as we go along.

Mark Frei, who is the Division Director, has been working on the waste program for quite a few years. He also has experience in the breeder program in AEC and ERDA, and program and project management and nuclear engineering are his specialties.

Turning to the first branch, the Siting and Geosciences Branch, I will put on the chart. Basically, as its title says, this is our Siting Branch and one that handles our geosciences work and all the geology, hydrology, and so forth, come under Dr. Brocoum's responsibility here.

Dr. Brocoum's background, as you see here, is in structural geology and tectonics, has background both in the

government and outside of the government, and very important for us, has a background working for the NRC in geology work, and I think was responsible for some of the regulations that we now have to live under.

The second branch in that division is the Surface Facilities and Waste Package Branch. Basically, that branch is responsible for the surface facilities whether at the repository or at the MRS, and the very closely associated and important work having to do with the waste package. There will be quite a bit of discussion of the waste package this afternoon.

That branch is headed up by Jack Hale, who is a mechanical engineer, has a lot of background both in industry and in government, also worked on the breeder program where he was the Deputy Director of Construction.

Jack is on his way in from snowbound Virginia and we hope he will be here. If not, one of his men on the waste package will speak in his place.

Finally, our last branch, but not least, is the Underground Facilities Branch. If the Surface Facilities Branch dealt with everything above ground, the Underground Facilities Branch deals with the Exploratory Shaft Facility.

You are going to hear ESF an awful lot this afternoon. That is one of the acronyms you will have to learn. It is the Exploratory Shaft Facility and it means more

than simply the two shafts, but all of the underground workings and test areas that go with it.

It is also responsible for the coordination of the testing program of the ESF and for the underground facility design and construction.

You will be hearing from Mr. Ram Lahoti a little later this afternoon. Mr. Lahoti's background before coming to us in Headquarters was in the salt project, where he was the QA Manager and Director of Analyses and Evaluations.

He is a professional engineer in the State of Pennsylvania and has extensive background both in industry, government, and state government.

That is my little presentation to give you the background of our organization. Before I turn to Mark Frei's presentation, which I will give for him, do you have any questions on that, how we organize ourselves?

Fine. I will then turn to Mark Frei's presentation on the Repository System.

Our first slide is a schematic that shows the fundamental elements of the geologic disposal of high-level waste. It is simply a schematic.

Starting from the bottom up, you see the characteristics that we look for in the different elements, the waste form having the low solubility, the slow release, and the physical integrity.

The waste forms are basically two, the glassified waste that comes from the defense programs and from the West Valley Civilian Reprocessing Facility, and the spent fuel that comes from the Civilian Program.

Moving up, these will all be contained in waste packages. The elements of the waste package that we are looking for is containment, longevity, and retrievability.

The geologic repository comes next. That is the facility that we will construct if the site at Yucca Mountain is found to be suitable. Again, constructability is very important there, stability over a long period of time, and retrievability which is a requirement of the NRC for the life of the repository and some years thereafter.

Moving up a little higher in the chart, we have the geologic formation and the benefits that we find from that.

The next element up there is hydrologic regime. That is not meant to shown necessarily above the geologic formation, but the flow of water is a very important element in what we are doing.

Our examination of how ground water will flow in Yucca Mountain will be very important in helping us determine whether it is indeed a suitable site.

Finally, there is the surface environment having to do with land use, population. I see human intrusion is shown down in the geologic formation, but it is a very important

feature that we have to consider in our site characterization. The possibility of human intrusion over the long period of time into the repository will have to be in place, and what are the sort of things that would attract people to the site and what can we do to deter them from coming onto the site over long periods of time.

Next slide, please.

As Tom pointed out this morning, we are subject to the Nuclear Waste Policy Act and its Amendments of 1987, and sets of regulations from three bodies of government, from the DOE itself. Part 960 from the siting guidelines from the Nuclear Regulatory Commission -- I am sorry -- 960 from the siting guidelines are ours.

Part 60 of NRC's regulations have to do with the disposal of radioactive waste in the geologic repositories.

Finally, Part 191 of EPA's regulations are the environmental standards for the management and disposal of spent fuel, high-level and transuranic radioactive waste.

Another schematic just to give you an idea in our steps in the siting program of where we are. We are approximately in the center now, in the rectangle that says Site Characterization Plan.

This plan came out on December 28th of just this past year. It is now before the State, the NRC, and the general public for their comments.

When we receive these comments and consider them, we can then move into new site characterization work and start the exploratory shaft, which, as you will see in a later slide, is due before the end of the year.

We will also be working as time goes on -- and Mr. Stein will be addressing this tomorrow -- in the Environmental Impact Statement, the draft and the final statements. We will make our site recommendation to the President, and finally we get into the site application phase and produce a safety analysis report.

We think we have accomplished quite a bit in recent years. We have had the completed SCP conceptual designs for the repository and the waste package, and these are incorporated in the SCP.

In December of 1988, we issued the consultative draft of the Site Characterization Plan in order that we could hear at an early point from the NRC, from the State of Nevada, and other interested parties as to what they think of the statutory document that would be coming out the following year.

We received extensive comments from them. This will be covered later. Based on these comments and on other work that we did ourselves, we have issued the Site Characterization Plan of this past December, and as I say, we are now in a phase of awaiting comments on that plan.

We have been doing design analysis work. We issued the Exploratory Shaft Facility Title I design this past December, at about the same time we issued the Site Characterization Plan.

We also did what is called a Design Acceptability Analysis Report at the behest of the NRC, in that they felt that if they were going to be reviewing the Title I design as part of their review of the Site Characterization Plan, they wanted our assurance and our analysis that this Title I design had been done equivalent to what would have been done if we had a Quality Assurance Level I Program in place.

We did not have what they would call a Quality Level I Program in place at the time the design was done, so we did a Design Acceptability Analysis Report to show them that the results that we obtained were the same as you would have obtained if we had done it under a Quality I Program.

That was also made available in the same time frame.

You have received I guess copies of the SCP. If you break open the bindings and plastic, you will find that it is a little uneven. There are eight chapters, but the eighth chapter is about as large in volume as the other seven chapters combined.

This is a general breakdown -- I am sure you don't want to look at this now -- of the way the eight chapters are broken down. If we now look at the eighth chapter itself, it

has quite a bit of detail.

The issues hierarchy that you heard about described earlier is in 8.2. 8.3 is the planned tests. 8.4, which is a very significant subchapter, at the time this chart was drawn up, it was based on the consultative draft, and it is shown as a relatively small chapter. Now it is over 500 pages and looks something like the 8.3, at least schematically. It describes the underground test facilities and program.

It describes potential interferences between test, test construction, and so forth. It gets into a number of the areas having to do with concerns raised by the NRC on the exploratory shaft.

We tried to address them in this part of the SCP.

Next slide, please.

Here is another little drawing of the Nevada test site. The drawing on the top shows the general breakdown among the three property owners. In the lower left, the blowup, you can see in the dotted line area about where the boundary of the underground facility would be, and the Nevada test site in the lower picture is where the surface facilities would be.

We will have better maps shortly that we will show you.

This is a cutaway showing the repository level up there in the Topopah Spring welded units and below it, the

Calico Hills nonwelded unit, which is probably the most significant barrier in geological terms that we will be depending on. This will be described in a lot more detail by Dr. Brocoum in a few minutes.

Here again, a small schematic of the Exploratory Shaft Facility. Ram Lahoti will cover this in much more detail, but it shows you generally the two shafts, the upper demonstration breakout room level where some research will be done, and then the main test level where there will be a number of areas of characterization going on, then three areas of drifting out to some faults that we know exist, in order to characterize what the rock is like on the way over there.

There will also be a surface program which will also be described to you shortly.

Here is a drawing of the surface facilities. We will show you more drawings later. The principal buildings you can see there are waste handling buildings. These will have hot cells, and so forth, and the siting of these buildings is very important to us.

We will be doing some early surface work in order to make sure of the siting of those buildings and the surface facilities in general.

I wanted to end this presentation with a little rundown on our major milestones, all forward-looking. We expect to start the ESF Title II design this month. We had a

management review on that just yesterday. A few more things have to be patched up and we expect very shortly we can tell the projects officers they can start an ESF Title II design.

Site prep is currently scheduled for May 1989. This will be preparing the ground for the pads and the utilities, and so forth, that will be supporting the Exploratory Shaft Facility.

Very early in the Exploratory Shaft Facility work will be multi-purpose boreholes that will go down very close to where the shafts will go, and we will develop scientific information from that, that will be discussed in a moment.

There you have your dates of what we hope to be the start of shaft construction, the actual collar of the shaft staring in November 1989. The completion of Exploratory Shafts 1 and 2 in '91, and then the start of the license application with the completion of the advanced and central designs in '92, and so forth, down the line, ending for waste acceptance in the year 2003.

This is a success-oriented program. It is a very optimistic program. We still think we can do it. It is certainly not a 100 percent certainty that we can keep on this schedule, but we are going to try as hard as we can.

With that, I would like to turn the program over to Dr. Brocoum and Messrs. Lahoti and Hale, so they can handle their branches in more detail and tell you exactly what the

programs are that they are doing.

I would be very happy to answer any questions.

CHAIRMAN DEERE: One question. Does the November '89 date for the beginning of shaft construction still look attainable?

MR. SALTZMAN: It is attainable. It is an extremely optimistic schedule, but it is attainable.

MR. ISAACS: Is someone going to describe what we have to do between now and then in order to make that date? Is that on your presentation?

MR. SALTZMAN: I am not sure, but I would be happy to go into it.

MR. ISAACS: I think we ought to get the Reader's Digest version of what we have got to do.

MR. SALTZMAN: Let me work from the collar backwards. It might be easier in time.

Before we can put the collars in, we want to sink the multi-purpose boreholes. These will be sunk to the repository level. The purpose of these boreholes would be to eliminate any surprises along the way, so that we know what the rock is like almost exactly at the point at which we are putting in the shafts.

It will look for perched water. It will look for any number of things that might lead us to want to take another look at exact shaft locations. Ahead of the multi-

purpose boreholes, we have to do some prototype testing of the drilling procedures that we would use in order to drill the multi-purpose boreholes.

We are going to be going very deep, 1,100 feet. We will be going dry, as close to bone dry, if not bone dry, as we can, so that we will not be introducing any water in the drilling process.

We will be trying to collect core, and at this depth and going dry, it is something that needs the confluence of a couple different technologies, and we want to try that out in multi-purpose boreholes -- in prototype testing.

The prototype testing would start, I believe in May -- as early as mid-April. It will be off the repository site itself. It will be an area where we will have similar rock, but what we are trying to do is test out the drilling techniques, make sure the people are properly trained, and so forth, so that we have all the procedures in place, that when we go to the multi-purpose borehole we will be able to do it.

DR. LANGMUIR: Over near G tunnel, is that where they intend to do that?

MR. SALTZMAN: No, I think it will be to the southeast.

DR. BROCOUM: To the southeast of the site, outside where you don't have to worry about waste isolation, because we will not be using Quality Level I procedures to drill those

holes. We are drilling those holes in part to develop those procedures.

MR. SALTZMAN: At the time we will doing the prototype testing, we will also be starting on the site preparation for the multi-purpose boreholes, which, as I say, will be right near the shafts.

Those are both in May or perhaps even April. Sometime soon we hope to start on the site preparation for the area that we will be doing the prototype testing.

Now, in all of this, there is also an interrelationship with the permits that we have to obtain from the State of Nevada and other such things as that. So we have permit questions that affect our schedule.

We have procurement questions that affect our schedule. We have design questions. The start of the SF design, the very first package of that will be the site preparation design. That should be coming out also in late April or early May, and that would allow us to get into that work.

The design work for Title II design will all be done at a Quality Level I QA Program. This is also another feature that goes into the schedule impacts, and that it is something that we have done before and our participants have done before, but never in the way such as the NRC would say that is what we, NRC, would call a Quality Level I piece of work.

We have a little bit of -- what is it called -- culture I guess is the word. Lake Barrett will be here tomorrow to talk about we have to overcome the DOE and DOE participants normal way of doing things, which is they do things Quality Level I. I have always done it and believe in what they do, but now we have in a sense another oversight group, a very strong one, the NRC, and we have to do quality level the way they expect it to be done.

So it is going to need some reorienting of thinking, but we think we are bringing all of these together in such a way that we can start the shafts in November, but as you can see, there are lots of elements and it is a very optimistic schedule.

Now I would like to call on Steve Brocoum who will be talking about the Surface Based Testing Program.

MR. BROCOUM: Good afternoon. I am going to talk about the Site Characterization Program with special emphasis on the surface based testing.

The first slide just defines what site characterization is. Those are the activities that are conducted to gather information about the geologic conditions at the site and to evaluate the site's suitability for a repository.

This is a process set forth in the Nuclear Waste Policy Act and it was one of the steps shown on slide Jerry

gave for Mark Frei's presentation a little while ago.

What is the Site Characterization Plan? In the Nuclear Waste Policy Act, a general plan was required for the Department to prepare, to state what they were going to do in site characterization. We feel that we have prepared a comprehensive plan for conducting site characterization. The Plan is over 6,300 pages long, and accompanying other documentation, it will probably total close to 30,000 pages.

There are basically two parts in understanding all the activities to be undertaken during site characterization. First is the Site Characterization Plan. The second are study plans which are a greater level of detail than the Site Characterization Plan.

It is a summation of all these that I was referring to in the 30,000 pages.

The Site Characterization Plan is a higher level document. It provides the overall rationale for site characterization. It identifies the information needed from site characterization based on an analysis of all regulatory requirements.

It discusses the overall testing strategy and describes the hierarchy or programs, of investigations, of studies, activities, and so on, to be conducted to provide the needed information to be gathered during site characterization.

The Site Characterization Plan in a sense stands by itself. Study plans are another level of detail below the Site Characterization Plan. They describe in detail the activities, the test analyses, methods and procedures, duration and sequencing of activities, very important to the NRC because they worry about interference of tests and the ability to characterize the site, constraints of these various tests, and the QA requirements.

In a sense, the study plans define the actual technical work to be performed by the investigators, and the principal investigators are the authors of the study plans.

There are a total of 106 study plans and most studies have more than one activity, so there is a total of roughly 320 separate activities as currently planned.

CHAIRMAN DEERE: Are study plans being carried out by different laboratories, consulting engineering firms, or a combination?

MR. BROCOUM: The study plans are being prepared by basically three to four groups: Los Alamos, Sandia, the USGS -- and I think there is one more who escapes my memory at the moment -- Lawrence Livermore -- they are the waste package, I don't know if they actually write study plans for the waste package.

CHAIRMAN DEERE: The USGS?

MR. BROCOUM: The USGS, yes. Los Alamos, Sandia,

and the USGS would be the bulk of them anyway.

Those are reviewed by the project office and by Headquarters before they are released, and there is a formal review process.

The Site Characterization Program is designed to provide information to basically accomplish two things. One is determine what the spatial trends and the variability are of the various site conditions.

The second is to understand, if you like, the phenomenological processes. So the first bullet there under the first heading is to get a range of properties, and the second is to reach an understanding of the site.

The planned surface based program, the next major group down, consists of investigations of previously recognized features, faults, anomalies, fractures, rock types, and also a systematic coverage of the site regardless of the features to make sure that we both understand unusual features and get the full range of the important parameters that we need to study the site.

The underground testing portion of site characterization is designed primarily to give us an understanding of the site and to give us insight into the actual conditions at the location of the repository. That part will be the subject of the next presentation.

Now, the question always comes up is when will we

know that we have appropriate and adequate data. This is the question that the NRC keeps asking, and this is basically our logic listed here.

We are going to collect the data to evaluate the values of the basic parameters at the site and in the vicinity of the site. We are going to use statistical techniques of various kinds to analyze the variability in these parameters.

We are going to develop the ability through the best available models to describe and predict the trends in these parameters. We are going to also use the information we gather to test the conceptual models.

We are going to obviously establish the range of parameter values that will be input to the performance assessment models.

The last bullet is very important. This is an iterative process. We collect information, we analyze it, we develop models, we make predictions. We compare it to our information and we keep iterating to the point where we are satisfied in the confidence of our data, such as that collecting additional data is very unlikely to change our understanding of a particular parameter.

The next slide lists what we think are the areas where we have the greatest uncertainty in the characteristics of the site. These will be followed by additional viewgraphs that will explain each one.

The four areas we have listed here are geohydrology where we are particularly worried about the flow paths and the geohydrological processes in the unsaturated zone.

The unsaturated zone is key to the waste isolation ability of the site. The reason that this site was chosen, one of the reasons was the fact that it does have a thick unsaturated zone, so that the water, which is considered to be the primary medium for removing the radionuclides is not -- it is not going to be free-flowing I guess would be the word.

Secondly is tectonics. We are concerned about -- there are some mistakes in this viewgraph -- the preclosure surface faulting and ground motion potential in terms of -- the term preclosure means during the operational and construction phase of the repository -- in terms of the postclosure, after the repository is closed in about 50 to 100 years, the impact of tectonics on the hydrological conditions, and that is an important thing.

For example, can the water table rise and therefore decrease the distance from the repository for the water table, or, i.e., decrease the thickness of the unsaturated zone?

Possible potential for volcanism. There are some volcanoes near the site.

The third major area of uncertainty is a climate change. If we change the climate, what impact does it have on the hydrologic system, could it have an impact on the water

table, and so.

Last is natural resources, are there natural resources present that would cause some future civilization to explore and have a problem with regard to human interference.

The next one is just a viewgraph. I just want to show you a close-up from a more geological point of view of what the site looks like. The square shows where the research facilities are. That circle where it says G4, is the approximate location of the exploratory shafts.

The vertical or north-south lines are faults that have been active in the quaternary. That is the last 2 million years.

Some of the faults have been active in what we call in the holocene, the last 10,000 or so years.

Forty Mile Wash is a major wash just to the east. I will refer to it a little bit later. You can see where it says black cone, red cone, and so on. Those are some of the volcanic features near the site.

The next slide lists some of the major hydrologic questions that require investigation.

The first one is what is the rate and areal distribution of net infiltration of water near the surface? The second is what is the rate and direction of ground water movement in the unsaturated zone from the surface to the repository itself?

Is there a significant component of lateral flow in the unsaturated zone? That is the third bullet.

Is there perched water at the site? Perched water is water that is trapped above the water table. That is a very important characteristic because the presence of perched water may suggest that at one time the water table was higher.

Also, perched water can be caused by the down infiltration of water. So the presence of it does not necessarily mean that the water table was high, but it is indicative.

The next bullet, is there significant ground water flow in the fractures in the unsaturated zone? This is a very significant problem because the advantages of the unsaturated zone are particularly true if the water flows in the matrix.

If a significant amount of water flows in the fractures, then the amount of time that it would take the water to flow from the repository horizon to the water table would be much shorter.

The analogy of the site would be if you had a pile of bricks and you poured some water on it, the water would tend to be absorbed into the bricks, but once you saturated the bricks, or once you put enough water on it, it would start to flow through the fractures. That is kind of an analogy.

Finally, what is the rate and direction of ground water movement from the repository horizon to the accessible

environment which would be down through the water table and out five or so kilometers.

The next viewgraph lists some of the type of studies that we are doing in the near term. First of all, as Jerry suggested, we are drilling two multi-purpose boreholes near each of the exploratory shafts. They are going to be about 60 feet away from each of the shafts.

These boreholes have several purposes. They are being drilled dry. They are designed to get baseline information before the shafts go in. The shafts themselves will use some water during construction. So they will be able to detect the movement of water and they will hopefully help us understand if there are any interferences from one shaft to another as they are being constructed.

That was one of the major concerns that the NRC had on the SCP.

CHAIRMAN DEERE: Those are separated by, what, 300 feet?

MR. BROCOUM: The shafts are separated by 300 feet.

That study plan that includes that activity went to the NRC on the 9th of February. So that is a study plan that is now public and it is being reviewed by the NRC.

The second is a series of infiltration tests. These are tests where you wet the surface and from some shallow boreholes you see how long it takes water to infiltrate down.

It is thought in the unsaturated zone that in the matrix, water moves about .5, at upperbound about .5 milliliters. This is part to investigate that.

That study plan is not out yet, but it is due to come into the project office for review from the USGS at the end of March.

The third bullet refers to a major program of unsaturated zone drill, and these are a series of holes of 18 or so or even more holes that will be drilled on the site and around the site.

These will be holes that are about 12 inches in diameter, go down to the water table, and will be instrumented, and the instrumentation will be designed to get the characteristics of the unsaturated zone.

Headquarters has gone back to the Project Office for revision, when it is revised, it will be issued and sent to the NRC.

The last is on regional studies in the hydrologic system, particularly where are the major areas of recharge in the region and one is thought to be 40 Mile Watch and that's why I pointed it out on the map before.

Again, by a series of drill holes, we know where there are flash floods or water in that wash. There will be evaluations done on how that area may recharge.

That study plan is due to the Project Office from the USGS at the end of March.

Now we turn to tectonics and it shows you some of the major questions in tectonics; what's the earthquake matnitude and the recurrence intervals that are associated with the local faults. What vibratory ground motion should be used to design structures, systems, components important to safety.

What are the likelihoods and characteristics of potential surface fault, and this is very important to surface facilities in Midway Valley. To what extent can the future tectonic events cause change in the ground water table.

Jerry Zamansky, in one of his hypotheses, believes that periods of teconism raise the water table. What are the

origins and ages of calcite silica deposits along faults as in one of the trenches on the site called Trench 14?

If these are in fact features that come from depth and they are very young, then they tell you something about the past water table and generally about hydrothermal activity.

Finally, what is the probability that the repository will be penetrated by the basaltic magmas? Some of the volcanism in the area may be as young as 5,000 years.

The next vue graph shows you some of the things we're doing to address these questions. We have a seismic monitoring net that is the Yucca Mountain Network which is a part of the Southern Great Basin Seismic Network.

We are also receiving data from the Department of Defense Stong Motion Recording Instruments for the NTS and we will be installing our own strong motion instruments.

We hope this summer, late summer, to start trenching the Midway Valley to determine the nature and potential faulting at the location of the surface facilities. That study plan has been reviewed and we expect to get that study plan to the NRC this month.

The return refault, all those faults I showed on the map are going to be studied, they are going to be trenched and mapped and so on to determine the age of these faults, how frequently they move and how -- what sized earthquakes they could produce.

Finally, the last are the volcanic features or potential future activity from volcanism. They are going to be drilling and coring anomalies associated with these. They will be doing a geochronological study, dating the ages of some of these volcanic features. They will be doing various kinds of field studies, some of these are ongoing today, and they will be studying the geochemistry of not only scoria but ash deposits and upper volanic flows.

Third was climatological questions. How will we be able to bond the future climatological conditions? One of the ways is by looking at the past climate and by looking at light deposits and by looking a paleobotanic data and by doing climatological modeling in the whole Southern Great Basin.

What will be the impact of future climate shapes and groundwater hydrology? The impact will be at least three things. One will be the rate of infiltration of water, if the amount of rainfall goes up, the amount of water infiltrates will increase.

That may affect the groundwater flow characteristics and that may affect the water table. So they are all kind of related. We need to understand the clime is likely to be over the next 10,000 years.

The following slides show some of the types of studies. The first and the last bullet, the calcite-silica

deposits and the last bullet are all part of one study. They were all different activities in one study. That study has been reviewed at headquarters and final verification will be issued to the NRC we hope in April of this year.

Studies of lakes, playas and marshes which may give us insight to paleoclimate and studies of the paleobotanic data, those study plans are not yet prepared and will be prepared in the future. Those are the types of things we intend to do to help us understand the climate.

The next vuegraph covers the last of the major areas of concern and that is natural resources. Particularly you want to understand if there is special or unique about Yucca Mountain because Nevada is a state with lots of mining, gold mining and silver mining which are important. There are a lot of -- within 50 kilometers or so -- a lot of mines, a lot of open pit mines and so on, but is there anything unique about Yucca Mountain itself that would attract someone there instead of someplace else? Is there anything unique relative to Yucca Mountain relative to other similar areas in the world?

As far as we know, there is not, to date but we are going to try to determine what potential for mineral and energy resources is at Yucca Mountain and within the Control Zone; what the potential demand and future supply of water resources are near the site; and to what extent

these, when you look at these things, may lead to future exploration for future exploration of natural resources.

I think again to a large measure that depends on if there is anything unique there.

We have a study to do that, the first bullet, The Mineral and Energy Resource Assessment with Regard to Minerals. That study has not been written, but what that study will do is take a lot of the information from all other studies and activities and pull it together into an overall evaluation of minerals and energy and those are listed below. I won't read them all and leave it to read at your leisure.

There is a parallel study on water resources and that's a second major bullet. That isn't written yet either. That will be pulling from all the data we're using in understanding the groundwater at the site.

These will be input into analysis for potential human intrusion.

So minerals and energy, water resources will be studied carefully. They will then be combined to do an analysis with the potential for human intrusion.

Those are the basic areas I wanted to covered and I covered it from the point of view of what things we have that raise concern to you, what we think the greatest concern is on the site.

Thank you. If you have any questions, I'll be

glad to answer them.

CHAIRMAN DEERE: Maybe we can take a five minute break?

QUESTION: What are the procedures for the Bureau of Land Management as far as well either the NTS and/or the Las Vegas Bombing and Gunnery Range? I know they allow, I guess, cattle grazing and sheep grazing with permission. Do they do other things?

CHAIRMAN DEERE: I think we ought to hold that question for tomorrow when our licensing and permit people are here and they are much more familiar with it.

MR. ISAACS: As I referred to the question of land access to the three pieces of property is on the front burner at the moment and we've got to make sure that we have the kind of access to that for the long term that we need.

I'm not sure I made it totally clear, the management scheme. I put the management slide on the board before. The actual site characterization or the actual physical field work at Yucca Mountain will be under the direction of the Nevada Operations Office, Yucca Mountain Project which is headed by Carl Gertz, a DOE employee, under which these many contractors and subcontractors will actually carry out the work based on the site characterization plan.

We have just had a competition and elected -- selected, I should say, a management and operating contractor

headed by the Bechtel Corporation which was teamed with Westinghouse, Betel, Science Applications, a couple of other major contractors, to take this analysis, this tremendous amount of information of design, of testing data that comes in and so forth, and integrate it into a package that will allow it to determine one, whether the site is suitable, and if so, to put together the appropriate documentation for licensing; and secondly, to help us go through the conceptual and then the final design of the repository, the waste package and these other facilities.

That is how the scheme will work. It is Headquarters who will manage that managing operating contractor, Yucca Mountain will actually characterize the Yucca Mountain site.

I think it is also important to state that obviously in 5 to 7 years as Steve just well went through, we have a tremendous number of issues to try and address here. Those issues are to both understand how this repository is going to perform in the expected situation and also as Steve mentioned in the unlikely event that some of these things that we're not sure whether or not they are going to occur, we don't think they are going to occur, but they might occur, how would the repository perform in that sense?

We're going to have to do then some very sophisticated assessments of performance and they're going to have

uncertainties and multi-attribute utility analyses associated with them.

The only way we can do that is by drawing the appropriate conservativisms where necessary, by running sensitivity analyses on these codes and models and by using other information like natural analogs which occur in various places around the world and other things to help build that case of confidence that if we think the facility is indeed satisfactory, that we put together a convincing case that it is satisfactory.

The last thing I want to mention, because it is an important issue, Steve mentioned in several places, we want to look early at things that if the site were to be disqualified for any reason, we identify those early. There is no need to spend years and billions, a billion or two dollars to identify a site that we can identify early isn't qualified.

So many of the things that Steve mentioned we will find out early indicators. We don't think the site's disqualified, we have a lot of information that tells us that we are confident that it isn't but certainly early on we expect, and the NRC would like us to and the State would like us to, and we would like to, make sure that if thereare some early indications that the site isn't good, we clearly intend to investigate thoseearly.

DR. COONS: Could I ask Steve a question? To what

degree is the hydrologic work and geologic work being done entirely by the USGS? To what degree are you people or other contractors involved?

MR. BROCOUM: It's being done essentially by the USGS.

DR. COONS: I see. You have none of your own, except for people like yourself?

MR. BROCOUM: No, in some cases, we have experts to advise us. USGS is conducting it, like Los Alamos is essentially doing all of the geochemical work and San Dia (ph) is doing essentially most of the performance assessment work.

That is the way the Project Office has organized the site characterization.

CHAIRMAN DEERE: I would think there might be a point in time where we would want to meet with these groups or have them make us presentations on the status of their work. Maybe it would be sub groups that might want to visit.

MR. BROCOUM: Any one of these topics, which we usually spend a day on, yes.

MR. ISAACS: One of the things, hopefully, Bill and we can help arrange on your behalf, is to put these into manageable pieces that we can organize to get the right people in the room with you all to interact with on a meaningful basis on all of these various disciplines as time goes on. We will work very hard with you and your Executive Director

to organize that in an efficient way.

I'm informed that the coffee shop that we went to this morning is closed.

(A brief recess was taken at this time.)

MR. SALTZMAN: Our next speaker is Ram Lahoti who will discuss exploratory shaft facility.

MR. LAHOTI: Just to let you know, we are talking about this area -- this one is the BLM line and this portion is a site.

DR. ALLEN: Just out of curiosity, where is the nearest actual testing that's been done to this area within the test site?

MR. ISAACS: Principally out to the southeastern.

MR. BROCOUM: This is Steve Brocoum. It's about 22 miles east of the nearest test.

DR. CARTER: Some of the testing done almost due north and a little bit east of the Mesa and so forth. That's in the Yucca Flat general area.

MR. LAHOTI: Just to give you an idea of ESF we're talking about the surface facilities, we are talking about the shafts. I will go into detail about the key features of the ESF. Also the underground facilities and also some exploratory drifts which are going to be part of the repository later on.

DR. LANGMUIR: How close does the buildings come,

physically come distancewise to any of the underground workings?

MR. LAHOTI: The surface?

DR. LANGMUIR: The maps show about a mile, but there it looked like they were closer.

MR. LAHOTI: I will have a slide and I will show that.

MR. ISAACS: The mile is closer.

MR. LAHOTI: As I said, I wanted to put an emphasis on the integration with the repository, both the use of shafts, they would be using the repository and also some exploratory drifts will be made part of the repository underground excavations.

This slide shows the surface facilities and also underground excavations. As you see, there are several buildings here. This is the integrated data system building where we will be collecting all the data. These are the prefab buildings for radius testers like Sandia, Los Alamos and USGS.

We have a change house. We also have -- and I have a bigger slide showing the head frames and the hoist house. The two shafts come from these two points and as you see, the underground passages are really close to the buildings you are talking about.

As you come on this side, we have communication

tower there and we have parking and other buildings there.

DR. ALLEN: You show a mountain behind the shaft. Is this being built down at the base of Yucca Mountain?

MR. LAHOTI: No. There is some height there. It's not at the base.

MR. BROCOUM: That's Coyote Wash. You're kind of looking west into the north, it's just a little ridge, just a little wash there. It's not really Yucca Mountain, Yucca Mountain is off to the lefthand. We have a large photograph upstairs we could bring down if you want to actually see the layout. It has a contour overlay on it but it doesn't cover all of Yucca Mountain.

MR. LAHOTI: I did have a slide showing the site plan but this one shows the repository boundary.

MR. ISAACS: Basically, we're still on top of a mountain. Essentially on top of the mountain a pad is constructed close to the top of the mountain and the shafts go off the pad.

DR. CARTER: You show the ridge of the mountain? To begin with, the mountain isn't all that high. It's a small mountain.

MR. ISAACS: We'll get the picture that's better. It's kind of hard to tell from any photographs.

MR. LAHOTI: Again, this is the underground surface facility area of the repository. As you see, the ESF

two shafts are located here and you also see the repository shafts. Here is the men and materials shaft of the repository and the emplacement and exhaust shaft.

There are several ramps and I think that Jack is going to cover that in his presentation later on.

DR. CARTER: Let me ask you a question about that particular slide. Why does the site itself, the Yucca Mountain Facility Site have such a weird boundary to it, or such an odd boundary. It looks like a dove asleep upside down. Anybody have any idea?

MR. LAHOTI: I'll refer that to Steve.

MR. BROCOUM: Based on the knowledge of the site, that's the area that is most suitable and provides the best isolation capability relative to fracturing and rock characteristics.

DR. CANTLON: The depths of those ash deposits go off in different directions, so it really is where your thickest layer of ash is?

MR. BROCOUM: That's right.

DR. ALLEN: Based upon drilling already done?

MR. BROCOUM: Yes. Based on limited drilling, yes.

MR. ISAACS: It might be worth mentioning that there are something like over 300 boreholes already drilled on the Nevada test site from which we did get a tremendous amount of information.

DR. ALLEN: It already looked like a sieve.

MR. LAHOTI: This is the hoist house and the two shafts there. This shows the column area which is about 80 feet and this column area is wired for staging and then once the staging platform is in place, then you're ready to use the conventional techniques to mine the shaft.

DR. LANGMUIR: You show the shaft going in as a wet process, you've got muck and so on. You're looking at a wet drilling --

DR. CANTLON: No.

DR. LANGMUIR: I thought it was dry.

MR. LAHOTI: We'll be setting the charges and then we will be mucking out. We'll use water to try to minimize the water used to control the dust.

MR. BROCOUM: The borings are dry, the multipurpose boreholes and other borings -- the shaft itself will be, as I said, constructed using conventional techniques with minimum use of water, recovering as much water as possible.

MR. LAHOTI: Basically, the surface facilities which cover approximately 5 acres consists of ES-1 hois and headframe and ES-2 hoist and headframe, hoist house for both hoists, utilities, temporary facilities for offices and temporary facilities for testing personnel.

This shows the basic geological column. You have the Topopah Spring Member which has a low saturated and --

conductivity but it's highly fractured.

The Calico Hills are here which are low hydraulic saturated conductivity.

MR. ISAACS: Show them, Ram, where the repository horizon is.

MR. LAHOTI: The repository horizon is somewhere here (indicating), about 1,050, plus or minus.

Again, this shows the two shafts. We are going to have about 600 foot level demonstration breakrout room and then as we go down, we will have underground escavation. These two shafts you see here are underground excavation.

The first shaft is the -- which is going to go slower because we are going to do a lot of testing. The second shaft is going to go faster. Once we reach the bottom of that area then this portion will be developed here and then we'll go this way and come back like that. By the time we reach here, again we're down in this area and we complete this loop.

Once the shaft reaches the 1,050 plus or minus level, the connection will be made and then the definition we are using for start-up in situ testing is after the connection is made, however, there will be a lot of testing done prior to that as we sink the shaft and as we open up the upper demonstration breakout room.

The two shafts have a minimum of 4 inch concrete

lining, approximate depth is 1100 feet. I already mentioned the function of the two shafts. The first shaft is for testing; the second shaft --

The shafts are 300 feet apart. In the repository, the shafts will be used as an intake shaft. In the repository construction, these shafts will be used for intake and exhaust both. One will be used for intake and another one will be used for exhaust.

Once the repository is built, then the intent is to use both the shafts for intake in combination with a transport ramp, so this will serve as the intake.

CHAIRMAN DEERE: But only for the ventilation.

MR. ISAACS: Down the incline, exactly right.

MR. LAHOTI: That transport ramp will also be used for transporting the wastes.

The extent of the underground expansion is 4,000 linear foot of drifts we're calling it main test area for tests we've identified as in situ tests and 5600 feet of drifts, and I'll show you where those drifts are. They go to three different zones.

These are sort of demonstration, these are the drifts that should become part of the repository.

This came from the repository conceptual layout. Here is the repository underground boundary and ESF is right here which you see here.

The 4,000 linear foot of drifts I was talking about -- these drifts are -- for example this goes to -- and this drift would provide access to that, and also there is a possibility of shafts here, Ghost Dance Fault and one goes to --

These drifts will be part of the repository as you see. This is the top ramp and also the waste ramp coming here, so we are trying to make sure that this integrates the ESF capacity into the repository.

DR. ALLEN: What's the primary concern on the faults? What is it you primarily are looking for?

MR. BROCOUM: Essentially, they are good conductors of water, water can surface down to Repository level and further down --

DR. ALLEN: Is there any way you can discover anything in any one of these faults that would represent a fatal flaw or something?

MR. BROCOUM: I think personally that would be very difficult. I find it very hard in my own mind to think of a single fatal flaw. You have to relate what you find to performance. An individual measurement or an individual data point, it would be very hard, I think, to find a fatal flaw. There are a few, perched water, extensive perched water, or extensive fracture flaw

DR. LANGMUIR: What if this fault is very open?

Any of the faults you're talking about?

MR. BROCOUM: That's a possibility. I think we will have to wait and see. We won't know until we look at them.

DR. LANGMUIR: But if there were, would that disqualify them?

MR. BROCOUM: I'm not even certain at that point they would --

CHAIRMAN DEERE: Hasn't the site itself been laid out so that these faults are peripheral to the area? They don't cut through the area; the area has been chosen so as to come sort of tangent to them, am I correct?

MR. BROCOUM: Except to the Ghost Dance, but that is a relatively minor fault compared to some of the other bigger faults.

MR. ISAACS: This goes back to the point I made just before the break and I think it's a very appropriate one. I agree with Steve, I think most people believe that the fact that you will find a smoking gun, let's say, is very unlikely in the repository.

What you're going to wind up with are pieces of information which will be used in codes and models and in analysis that will make you feel more or less comfortable that this facility can meet the performance requirements and at the end, there will undoubtedly be residual uncertainties

additional tests that you can always run and some bottom line residual risks.

The objective of our program is to put together the most satisfactory case of what the reality is and hopefully, if the site is suitable, to put together a convincing case of why it's suitable. It's those kinds of things that we will find out are only going to help us determine whether the site looks more or less attractive with regard to performance and will be used to build a case for meeting the performance objectives of the license if indeed the facility does merit that.

DR. NORTH: Is there anything in writing noting what it is about the faults you would like to study with these tunnels? In other words, the characterization you just gave, is there a set of questions laid out for inputs to the analysis that you expect to get answers to from this program?

MR. ISAACS: Yes. The site characterization plan, that 6,000 page document, is laid out up at the top with what's called the issue hierarchy which is all derived from the NRC regulations and the EPA regulations, and the requirements.

All of the information needs in the program are derived from trying to establish the confidence that we can meet those regulations if indeed the facility turns out to be suitable, and all of the testing and ultimately the study

plans that were talked about earlier by Steve will be actual procedures for conducting the experiment, all flow from this issues hierarchy as we call which is designed to show that we have coverage of all of those kinds of key issues in a way that will allow us to build a convincing case that we can meet those kinds of performance goals.

That is the conceptual framework of the site characterization plan and the site characterization before you.

MR. LAHOTI: Also it appears that the Ghost Dance fault would provide insight which would help in the design and also the performance of the repository, the rain wash is going to provide information for construction of the repository and performance.

So the ESF Testing Program includes testing in shafts, testing at upper demonstration, record rooms at the main test levels. In addition, we also have off site testing which is not under ESF but testing conducted off-site.

These are not the types of tests but most of the tests that we are going to perform, they are like a couple of tests, geothermal, geomechanical, will provide information in more than one aspect, for example, under geological we would have shaft mapping. We are also going to study excavation techniques, shaft conversions, for example mining techniques and so on.

I did not put together a separate set of slides to go over the testing program. There are tests planned, the in situ testing, particularly in the underground area and the demonstration breakout room area.

I could go over some major ones. We would do the mapping throughout the vertical and horizontal areas to get the major structural features. We have, for example, in geochemistry and hydrochemistry, we want to know the chemistry of the water, for example.

Also we would like to know age dating of the water using flouride, properties which would help a designer in designing the repository, in situ stresses, shear stresses, so on.

We are also doing some mechanical testing, for example, which would give information on the stresses and heat conditions. There are tests designed using the cannister for example, tests which are designed to simulate the conditions.

We are doing for example the vacuum test or you vacuum the excavation and study the effect of vacuuming on the excavation because we feel that the fluid movement in unsaturated zone is very important.

Shaft and borehole seal concepts, we are studying the concepts at this time. We feel that the testing in geology, geochemistry, hydrology and thermomechanical areas

provides some information to help us design this test.

Basically there are 34 or so different kinds of tests and each test would be -- some tests would be duplicated several times to get more data points.

Again this underground layout shows some testing for example, this package we would be testing vertical and placement testing, sequential mining, we'll be mining here and then will mine the second drift and assess the impact of mining.

We have a heated block test, cannister scale heater test and again we're going to study the excavation effects and so on.

CHAIRMAN DEERE: You can also see on that drawing the location of the NPBH that goes to the exploratory shaft.

MR. LAHOTI: Shaft 2 is here, and Shaft 1 is here and here is the NPBH. Again, when we do the excavation, we will have a borehole about 25 feet or so in advance of excavation to see if we get any perched water. So we have a contingency case plan.

CHAIRMAN DEERE: One of the reports mentioned I think a probe hole 200 feet ahead. That seemed a little bit long.

MR. LAHOTI: Yes, I think the final design report does say a 200 foot when you start excavations, then as you go down, then the 200 foot distance would be reduced to 25 or

30 feet.

CHAIRMAN DEERE: Right.

MR. LAHOTI: 50 feet?

MR. ISAACS: 50 feet.

MR. LAHOTI: Yes, Title I design report does say 200 feet.

MR. ISAACS: By the bewildered look on your face, you must be the last Commission member, come on in.

MR. LAHOTI: Again, the off-site tests in G-Tunnel are conducted and these tests are designed to -- excavation effects and we want to know the full movements in saturated zones due to excavation.

Also there are some tests being done, mechanical and thermo -- barrier tests of barrier design.

CHAIRMAN DEERE: Excuse me, Dr. Ellis Verink has now arrived from the snow bound parts of Pennsylvania. He's from Florida and that's what happens when you go up north.

(Laughter.)

MR. ISAACS: Welcome, on behalf of the Department.

MR. LAHOTI: This is the G-tunnel where we are doing some of the testing. We are doing thermal stress tests and we are also doing some experimental drift work here, rock mechanical drift.

Some of these drifts are already there from the weapons desting program. I'll show the slide just to show you

we are doing some work in G-tunnel.

DR. LANGMUIR: Has any weapons testing been performed in the area to confound the geochemistry?

MR. LAHOTI: I can't answer that.

MR. BROCOUM: Yes, some weapons have been performed in the past. Those tunnels are sealed off. Outside of geochemistry, I can't answer your question.

MR. ISAACS: Is the question related to G-tunnel or is the question related to where the exploratory shafts are going?

MR.LAHOTI: The G-tunnel, yes because they have sort of a block at -- if you go into G-tunnel, you can see that they are --

CHIARMAN DEERE: This is up on Pahuti Mesa, isn't it, the G-tunnel? This is not in the area?

MR. ISAACS: No, no, this is tens of miles, from the facility. You're absolutely right, this is where they conduct tests, not in those particular tunnels but it's been a sign of encouragement actually to people evaluating this site that right there they've been testing weapons and these tunnels are still there. It's an indication that we believe that the effect of weapons testing on a facility that's some tens of miles away is expected to be nominal.

MR. LAHOTI: Somewhere here (indicating). Basically these are the concerns that we identified, environmental

permits/approvals, land access, which is progressing satisfactorily, and external review of the site calculation plan and by that I mean review by NRC and so on, so that we get the comments in a timely manner.

DR. ALLEN: Review by who?

MR. LAHOTI: Review by NRC, Nuclear Regulatory Commission.

MR. ISAACS: And also the state and the public, the comments of all the parties who are reviewing it and consider these comments before we can start on our site characterization work.

Some of those permits are federal flow down to the state and they have not yet been forthcoming. It is an issue that we're going to have to wrestle with.

MR. LAHOTI: And look at the air quality and water permits.

MR. SALTZMAN: Our final speaker this afternoon is Jack Hale who will speak on two parts of this program, the waste packaging and the repository design.

CHAIRMAN DEERE: Before we start on the next topic, I'd just like to make a comment again, the importance I think of these test shafts. I think it's really a very important part of your program and one that is going to bring you right up to face with many of the site problems that exist there.

The peripheral drifts going out into the directions

in at least three places and trying to check what you think are the structural defects of the area, I think they are structural defects in the continuity of the rock system. They certainly will affect I would think the groundwater flow patterns.

I think getting to those fault zones just as soon as you can is really necessary. It's not so much different from the work that I'm involved in on a day by day basis which is the stability and the water tightness of hydroelectric projects where we've had many, many unpleasant surprises from a long transmission of reservoir waters leading to different types of failures simply because of one single fault, many times not looking particularly bad.

This is not talking about the activity, but simply the engineering characteristics, so I think it's important that you get in. I'm sure you have information already that's in some of the documents that I haven't had a chance to get to or other members of the Board, that give us information about the permeability and so forth, but there is nothing like seeing a fault face to face at the depth you're interested in.

I think this is a very important part of your program and one that we really should keep right on schedule and even advance if we can because if anything can put this out of business, it might well be if you have one that has

permeability going through the site.

Stay away from the site, isolate yourself from the fault and you're all right.

MR. LAHOTI: There are a number of tests planned and we can discuss each test in much more detail.

DR. ALLEN: To what degree is the extrapolation of these faults to depth based solely on surface exposure versus actual intersections with them on various poles?

MR. BROCOUM: Most of them are based on surface exposures right now. The question is, are these cleaner or do they start to flatten out.

MR. SALTZMAN: I think this all just emphasizes we're at the very beginning basically of site exploration and we really have to get below ground. That's what we're chomping at the bit to do, get underground and see what we really have here to prove one way or another the feasibility of the site.

MR. BROCOUM: You presume that we have surface geophysics though to confirm the fault, orientations and seismic information.

VOICE: Geophysics until now has not been that successful in that tough environment on defining the sub-surface structure. We are developing -- we have some prototype lines we're running and we do have an integrated geophysical program.

DR. ALLEN: To what degree are you sure you've identified the major faults versus other faults that may be sitting there that don't happen to be exposed in some reasonable way at the surface?

MR. BROCOUM: I think we may have some surprises. It wouldn't surprise me as a geologist if we discovered faults. I think most major ones -- there's been enough work done up there by the USGS over the years that we probably have most of the major ones.

For example, Midway Valley research facilities, we think it's very important to do that trenching. We advanced it; it was originally scheduled for next year. We advanced it to this year so we can start to feed information we get into the advanced research and design facility.

DR. ALLEN: The faults in the repository site itself, what kind of displacements are typical on these sites?

MR. BROCOUM: On the Ghost Dance Fault, the one that goes to the repository, I don't think they know what the displacements are. It's not a very impressive fault from the surface, on the exposed surface.

DR. ALLEN: But if they don't know what the displacement is, how do they identify it?

MR. BROCOUM: It has an alteration line also.

MR. ISAACS: I'd like to pick up on something that Dr. Deere said because I think it's real important to how the

Board operates and how successful we are in working with you.

The kinds of things that you just expressed are, I believe, exactly the kinds of things that will make this Board so valuable to our program. I hope what we can do, and my office can do in particular, is work in a way to help you focus on those issues that are key to the success of the characterization program over the next 5 or 7 years and to get from you not simply 6 months reports that criticize what we should have done but to look ahead just exactly like you're doing here into the key areas and to help in the same way the Secretary mentioned, help us look forward at the kinds of things we're about to do and to help us evaluate, criticize, or adjust the program in a way that allows us to do the work right as well as we can the first time and to cover the kinds of things that otherwise we might miss.

I just want to encourage that we work together in the early stages here to develop a good connection between us and a way of operating together that you can be of most use to the program by helping us make sure we've got the thing going properly.

CHAIRMAN DEERE: I agree with you. It would be hard to shut us up anyway.

(Laughter.)

MR. HALE: This afternoon, I'd like to cover for you the waste package program and the surface facility. The

repository consists of both the surface and the underground, and I'll be covering both of those.

Ram's talked about some surface facilities but they primary I guess totally are tied in with the exploratory shaft. I'll be talking about the central process facility.

The first part of the program is the waste package program. The next slide, I have shown there that the waste package is one part of the engineered barrier system as defined in 10 C.F.R. 60 where the waste package would include the waste form, the containers, the shielding, packing and the other sorbent materials in the immediate vicinity of the waste container.

The underground facility includes the underground structures, the openings and backfill materials but excluding the shafts, the boreholes and their seals.

Principally I want to talk about the waste package at this point and later on get into the underground facilities.

The waste package consists of the waste form and the containers. The waste form that we're talking about here is basically two generic types of waste. The first one is the spent fuel from the nuclear commercial reactors and the second portion is the high level waste from commercial and defense facilities.

DR. CARTER: Could I ask you a question about the used fuel elements? How will those things be placed in there?

Are they going to be disassembled and the headers and all the stuff removed?

MR. HALE: I'm going to get into that in just a minute.

Let me show you on the next slide basically the quantities of fuel that we're talking about. We're talking about in the first repository a total of 7,000 metric ton units and it's divided up basically as I indicated here, boiling water reactor is 24,800 and 37,200 for the pressurized water reactors. These two elements here are the high level wastes -- this is from the West Valley and this is the defense high level wastes from Savannah River. There are some more smaller quantities but this is basically the way that it's split up.

When you take that kind of an inventory of waste materials, this is the number of waste package containers that we're talking about here, basically 40,800. I want to point out that number can vary. I think I've seen numbers around 47,000 and that will depend of course on how we eventually decide to package in the waste package containers.

One other point I should make on that slide is that of the 62,000 or so that is for spent fuel, 62,000 MTU's, 17,000 exist to date, so we're having to design for a facility that will handle material two-thirds of which doesn't exist yet. So we're going to have to extrapolate the properties

based on the burnouts and the enrichment of the fuel.

I did want to make that point because it's certainly an unknown that we're having to deal with in the design.

I wanted to point out also that in the design of the waste package, there are three basic regulations that we have to deal with, 10 CFR, Part 60 which I'd like to come back to in just a minute. The other two principal ones are 10 CFR, Part 960 which is the guidelines for recommendation of the site and of course the waste package is an integral part of the site and it gets tied in there; and then 40 CFR, Part 191 has to do with the radiation protection during the handling of these materials. So we have to deal with that.

I'd like to go back now to the first one, 10 CFR, Part 60 which basically addresses the NRC retirement. In there, they address the performance of particular barriers after permanent closure. What they are talking about is principally the waste package.

Two major items we have to deal with is the substantially complete containment and the controlled release. I've got a couple of charts in just a minute and I'll address these in more specific detail.

In addition, in 10 CFR Part 60, they have identified a number of design criteria that we have to deal with. It requires us to address the thermal effects, mechanical loading, unique inspection and that sort of thing. So those

are very well spelled out in the regulations.

There are other parts in the regulations we will have to deal with. One of them is that we have to consider alternative designs in the event that our environment turns out to be more severe than we anticipate based on the early testing, we'll have to go to a substantially improved waste package design.

We also have to have retrievability of the waste package for a period of 50 years after emplacement. Then we have to deal with criticality. We have to make sure that we do not put the fuel centers in there if they will exceed the effective of .95.

Then there is performance confirmation and I think you will hear a lot more about that tomorrow in Don Alexander's talk where we have to confirm the performance of these packages in the site.

The next slide. In these regulations, some of them are defined qualitatively. For example, the anticipated process of some events are those that can be reasonably expected, I believe is the way the regulation states it.

For our purposes, we try to be more specific and we have defined the anticipated processes in advance in terms of the probability of occurrence. If the probability is greater than .1, we called it an anticipated event; if it is less than .1, we call it the unanticipated.

Just a couple of examples of the kinds of things that could exist in unanticipated situations would be that we could have greater quantities of water. You've heard we expect the water quantities at this site are very minimal and that's the way we're designing it, but in the event that there is substantially larger quantities, we would have to deal with that also, that would be an unanticipated event.

Also, the ground water could be more corrosive than we're anticipating, as an example. (slide)

Getting back now to the substantially complete containment, basically we have to have complete containment for 300 to 1,000 years after permanent closure.

The precise number to be used here is still to be determined by the Commission and it's not to exceed 1,000 years, somewhere in this range.

In meeting this particular requirement, we will be counting on the waste package, the metallic waste package we're talking about as our primary barrier. We do recognize, however, that there is no such thing as 100 percent reliability. I think NRC recognizes that also, so we are not saying we have to have 100 percent containment.

We're still in the process of trying to determine just how much we can back off from that full 100 percent, but we recognize that in the manufacture of anything, there's going to be defects that just cannot be detected and we're

still identifying how much we can back off from 100 percent reliability but everybody knows we won't have 100 percent.

DR. CARTER: When you talk about 100 percent, you're talking about ensuring that everything would be contained for at least 300 years? You've got a sizable range there, 300 to 1,000.

MR. HALE: We're designing for the maximum of 1,000 years. It has to do with whichever period, time period, we're talking about. It's not 100 percent at 300 and something less at 1,000 years. That number will eventually be determined and we will have to go for as good a number as we can achieve within the technology limitations that we have imposed on us.

MR. ISAACS: What we're basically saying is if you have 40,000 plus waste packages, you will probably have some small number of waste packages which will not last the 300 to 1,000 years. We have to determine what is an acceptable smaller number of waste packages.

DR. LANGMUIR: This is one of the serious questions in the whole program, that no metallurgist has ever been able to predict things that far away and breakage or rupture is a very tough thing to predict.

Have they looked at the possibility that the water is goine to be more saline than the J-13 water which is available at the site for analysis, for example?

MR. ISAACS: I think that previous slide --

MR. HALE: We are just saying that we are going to look at those. We don't know how the water properties are going to differ and that is a part of the site characterization will determine.

DR. LANGMUIR: I'm involved with the team that's looking at -- zone water, and it's several times more saline than J-13. I'm just wondering if anybody's looked at that kind of water as a corrosion agent. They need to do that.

MR. HALE: We are looking at the most representative samples we have been able to find.

DR. LANGMUIR: But it's not groundwater, it's moisture from the unsaturated zone which is several times more saline than the groundwater.

MR. HALE: Tom, are you --

MR. ISAACS: I'm not familiar with exactly what salinity they are using.

MR. BROCOUM: A similar question to your's came up at the Waste Management '89 meeting in Tucson last week -- they did say we're looking at what we consider the range of waters to be and not just relating to the water from J-13.

DR. LANGMUIR: I raise the question because the detailed study plan documents don't have information on that moisture chemistry in them. It wasn't available then, so it's not common knowledge, in fact, even in the organizations doing

the research.

MR. ISAACS: We'll take note.

CHAIRMAN DEERE: Isn't that a little bit of a -- I'm not sure of the bgic of this. You've contained it for 1,000 years and then you let it go. You've got to then contain it for 10,000 years, so what's the difference between containing it for 9,000 versus containing it for 10,000?

It looks to me like we could do away with this part of it and we still must have the geologic repository.

MR. ISAACS: Where were you when 40 CFR 191 was being put in place? It's a long history of how 10 CFR 60 and 40 CFR 191 with EPA and the NRC regs in reverse order came to have what they have in them.

There is clearly redundant some might say unnecessary regulations. We also have a requirement that the groundwater travel time be less than 1,000 years and one could make the same case about why is that important, the ultimate performance of the repository over the necessary isolation period would seem to be key.

I think people believed -- this is my own feeling and there are probably others -- it would be a good question to ask of Ralph Stein tomorrow -- that there is an intuitive feeling that we can gain a greater degree of comfort and certainty and conservatism in the system by having these redundant regulations and that plus the fact that some people

wanted to see dose to individual kinds of regulations where others felt that we couldn't do such a thing over thousands of years and therefore, it was dose to the accessible environment led to a proliferation of regulations that some people might say well, they're redundant and unnecessary. I think that's where it came from.

CHAIRMAN DEERE: I guess it's the redundancy thing, it's been noted to be acceptable and desirable.

MR. ISAACS: Yes.

MR. HALE: The second part of that is of course controlled release requirements and it has the period for 10,000 years following containment period and the release rate for the specs there is supposed to be less than 1 part in 100,000. That's based on the inventory that exists as of 1,000 years for each of the radioisotopes.

So whatever agreement was there, 1,000 years they would have to keep less than 1 part in 100,000.

In the previous part where we were dealing with substantially complete containment, our primary barrier was this metals waste package container, whereas here, our waste form, that is this last high level waste or it will be the cladding of the spent fuel is one of our primary barriers for keeping to less than 1 part in 100,000.

MR. ISAACS: I think another way of saying that is we don't take credit for the waste package after the 1,000

years. It still might be there.

MR. HALE: Here is a slide illustrating the two referenced waste packages. On the lefthand side, is the one for the spent fuel. It's about 15 feet long, whereas the one for the high level waste is approximately -- as you will note here, in this waste package, we have what we call a four cannister. This is a stainless steel vessel that you can see on the inside here and it is filled at the waste processing facility.

It is also made of stainless steel, I think it is three or four stainless steel, and it's a complete vessel. The material is poured through the top here and then it's closed.

These four cannisters then are shipped to us -- transported to us and then we in turn put them inside of the waste package. The waste package, the external materials and geometry except for the length would be identical for both of these but this would be shorter since this is the configuration.

The next slide illustrates the way the spent fuel is placed into these packages. Again, this is the same package you saw in the previous slide. The upper portion here, we've shown a configuration for consolidated -- here we have six consolidated PWRs shown in these sections around the peripheral of this device. The fuel assembly hardware

would be put in the center portion here. Here we're showing 18 BWR's could be contained in a single waste package.

The lower part of the slide here, we're showing how the intact fuel assemblies would be placed in the waste packages. Here we have PWR's and on the right would be BWR's, you get more of the BWR's in that particular package.

Just as a point of reference, the weight of these things varied depending on the particular packing configuration but it ranges from about 6,000 pounds up to around 14,000 pounds. For the high level waste package, it's about 6,000 pounds in the loaded configuration.

MR. ISAACS: If I could just add a point, one of the uncertainties remaining in the program is whether or not it makes sense to consolidate the fuel rods. We have a demonstration program underway for several years to do it cold, not in radioactive materials. We would like to move forward in that.

The major benefit -- and this could take some more time because the major benefit of consolidating, of course, is that you can get more fuel into the waste package so you need fewer waste packages so that the more expensive a waste package is, the more money you would save by consolidating fuel.

Of course consolidation is an operation in itself with costs involved and consequences with regard to operational

complexity. The crossover point has yet to be determined whether or not it makes sense, so we're looking at both and we will hopefully make a decision.

It's key in the determination on the MRS because had we an MRS and would we consolidate our plan, would be to consolidate the fuel not at the repository but at the MRS.

VOICE: Unless you got criticality --

MR. ISAACS: Correct.

DR. LANGMUIR: And also it breach you, if you breach one of these with more fuel rods in it, there's a larger contaminant source, the nuclear waste is going to get out.

MR. ISAACS: That's right. There are a number of follow-on complexities that we could discuss with regard to whether or not it makes sense to consolidate the fuel. Like I said that's probably a good subject for some subset of people to help us look at.

MR. HALE: The waste package design as it has evolved up to this point is based on expected waste package environment that is briefly summarized on this chart. You've probably heard a good bit about this in other talks.

Basically we're talking about the densely-welded tuff rock being unsaturated, fractured, slightly porous, with a downward water flux.

Water chemistry is pretty favorable at neutral pH,

moderately oxidizing, low levels of corrosive ions such as chloride ions.

There is very limited water quantity, but there is some possibility of intermittent water contact and we have taken that into account in the design. Radiolysis of water vapor/air mixture is possible but is not expected to be very significant but that's still under study.

The next slide indicates the design approach that we have used in terms of using the favorable natural characteristics of the environment. We're talking about a vessel that has a thin-wall somewhere in the neighborhood of 1-3 centimeters. I think right now we're talking 1 centimeter but it is possible to go above that.

The candidate materials we're looking at right now are listed here. We have two stainless steels, a copper nickel alloy, a pure copper, we have aluminum bronze, then we have the 825 incolloy.

We have not made the final decision yet on which of the materials to go with. It's still being studied but the preliminary indications are that the stainless steels are not going to turnout to be satisfactory candidates, it probably will be the incolloy.

DR. LANGMUIR: If you pick something like the incolloy, what are you looking at in terms of the overall cost in the repository of going from 1 centimeter to the much

more sacred 3 centimeter wall thickness? What kind of numbers do we have dollarwise?

MR. HALE: Dollarwise the stainless steel containers we're talking about here, we're talking about $15,000 apiece. If you're talking about the quantities we're talking about, that amounts to like 600 and some million dollars.

If we go all the way up to the incolloy, we're talking about $60,000 per waste package because it's internal and so that runs the cost up by a factor of four, so you're talking over $2 billion dollars in waste package costs, so it's a substantial item.

MR. ISAACS: There are people who won't be bashful about saying it could be more than that and that's why the issue of rod consolidation obviously has to be very seriously addressed.

MR. HALE: The next chart here illustrates the conceptual design of the vertical borehole. We are looking at horizontal but the preferred approach at this time is the vertical borehole. We've scaled it down a bit here so we could get it on but basically this is the waste container at the bottom. We have a liner coming down part of the way.

We do have an air gap around the waste package in the lower portion here. This is basically how the waste package will be emplaced in the repository.

DR. LANGMUIR: Jack, you're not showing any betonite

or other materials surrounding the package against against the rock?

MR. HALE: No.

DR. LANGMUIR: We were talking earlier in the day or someone else was about air is the spacing between the two?

MR. HALE: There is this spacing basically from here (indicating) on down, that's an air gap.

DR. LANGMUIR: Years was spent looking at other kinds of things like betonites put around these cannisters and I gather that's now been discounted as the route to go?

MR. HALE: I think that was in some of the earlier --

MR. ISAACS: It was particularly looked at as being attractive in the saturated rocks, for example at Hanford. In the unsaturated zone, the conceptual design which has yet to be validated, shall we say, is to take advantage of the unsaturated rock and the heat in the waste package by maintaining an air gap to essentially drive the moisture away from the package and thereby count on, to some extent, the fact that, to some extent, this will remain dry because of the configuration. That has to be tested.

VOICE: The 26 inch diameter?

MR. HALE: That's basically the packing configuration, the way the BWRs, the PWRs, fit in there as intact assemblies. That's not been finalized yet; in fact, we have

some alternate designs that are 28 inches in diameter, so it certainly hasn't been optimized yet.

I guess if we decide to go with consolidation, that may have some influence on that also.

DR. PRICE: Is that going to have some passive circulation to it, the borehole?

MR. HALE: I doubt if it will be very much. There may be some selective.

DR. CARTER: The air gap is connected to the top.

MR. HALE: No, it's filled.

DR. LANGMUIR: I know the American program is intended to deal with much hotter temperatures for the waste, 200 and some degrees if possible, and the Europeans are looking at 100 degrees down for their's but our stuff is sitting in storage and it's going to go down in temperature before this thing ever starts, our temperatures are going to be down, what, 150 perhaps, so you're designing the system perhaps for much higher temperatures than you're liable to have, isn't that true?

MR. ISAACS: I think this is a valid question to be evaluated myself. Certainly the early fuel to go into the repository, we accept it on an oldest first basis. That hasn't been mentioned but the contracts with utilities says take the oldest fuel first, that's obviously the coolest fuel.

By the time the repository is in operation, that

oldest fuel will be quite old and therefore will be relatively cool.

However, we also have to recognize that at some point in time when the facility is in full operation, we will be taking down the backlog. We will be taking younger and younger fuel.

The numbers that I've seen have shown that we will ultimately take fuel -- this is questioned, it depends on assumptions -- we may take fuel as young as 12 or 14 years old, so the facility needs to be designed or at least we need to entertain the possibility that the facility needs to be designed for ultimately seeing fuel more in that age range.

I doubt that the facility will see fuel younger than 10 years old.

DR. LANGMUIR: What kinds of temperatures are you talking about at 10 or 12 years?

MR. ISAACS: I can't tell you but it's well over 100, 10 or 12 years.

MR. HALE: It gets up to 240, it peaks out after about 20 or 30 years after emplacement, then it drops off substantially. We're looking at some right now and we're trying to take advantage of keep any water that may be in-site driven off, so that we keep it above 100 degrees or 97 degree safe, when you drive off the water, I think the early indications are we can keep above 97 degrees for about 300

years but we're not going to be able to do it forever.

MR. BROCOUM: Isn't it correct though that we're not taking credit for that air gap at that point?

MR. HALE: That's right. We're not taking credit for driving this heat, we're trying to design the package to contain it without taking into account any credit for this heat being generated driving off the moisture.

MR. ISAACS: It's a conservatism, something that who knows we may need credit for before all is said and done.

MR. HALE: Some of the current activities that we have underway right now are listed on the next chart. We are putting together a strategy document that we plan to pursue. We are further defining the reference waste package environment and this will come out of the site characterization activities.

We are further defining the waste form characteristics. We know what some of them are but we're going to have to develop an overall envelope of what the waste form characteristics are. This is quite -- as well as the high level wastes.

We are characterizing the reference barrier materials leading to waste package container material that I mentioned on the slide earlier, still characterizing those leading to eventual selection of material.

We've been conducting some integrated tests and

thermodynamic property measurements. These are data that will fit primarily into our modeling studies that you will hear a lot more about tomorrow from Don Alexander.

We also are developing defined drawings and trying to update our cost estimates for the waste package container because as I indicated earlier, this is a pretty substantial cost element and we're trying to define that more.

Of course we're developing study plans for the waste package environmental studies.

Some of the issues that we still have to deal with are the container material degradation, as someone mentioned earlier, a very good point. Normal engineering will not allow you to predict performance of something for 1,000 years, so we are concerned about that and how we're going to really be able to project how well these materials will perform for those long periods of time.

We are also concerned about the characterization of the environment and that is underway. The waste form characterization, we have work underway to do that and then the spent fuel cladding performance, how much can we count on the cladding of the spent fuel.

DR. PRICE: In the vertical configuration, you built one container per borehole and in the horizontal, you build several?

MR. HALE: There's several. There can be several

for sure. Right now, we're leaning toward the vertical but there's a study underway right now to determine whether we are going to go horizontal or vertical.

MR. ISAACS: My understanding is the horizontal, the original concept of several has been reduced to few because of retrievability considerations. So reference is vertical. If we went horizontal, I'm not sure how many we would -- maybe three or four, not a dozen.

MR. HALE: Let me shift to the repository facilities now if I could and initially talk about the surface facility. We'll talk about the essential facilities that's in this zone right here (indicating).

Earlier, Ram was talking about the exploratory shaft and the surface facilities are located up in this zone right here. Right now, I'd like to talk a little bit about this.

MR. SALTZMAN: There was a question earlier about where the mountain was.

CHAIRMAN DEERE: Why don't you put it on the screen and take off the slide?

MR. HALE: This is the crest of the mountain here. The ESF and the shafts 1 and 2 are located here (indicating). This is the drainage coming down.

MR. ISAACS: What's the elevation of the crest and the elevation of the pad?

MR. HALE: 4500 feet, I think is the --

MR. ISAACS: Crest. And the pad which would go down at the ESF, 30 something.

MR. HALE: 31.

MR. ISAACS: I'm trying to get back to Clarence's question. Clarence, it's not at the top of the ridge. It's off the top of the ridge.

MR. HALE: 4100.

MR. ISAACS: 4130.

MR. HALE: This is the general slope side of the mountain. The crest then drops off sharply on the west.

DR. ALLEN: Where would the rail head be?

MR. ISAACS: A mile more to the east.

DR. ALLEN: How far is the mile on this map?

MR. ISAACS: Off it I would think, way off. The two shafts are 300 feet apart.

DR. ALLEN: That's about a mile that we're looking at.

MR. ISAACS: Something close to that.

DR. ALLEN: So the rail support facility is way off.

MR. ISAACS: Yes, and down 3000 feet. What's the valley elevation where the surface facilities are?

MR. HALE: I think that's about 3800 feet.

MR. ISAACS: In the valley?

MR. HALE: Yes.

MR. ISAACS: So we're up like 1,000 feet from the valley to the pad. It's a little bit below, that's why you can build a ramp.

DR. ALLEN: So you've got a ramp that goes down 100 or 200 feet or so?

MR. ISAACS: I think it's a bit more than but that but it's something like that.

MR. HALE: Here is a summary of some of the summary design basis for some of the facilities and the two basic types of fuel. We have a 60/40 split of PWRs and BWRs. The spent fuel burnup nominally is 33,000 and can run up as high as 60,000 megawatt days per MTU.

We have a requirement that we don't have to take fuel any less than 5 years old and we expect the average age will be greater than 10 years. Certainly in the early part or early years of operation, it's going to be greater than 15 years.

Design capacity, eventually we'll have to deal with 70,000 MTUs. The operations will be started up at 400 MTU per year of spent fuel and then when we get into full operations, we'll increase this from 400 to 3,000 MTUs per year of spent fuel, plus we will be taking 400 of the high level wastes.

Any site generated waste will be shipped off-site.

MR. ISAACS: That's not high level waste.

MR. HALE: Right, low level wastes. Tomorrow, you'll hear in great detail about the transportation system. I just wanted to point out here that the materials will be coming in in either rail or truck transportation casks. The key point to make here is that for example this railroad, this rail cask will haul 24 BWRs and 49 PWRs, substantially greater than one of our waste packages will contain.

I wanted to take a few minutes and walk you through the operation of the waste handling building. On the lefthand side we show here a truck bringing in the waste package, the transportation cask.

Here it's unloaded, goes into the cask transfer tunnel and then for those cases where we're talking about a high level waste or the material that comes in with intact assemblies, they are going to remain that way, they are unloaded here and then we will be placing them in the waste package at this station with containment refills. It will be welded and we will have weld inspection. They will go through decontamination and from here, we go over to the waste transfer tunnel and you'll see on one of the subsequent slides we go over to an on-site storage until it is later picked up by a transporter and carried into the repository for emplacement.

The next slide, this is where the fuel comes in

on the truck the same as it did before but here we take the assemblies out of the transportation cask and we go through consolidation operations, we take the inpinnings off, run through the consolidation and then it goes into a cannister.

The next slide --

MR. ISAACS: If I could just mention that as I mentioned earlier, we are looking at system studies for what operations ought to be conducted in MRS if we have such a facility versus at a repository because there is still some question as to what operations would be conducted here and we've got to design an integrated system which Ralph Stein will talk about tomorrow that will optimize these operations in the appropriate places.

DR. ALLEN: Has the NRC given any indication of the degree of safety they're going to ask in this particular facility for stuff that's sort of in transit through it, in terms of say in comparison with nuclear plants and so forth?

MR. BROCOUM: In terms of seismic hazard, we're trying to make sure that we're being as conservative with the source facility as with the power plants.

DR. ALLEN: We're being what?

MR. BROCOUM: As conservative -- remember this facility is going to last 50 years or so, the same time span as a nuclear power plant, so we're trying to be as conservative in designing from the safety/hazard point of view for

the surface facilities as we are for nuclear power plants.

DR. ALLEN: But potentially any kind of an accident here -- the maximum credible accident here would be much less severe than the maximum credible accident at a nuclear plant.

MR. BROCOUM: You're correct, yes.

DR. ALLEN: So why the same degree of conservatism?

MR. BROCOUM: Because the NRC has suggested -- some Energy staff members have suggested we have to apply 10 CFR Part 100 and be safe, which is the reactor site criteria used for site reactors.

MR. ISAACS: Clarence, I think your point is an excellent one and we need to think about it carefully.

DR. CANTLON: Each one of these is a big cost item when you look at the life cycle cost of this operation.

MR. HALE: Very much so. If I could go on then, after we come out of the consolidation operation in the previous slide, then we go into the packaging of the hot cell and weld the top on. Eventually, as we show you on the next slide, it goes into a surface storage vault where it is retained until we get ready to take it to the --

I think Tom made an excellent point. I'm trying to show you here basically how you would step through if we go through consolidation and if we don't, we still study this to determine where these operations can lead.

DR. CANTLON: The vitrification of the defense wastes are done off-site not here?

MR. HALE: Oh, yes, the vitrification is done at Savannah River and West Valley.

DR. CANTLON: There has been no thought about vitrification as a way of stabilizing, slowing up loss of the materials out of the fuel rods?

MR. HALE: I guess -- but that's not the way our design is going.

MR. HALE: Some of the activities we have underway right now, we are right now preparing a repository design requirements. These are the requirements we turned over to the A&E firm that has responsibility for designing this facility, then they flow down from the regulations and higher level requirements.

We're conducting a number of advanced and sectoral design studies in anticipation of beginning events in sectoral design in October of this year.

CHAIRMAN DEERE: Excuse me. I didn't understand on the first one again, to get the design requirements to turn over to whom?

MR. HALE: To an architect and engineering firm, A&E firm, which at this time is expected to be our M&O contractor, the one that Tom mentioned earlier.

CHAIRMAN DEERE: The Bechtel, Westinghouse, et al

group?

MR. HALE: Right.

CHAIRMAN DEERE: They will do the design?

MR. HALE: That is our plan. I tried to identify a few of the ACD studies that we have underway right now. One of them is we're looking at the impact of receipt rates. I think I told you we were receiving a total of 3400. We're looking at that to see if it should be increased or decreased.

We're looking at the seismic design criteria to determine what conditions this building will have to endure. We're also looking at closure inputs as it affects the waste package container. (slide)

I'd like to shift now over to the underground facilities. You've seen this slide before and I won't dwell on it.

This is basically a conceptual drawing of sections to the mountain. I'd like to point out a couple of things here. We are approximately 2,000 feet below the peak of the mountain where we get into our underground water flow.

The repository area we would be addressing is about 1100 feet below the peak of the mountain or 900 feet above the surface water table. This is the repository that we're addressing.

In the next slide, I have a plan view of the repository and I'd like to talk about it just a little bit.

I think Ram pointed out earlier that the exploratory shaft facilities are in this end here but these are the drifts and the panels that we will be developing.

As you can see on the lefthand portion of the slide, the waste material will come in through this ramp. This is a 23 foot diameter shed, we have a 25 foot diameter top ramp where the materials are removed as they are mined.

We start off by developing a panel, this particular panel would probably be -- and then we'd proceed clockwise around but first we would develop panel. While we are developing the panel, we'll be bringing air in through the exploratory shaft 1 and 2 here. These are 10 foot diameter shafts.

We will also be bringing the air in through the material shaft, that's a 20 foot diameter shaft. It will be exited or exhausted through the Tuff Ramp.

Then we will proceed over into the next panel to develop it and to mine it out while we're doing the emplacement operations over here, so we keep those two operations separate.

The emplacement -- during the emplacement we'll be bringing air in through the top ramp, 25 foot, and we will be exhausting it out through the emplacement exhaust shaft at this time. So we have two separate ventilation systems. We also always maintain a positive pressure of the air in the development zone relative to the air in the emplacement

zone.

These are the indications of the drift and of course, and of course you have the peripheral drift. I'd like to show you a little more detail now of the typical panel. The next slide shows that.

DR. CANTLON: Are the -- the perimeter drift is primarily a ventilation?

MR. HALE: That's right. Here is a blown up version of one of the panels. Here is the panel access drift, the mid-panel drift and there will be another one of these panel access drifts about right in here (indicating).

The point I wanted to make here though is that the emplacement that we have, we are comingling the high level waste with the spent fuel. The dark dots here and the lighter dots -- we're alternating high level wastes with the spent fuel.

Here is a cross section taken at this section right here (indicating). This is the longer, 25 foot waste package and we have a 25 foot borehole for that, whereas here we have a shorter package, 10 foot and we'd only be drilling 20 feet for that, but we are alternating the spacing. The exact pair will depend eventually on the heat output from these.

DR. ALLEN: What's the rationale for alternating rather than separately?

MR. HALE: We want to keep it as hot as we possibly can and the high level waste package will probably come into us at less than 100°C, so we will keep these hotter waste generating spent fuel packages, they will be generating much more heat than the amount of waste, so we're trying to keep it as hot as we can to dry off the moisture for as long as we can.

We are not counting on that but it's an additional safety factor.

DR. LANGMUIR: How does your ventilation system operate in here? You're inferring that you've got a substantial ventilation system to extract the moisture that's created by this heating effect. Where is that going? If there's a breach, you potentially could have some radon gas for example. What happens to that stuff?

MR. HALE: The ventilation system I was talking about was during the development of the emplacement cycle. Eventually this cycle will be closed up.

DR. LANGMUIR: I'm just interested in the whole evolution of vapors as a function of time before and after closure, I guess, my question goes to that extent. This is one of the major risks in nuclei transport, the radon stage if you have a breach.

MR. LAHOTI: We have different ventilation systems for waste emplacement area and for development of panels.

Also in the waste emplacement area where there is a -- there will be heat computers and so on, so if there is a release it will be through that separate ventilation system. For man and materials you have different systems entirely.

DR. LANGMUIR: That helps.

DR. CANTLON: The presumption is that the filters will scrub out the radon.

MR. ISAACS: Yes, the presumption goes even more, that we will be testing the integrity of the waste packages themselves before they go underground so that hopefully we minimize the prospects. Nonetheless, statistically we're going to have some concerns like that. I'm not sure we can address here in great detail the idea behind how this ventilation system will work. We can easily get that for you, particularly when you go to Nevada, the folks out there actually designing this kind of thing can do it for you.

During pre-closure, that's the concept that you would have the filtering system. Post-closure, as we mentioned, we expect to have a small number and hopefully through QA, we can keep that number to a manageable level of breaches. That's what substantially complete containment is all about. The issue with NRC is what kinds of levels of assurance do we have to provide but I think we can certainly get into more detail with you on that.

MR. HALE: I've included this next chart just to

show the concept of a transporter. Basically the waste packages would be loaded on the transporter in the horizontal position and go through the tunnel. We also have one for the concept developer, the horizontal boreholes -- go that way. (Slide)

I don't believe it's necessary to repeat this. I tried to point out the shaft diameters as we were going through.

This is a view of the design features. We have 1850 acres available for emplacement, we're actually utilizing 1420 acres. The total length of drifting is 116 miles and we will be removing 14.4 million tons of rock.

It will be fully underground construction, using conventional drill and blast and we'll be using tunnel boring machines.

DR. CANTLON: What's the determinant between those two?

MR. LAHOTI: Basically when you use the tunnel boring machine you want to make sure that you have straight sections and a section is long enough, so economy is the key concentration.

MR. HALE: Some of the activities just completed or in the process of working on, we just completed the site characterization plan, conceptual design report. This is published and we have copies that would be available to you

if you need to see them.

Again, we're doing pre-ACD studies. We're doing also retrieval strategy studies. Basically, we're looking at various concepts for retrieval and trying to come up with the preferred option there.

We're looking at the areal power density. That's the amount of energy that can be dissipated per acre of site so we can determine just how much heat we can allow these waste packages to generate. Right now I think we're at 57 kilowatts per acre.

We're also doing studies on interfaces, interface definition between the ESF, equipment and repository. Again, the receipt rates that I mentioned in the surface facilities will have a bearing on the underground facilities also, so we will be looking at them trying to determine the optimum receipt rate that's at 3,000 ton.

Of course the seismic design criteria will have an impact on the design of the underground facilities also.

The sealing strategies, here we're basically trying to decide what we're going to seal, where we're going to seal it. It's in a very early conceptual stage at this time.

Some of the issues that we're working on is vertical versus horizontal placement that I mentioned earlier; usable area and flexibility. How much can we allow

this facility to grow?

Of course we always have to deal with radiological safety and the Q-list, determine a Q-list for items important to safety and waste isolation.

We are gradually getting additional seismic design data and I think you'll probably hear about it tomorrow, and you heard some of it today where we will be implementing necessary QA procedures. We've put a substantial amount of effort into developing QA procedures, to make sure they get followed properly.

DR. CANTLON: The tradeoffs on vertical versus horizontal have to do with moisture accumulating in the vertical as well as opposed to seismic stability in the horizontal?

MR. HALE: That's one of them

MR. LAHOTI: Other tradeoffs would be how you would take that cannister and containers inside and determining radius you would need.

CHAIRMAN DEERE: How many volumes of that ADC design report, the conceptual report that you referred to on the previous line. Is it eight volumes like we received today or is it --

MR. HALE: It's pretty big. I think it's five or six volumes.

MR. LAHOTI: But I think if you read one volume

that is the backup information, you probably can get most of it.

CHAIRMAN DEERE: I was just going to suggest maybe we could have a set here tomorrow that we could take a look at and those of us who might want certain volumes.

MR. ISAACS: Sure.

CHAIRMAN DEERE: I think that would be a good idea.

MR. HALE: That's basically all I had to tell you. Some of this work, I should point out is under the responsibility of other people, so I don't feel too bad not knowing all the answers.

MR. ISAACS: Let me just say that's what we had intended to give you today. Obviously you're getting a feel for the tremendous scope of the program and how much is involved. I'm sure you have some feel for that from looking at the documentation we've already sent you.

What I hope will come of this is some insights into the kinds of areas you'll want to go into some more detail and how you might organize yourselves and how we can best support you in carrying out your responsibilities.

Tomorrow you'll hear more about how we integrate all these pieces and how we are focused on trying to meet the licensing requirement in the morning. In the afternoon, we will talk a bit more in detail about the monitored

retrievable storage facility and the transportation system, and the entire program of quality assurance.

CHAIRMAN DEERE: Thank you very much. This has given us a lot to assimilate. We will go into closed session now to talk about our calendars, our space, our staff and perhaps breaking up into panels that can get into more detail with your various groups and various other contractors and laboratories.

(Whereupon, the meeting was recessed at 4:40 p.m. to reconvene the following day at 9:00 a.m., Wednesday, March 8, 1989.)

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before UNITED STATES DEPARTMENT OF ENERGY

in the matter of:

NUCLEAR WASTE TECHNICAL REVIEW BOARD MEETING

were held as herein appears and that this is the original transcript thereof for the file of the Department or Commission.

D. Tallman
Official Reporter

DATE: MARCH 7,1989