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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE

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147TH MEETING

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WEDNESDAY

NOVEMBER 20, 2003

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LAS VEGAS, NEVADA

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The meeting was called to order in Dallas Ballroom D, Texas Station Hotel, 2101 Texas Star Lane, Las Vegas, Nevada, at 8:30 a.m., by Dr. B. John Garrick, Chairman, presiding.

PRESENT:

MEMBERS:

B. JOHN GARRICK, Chairman, ACNW/NRC

MICHAEL T. RYAN, Vice Chairman, ACNW/NRC

RUTH F. WEINER, Member

STAFF:

SHER BAHADUR, ACNW/NRC, Designated Federal Official

JAMES H. CLARKE, ACNW/NRC

NEIL M. COLEMAN, ACNW/NRC

HOWARD J. LARSON, ACNW/NRC

MICHAEL LEE, ACNW/NRC

I N D E X

P-R-O-C-E-E-D-I-N-G-S

(8:30 a.m.)

CHAIRMAN GARRICK: Good morning. The meeting will come to order. This is the second day of the 147th Meeting of the Advisory Committee on Nuclear Waste. My name is John Garrick.

The other members of the committee present are Michael Ryan, Vice Chair, and Ruth Weiner. Also presenting the committee today is a consultant, Jim Clarke.

The Committee will hear a briefing on DOE's Path Forward on Igneous Activity. We will hear an information briefing on weld drilling activities by Inyo and Nye Counties; a presentation by affected units of government.

We will hear an information briefing by a representative from the Electric Power Research Institute on its recent workshop on natural analogs. We will reserve time for interactions with stakeholders and meeting participants, and we will discuss proposed reports.

Howard Larson is the Designated Federal Official for today's initial session, and the meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act.

We have received no written comments on requests for time to make oral statements from members of the public regarding today's sessions.

Should anyone wish to do so, please make your wishes known to one of the committee members, one of the committee staff.

It is requested as usual that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

I want to acknowledge that we are pleased to have in the audience this morning a couple of the members of the Nuclear Waste Technical Review Board. Yesterday, Dr. Dan Bowen was here, and today Dr. Richard Peresnick is here, and there is also staff.

We know that Leon Ryder is here and Carl DiBella, and there may be others. We are pleased that they could attend the meeting. With that, I think we will turn to the agenda, and the first item on the agenda has to do with Igneous Activity, and the committee member that is going to lead that discussion is Mike Ryan.

VICE CHAIRMAN RYAN: Thank you, Mr. Chairman, and if you will recall yesterday, George Hornberger, who would be the logical choice for this

session, is not with us today. He is absent. So I would ask that we turn our attention to the Igneous Activity Status Report.

And we will have three speakers; Eric Smistad, Frank Spera, and Mike Cline, and I will immediately turn it over to Eric, who will lead us through these two presentations. Thank you, Eric.

MR. SMISTAD: Good morning. My name is Eric Smistad, and I am the Vulcanism lead at the Department of Energy. It has been a few years since I have spoken in front of the committee. I believe it was around 2 or 3 years ago that I spoke on performance confirmation at White Flint, and the status of that program at the time.

This session here we are going to be talking about the igneous consequences of peer review and I might mention that the program has conducted many peer reviews through time.

This is the first formal peer review that we have conducted on igneous consequences if you will. We have conducted other formal peer reviews, and biosphere, waste package, a couple of different TSPA reviews, and others, and there is a whole list of peer reviews that we conducted through time, both directly with the Department, and with our prime contractor.

I will just be going through essentially why we did a peer review, and why we conducted the peer review, a little bit on the process, and just briefly outcomes that the Department felt that we obtained from this particular peer review. Next slide, please.

I will give you the intro here. Frank Spera, from the University of California at Santa Barbara, who is a peer review member, will give a summary of the report, a consensus peer review report by the way.

And Mike Cline from BSC will give a short version of our responses to the recommendations that the panel made in Chapter 5 of the report. Next slide, please.

Okay. Why did we conduct this peer review? There were really several reasons why we did this. I mentioned that we had conducted many other peer reviews in the past on other modeling and activities within a project.

In this one, we had never conducted a formal peer review. We had an expert elicitation on probability of volcanism, but we had never had an outside if you will formal peer review of our igneous consequences model.

Following SR as we did in all of our modeling, we took another look at what we had in place for processing modeling the TSPA as a normal course of trying to improve what we had, and looking at additional information, or work that we had done since then for inclusion in our modeling for Las.

So that was a step that we took as a matter of normal course, and the igneous consequence modeling was no exception to that process. Around about the same time, we had entered into several agreements, formal agreements, with the NRC on igneous consequences or igneous activities.

So we had those two parallel activities going on at the same time; our own analysis of our work and a review and formal agreements with the NRC. And the big question coming out of this before us was are we on track with this particular piece of work, particularly -- and this won't read the dashes here, but in terms of the processes that we are representing and the overall conceptual model that was more or less the summary of the charge that we did actually give to the peer review.

So in other words, do we have gaps in our modeling, and we have some gaps that matter, and in the processes that we did model, did we go about that

in the right way. Next slide, please.

Briefly on the process, we did a follow-up governing procedure. It is our peer review procedure, AP 2.12Q. The scope of this particular peer review was put together by several groups within the project; myself and others of the Department of Energy, the BSC folks, and the Landel scientists and volcanologists as well.

That was followed by consulting with experts in the field of volcanism and other related fields, sort of a multidisciplinary modeling effort. So we went out to the community if you will to see how we can go about perhaps conducting and staffing if you will this panel.

As I mentioned, there were a lot of processes involved, and it is a multidisciplinary process, and so we ended up with not just a peer volcanology panel, although the balance was primarily volcanologists.

We had three volcanologists and Professor Spera will walk through I believe in his talk with the members of the panel. We had three volcanologists, and we had a fluid dynamics individual, Anthony Pearson, Bob Budnitz, who was a risk assessment expert, and Emanual Detournay, a fracture mechanics

expert.

So you will see that we tried to represent the primary process in this consequence modeling with this panel. As far as interactions and meetings, there were several. We had a kick-off meeting in May of '02, and the panel did quick work, and put together an interim report in September of '02.

We had a field trip in December of '02, and I believe that we might have had a smaller one subsequent to that. I think that Frank Spera may talk about those field trips in brief.

And then there was a final report in February, and in which we posted these reports on our website as soon as we received them from the panel. In other words, there was no critique review made by us. We put them right out there for folks to see. Next slide, please.

Briefly on outcomes. We believe that the panel did a thorough review with the charts that we gave them, looking at our past modeling, and in the plans that we had at that time for the modeling, they looked at those as well.

The Department did not feel that there were any significant gaps identified. Now I want to be clear that the panel did present in their final

report several recommendations and Mike will walk through those.

There were recommendations, but we didn't feel that they had identified anything that would lend itself to underestimating dose in a significant way.

And just the last bullet here on this slide is that from sort of an overall conclusion standpoint that the panel stated that the overall conceptual model, namely that of the dike rising through intersecting drifts if you will, intersecting the drifts, was both adequate and reasonable.

And I will say that they did have recommendations that went along with that statement, and that is all that I had by way of introduction.

VICE CHAIR RYAN: Great. Thank you very much. The next speaker will be Frank Spera, and he will talk on Igneous Consequeces Peer Review Panel Report: Proceedings and Salient Recommendations.

PROF. SPERA: Good morning. Okay. I am Frank Spera, and I am a member or was a member of the Peer Review Panel, and this morning I will try and make a brief presentation of the salient recommendations of the panel, as well as describe how we worked.

Eric has already mentioned some of this,

and I thought that maybe I would embellish that a little bit. So the first part then would be the methods and products of our work, and the second is a summary of the recommendations.

There is available on the web the interim report, as well as the final report, as well as an appendix to the final report. There is a number of complex issues that are discussed in our work, and I will try and summarize that in a few minutes here.

But there is really no substitute for going back and reading those reports. The committee membership included Budnitz, an engineering risk analysis expert; and Emanual Detournay, an expert in solid mechanics, Larry Mastin, a volcanologist with experience in pre magma magnetism.

And Anthony pearson, who is a very distinguished fluid mechanicism, and worked in polymer food mechanics for many years; and Alan Rubin, a structural geologist, and expert in dike propagation, which is really very central to the problem, and myself.

And the point here is that, yes, it is a multidisciplinary committee because the problem is a multidisciplinary problem. As far as the logistics, and how we worked, as I mentioned the panel worked for

about 10 months, and started in May of 2002 with a kick-off meeting here in Las Vegas.

We worked through the entire period of time, and issued an interim report in September of 2002, and with a public presentation, and our final report in February of 2003, and all of this material is available.

The scope of the work, there were a couple of field trips in May, and one in December, and we had a video conference, a number of conference calls, and two, one day panel meetings, independent of anything else happening.

And innumerable e-mail communications, and one-on-one phone conversations between panel members and other experts that the panel felt worthwhile interacting with; and self-study analysis, and of course document preparation by each panel member.

So it was a fairly intense period of 10 months, as far as the scope of the work. Next slide, please. Our goals were to review and comment on previous igneous consequence project work, and most of that, of the review and comment, is found in the interim report, which was issued about September of '02.

Another goal was to provide new analysis

when appropriate and possible given the time limitations to all when possible in trying to lower the uncertainties for the TSPA input, and that was the mantra of the work.

And related to that is the last point here, the last point, to recommend additional analysis that the panel itself could not do that is needed to resolve some of these outstanding issues related to igneous events.

And so that is based on our analysis of the previous work, as well as new problems and some preliminary analysis of those new problems. So that forms the basis of the recommendations.

A few points here and trying to summarize a lot of material, and I thought that I would state this as kind of a precepts in a frame of reference that the panel agreed to early on as far as some basic conceptual guides to looking at the problems involved.

Obviously, volcanological phenomena are apparently pyroclastic phenonema, and it is important in these complex systems that the range not get focused in too early to a particular conceptualization.

So we need to consider a range of magma and host rock properties, magmatic flow regimes, and

eruptive phase sequences, and how volcanoes actually erupt, and what the detailed chronology could be.

There is no definitive pattern. There are certain guides, but things can be variable, nd so we need to keep this in mind, and to consider various models for fracture propagation and states-of-stress and how these will interact.

So in other words, it is a complex problem, and let's consider all the possibilities. The second point is that the past is the key to the future, and my apologies to James Hutton, and Charles LaNell, one of the founding workers in geology, and that the past is the key to the present.

Well, past is the key to the future if trying to understand or trying to make predictions, or forecasts, of volcanological events in Crater Flats volcanic fuel events.

And the best way to do this is to consider the recent past, the recent geological past; and then the question is, well, how recent is recent. Is it a hundred-thousand years, or is it 1.0 million years, or is it 10 million years, or is it a hundred-million years.

And we of course spent a lot of time considering what that period should be, and so it

forms an important component of trying to understand the previous history and to make predictions for the future.

The third point is that attention is focused in many places in the final report on what we consider the most hazardous scenarios. Not necessarily because these are more likely, and that is an important point, but because we felt that they were most critical to the total system performance assessment, which is really the crucial outcome of this investigation.

So we may have spent more time looking at the more hazardous scenarios, and again, not because of their intrinsic probability, but because these are the key ones as far as dose.

Now, a final point is that we certainly have to recognize the difficulty of this problem, and I sort of apologize for the first bullet up there, but perhaps in the sense that it is perhaps too wordy.

But really when you think about the issue of the rising dike, and this rising dike is filled with materials, and this material is a multi-component, and many components, and the entire periodic table is involved in magma.

It is multi-phased, and silicate liquid,

a molten, low viscosity liquid, and there are gas bubbles, and there are solid fragments, and so it is a mixture.

It is rheologically complex, and rheology is the science of deformation in flow, and so the flow properties of this complex mixture are involved. The mixture is compressible and so as the pressure increases, and as magma ascends towards the surface, the volatile, the H2O and CO2 that are dissolved in the solution will exsolve into the vapor phase.

So it is like picking up a bottle of coke and popping the top. What is this stuff rising in? Well, it is rising in a heterogenesis media, the host rock. So the couple problem of the thermal dynamics, fluid dynamics, and fracture propagation of -- in three dimensions, of this fracture filled with this goo, complicated goo, is not a trivial problem, and we have to recognize that.

It is a cutting edge problem. But it is a problem that can be addressed. So that is exactly what we still have to do, and to bring diverse elements together from different areas to look at this question in a complete way.

So we spent a lot of time arguing about things, and which was I felt very healthy. Okay. So

now we can move on and talk a little bit about the structure and the scope of the final reports.

The interim report, which was issued in September of 2002, basically reviewed previous igneous events project work, and there was considerable material to digest there, to understand what work had been done in the past.

And we also, because we recognized that really the essence of the problem is the interaction of exactly how does a dike of magma propagate, and what are the characteristics of the dike; sizes, shapes, pressure distribution, velocity field, and so forth.

So we provided a primer in the interim report, and basically in Chapter 3, I think. which gives a background on dike propagation in general of magma dikes in the absence of a repository.

We don't understand that, and understanding how it interacts with a repository is a lot more difficult. We also gave some assessment of the dog-leg scenario, and this is a situation where magma arising dike intersects the system drifts, and magma flows down through the drifts, and then new fractures propagate to the surface. So this is the dog-leg scenario.

And also the shock wave situation where pressure magma suddenly is exposed to zero pressure one atmosphere pressure and there has been some work on that.

So in the interim report we provide some analysis for all of those problems, and also some analysis of waste entrainment, and magnitudes, and magma flowing down drips, and the interaction of magma with the canisters.

The main point was to absorb the voluminous earlier literature and to understand where we had to go in the last 7 months of our investigation. The final report issued in February of '03, this is just an outline of that report. It consists of five chapters, and a rather long appendix.

Chapter 1 provided essentially an introduction to the problem, and an overview of the issues that the panel was able to address. The second chapter basically discussed the volcanological setting at Crater Flats and the environment.

The eruption chronology of the pyroclasine vocanoism and even earlier vocanoism to try and understand the sequence of events in this type of -- and in the most likely type of eruption.

And it also discussed the properties of

the magma, both thermal dynamic properties and the transport properties, and some discussion of the properties of the host rock, which the propagating dike traverses on its way to the surface.

And in a little more detail here, a synopsis of the volcanic history at the Crater Flat volcanic zone, and reviewing previous literature, and trying to understand the geochronological constraints, and whether those constraints could be amplified.

And an analysis of the volatile content. Volatiles are the -- the magnetic volatiles are the components, such as H2O, and carbon dioxide, sulfuric acids, and these are the components that add pressure, a few hundred bars are dissolved in the silicate liquid.

But upon decompression these are the components that exsolve and form a discreet vapor phase, and that there is a gas phase with the liquid.

And the volatile content is extremely important to fix because it changes the dynamics of the magma in a very marked way, making the system much more compressible. So we are trying to use the petrology of the Crater Flat volcanics and some thermal dynamic modeling to constrain volatile abundances and trying to understand the transition

between the liquid dominated system and the magmatic liquid vapor system.

We also looked at eruption chronologies, and then addressed some unresolved volcanologic issues, which we will return to in a recommendation; and he magnetic anomalies, and the age constraints on the pliocene and especially quaternary vocanoism.

And the issue of phreatomagmatism at Lathrop Wells. Phreatomagmatism is a style of magmatism, where magma interacts with the water table, the water saturated sediments, and the heat from the magma expands this water in the porest sediments, and can lead to a process of phreatomagmatism.

And finally the magma and post-rock properties. Chapter 3 was really the guts of the report in a sense. A lot of technical detail here. The actual fracture mechanic, and fluid dynamic analysis of what really does happen when a dike interacts with a repository or a system of drifts.

And there was a lot of focus here on the dog-leg scenario, and which I had defined earlier. And dike propagation in the absence of a repository, and trying to understand the cavity lengths when the dikes propagate, and the fuels magma.

The upper part of the dike is actually not

filled with magma, and it is filled with gas. And the size of that cavity, and the width of it, and propagation rate, and the pressure in that cavity is very important, because the tip cavity, which first interacts with the system of drifts. It is not actually the magma, but the tip cavity.

So understanding the pressure field in the tip cavity is very important for evaluating the shock wave scenario. And if the tip cavity is very long, then the pressure front is also long, and the gradient is relatively small, and that leads to one scenario which is quite different than, for instance, a very high pressure and immediately seeing a zero pressure.

So in Chapter 3, we discuss that issue, as well as inelastic deformation, freezing of magma, and other sorts of fluid dynamic types of analysis.

Chapter 4 involved the eruptions in the waste entrainment, and the specific issue of how waste would get entrained, and what those loads would be in terms of magma flowing down drifts.

The quantity of waste entrained, and the dispersal in the atmosphere of eruptive waste, and some comments on the TSPA. All right. And finally the last chapter is a summary of the conclusions and recommendations.

In addition to the final report, there is also an appendix to the final report, which we felt would be very useful to the project in performing some of the work that we recommended.

I am not going to go through this in any detail here, but the appendices include a lot of information and analysis, a lot of the detailed analysis; solution of the differential equations, and thermal dynamic analysis of the magma.

So we felt that some of this information could be used as a guide perhaps to the project. Some of the dynamical issues considered in that appendix are listed here, and again I won't go through them in any kind of detail, but I guess I just want to emphasize that we did some modeling ourselves, and did some scale analysis.

And we tried to summarize that to support the recommendations. The recommendations, which is the last part of my presentation here, I will basically talk about -- well, first off, as mentioned already, the overall approach we found reasonable.

However, we did come up with a number of recommendations, all posed towards reducing uncertainties. The recommendations are of two type; the volcanological recommendations, and

recommendations in the modeling arena.

So I will try and go through these very quickly. The volcanological recommendations, we felt that there perhaps could be a further and better characterization of the number, size, volume, and age distribution of the magmanetic anomalies, which may be buried volcanic centers in Crater Flat and environs.

And recommended that perhaps further geophysical work, and some drilling, and geochronological work on return samples, could be useful to define the ages of these, and their volumes.

And in addition, further geochronological work on pliocene and especially quaternary basalts at Crater Flats to better characterize the spatial distribution of these in terms of age.

All right. We have connection, and number of volcanic centers, and are they of the same age, or is the age span measured in tens of thousands of years, or hundreds of thousands of years.

This volcanism is most approximate to the repository site. The further studies also were recommended to evaluate the shapes and dimensions of volcanic conduits. Conduit is the region above the dike, the kind of pseudo-cylindrical conduit that has this funnel type structure.

And the width of the conduit is very important. It is a direct input into TSPA, all right, because that sort of says how many drifts would be involved. The size of a conduit is obviously very important.

Also included here is a review of the status of phreatomagmatism at Lathrop Wells. There is not a lot of evidence for free atom magmatism in Crater Flat, except at Lathrop Wells, as a small early phase may have been phreatomagmatic.

We felt that understanding that better would be useful. The last bullet here, a model here that is used is called ASHPLUME in the TSPA to predict volcanic ash dispersal, and we felt that additional modeling using other available models could be used to test the validity of ASHPLUME.

As far as the modeling recommendations, and I will run through these as quickly as I can here, basically the idea is to place more confident bounds on the magma drift pressure, and if magma does enter the drifts, what is the pressure in the drifts.

As well as the normal stresses in the region above the drifts, because from magma to do the dog-leg flow, the magma pressure needs to exceed the dike normal stress.

So the stress field above the drifts, as well as the pressure magma in the drifts, is very important. So we need to know that. How can we get that?

Well, we can get that by doing a number of things and these calculations are summarized here, 1, 2, 3, 4, 5. There is a very critical region near the magma front-tip cavity, which accounts for the ex-solution of vapor from the magma, and modeling to fix the pressure field.

And understand that it is evolution during outward ascent would be useful. The tip-cavity, the size of it, and the pressure distribution in it, is something that could be studied in more detail, specifically for the flow of a compressible material, for which a volatile rich magma is a compressible material.

The development of some three dimensional models for unsteady magma flow, when a planar dike has intersected the system of drifts, what fraction of the magma continues upwards, and what fraction of the magma moves down the drifts.

And the impact of the drift flow on canisters within drifts. I will jump ahead to number five here. Modeling the effects of infiltrating fine

ash and variable vapor pressure on gas loss through the permeable dike.

In the tip cavity where the gases are concentrated, the host rock is somewhat permeable, and so gas can move into the host rock. But that can be affected by the distribution of very, very fine volcanic ash that can actually decrease the permeability.

And we thought that it is possible to model that. Let me jump to the last slide here. The final set of recommendations pointed out that perhaps reconsideration of, and is really not our main charge, but reconsideration of some repository design elements to minimize the impact of any possible igneous events.

And this could involve backfill possibilities, and it could involve introduction of bulkheads to minimize magma flow into drifts, and the incorporation of perhaps these engineering design considerations into the TSPA to address the questions of the possibilities of limiting any or mitigating any hazardous effects due to magma flow.

I think that that ends my presentation.

MR. MARSHALL: Does anyone have any questions?

CHAIRMAN GARRICK: Maybe a couple of

questions. Can you turn to Slide 7. I am sure that Bob Budnitz cautioned the panel on Bullet 3 there of focusing attention on the most hazardous scenarios. If we take the view that we want to risk inform this process, then of course what we want more than anything else is an importance ranking of the most -- of the scenarios contributing to risk.

And as it usually turns out the most hazardous ones usually are not on that list, and this reminds me a little bit of reactor safety in the 1950s, where there was great focus on the large loss of coolant accident, and somewhat to the expense of focusing on other scenarios.

And as we learned from the reactor safety study, and subsequently 3 Mile Island, the most contributors to risk were things like small LOCAs, small loss of coolant accidents, in combination with off-site power losses, and what have you.

And I see history kind of being repeated here. What I would really like to know if we are to take a risk-informed approach is what are the most important scenarios contributing to the risk, and is the dog-leg scenario among those.

Are you planning to do something like that, because here I don't think we have answered the

$64 question with respect to risk.

PROF. SPERA: We felt that the dog-leg scenario was intrinsically very unlikely, and --

CHAIRMAN GARRICK: And so the obvious question is, well, what are the contributors to the risk, and not to the consequence?

PROF. SPERA: As to the dog-leg?

CHAIRMAN GARRICK: Well, what I am really getting at is the question that we have to answer is what is the risk, and in order to do that, we need to know what scenarios are contributing to the risk. And if the dog-leg scenario is contributing to the risk, then the emphasis on it is truly justified.

If the dog-leg scenario is a no, never mind, with respect to the risk, then the question is, well, why aren't we allocating our resources to answer the real question, namely what should we be working on.

PROF. SPERA: Well, I think at the beginning of our work that was a question. I think one of the points that we made is that -- well, in other words, it wasn't known at the beginning of the likelihood of a dog-leg.

We feel, and the panel felt, that at the end of it all that that was not a very likely

scenario. The shock wave scenario as well. The earlier work, we analyzed that and felt that the initial conditions were not reasonable.

So in terms of the shock wave, and in terms of the dog-leg, we felt that they were less likely than maybe had been posited.

CHAIRMAN GARRICK: Yes. I am sure that the performance assessment people are going to ask these same questions, and will want to manifest the scenarios that we really should be worrying about, rather than the ones that -- well, to be sure, we want to know what these high hazardous scenarios mean and do.

But they may be relatively irrelevant to the finding that has to ultimately be made. That is my point.

MR. SMISTAD: If I might turn the mike on to begin with here. We didn't really ask the panel to go that far with the report. I will make a comment on the dog-leg, however. If a dog-leg were to occur, that would be a significant -- significant to risk.

And the way that we have chosen to approach that is like the panel said, and we are in agreement with it, that it is unlikely. That we are not able at this point to apply probabilities to it,

or to screen it if you will.

So what we have done is that we have chosen to model the entire process of magma entering the drift, and any of the interactions or processes that may cause a dog-leg down the drift, that is how we have chosen to approach it. And at this point we are not able to propagate another dike down drift.

CHAIRMAN GARRICK: Yes. I am just cautioning us to be aware of history this kind of safety analysis.

VICE CHAIRMAN RYAN: Ruth.

DR. WEINER: First of all, Professor Spera, you will have to excuse me. I don't know anything about volcanology, and so my questions might very well strike you as completely naive.

And I have a lot of questions, and I will try to boil them down. First of all, if the magma enters the drift, and the gas on top of it enters the drift of the repository first, isn't the volume of the repository going to relieve the pressure and to what extent.

And won't the logical path out be out through whatever closure there were rather than up through the rock, so that you would get a flow out at grade, or what am I missing there?

PROF. SPERA: Right. Well, it is the volume, and one of the things that we worked on was the volume of a typical eruption, and comparing the volume of a typical eruption to the volume of the drifts.

And the volume of a typical eruption would be much larger than the volume of a drift system.

DR. WEINER: Where did you get the data for the volume? When you call it a typical eruption, is that everywhere in the world?

PROF. SPERA: Well, there is a lot of detail in Chapter 2 actually, and what we did is -- and the project had done this before, is looked at the eruptions within the last 15 million years, 4 million years, 1 million years, and --

DR. WEINER: At Crater Flats?

PROF. SPERA: At the Crater Flats region and environment, and looking at a number of the eruptions, and having estimates of the volumes of those particular eruptions. Making a list of the ages and the volumes, and so understanding the volcanology.

Understanding the nature of the eruptions, the sequences; were they pyroclastic eruptions, or were they lava flow eruptions. Then going outside this region, and looking throughout the world, because

there are 400 volcanos as I speak that are erupting, and understanding basically the volcanological basis.

And by taking that information and coming to put some bounds on likely volumes.

DR. WEINER: So did you use an average volume, a medium volume, a maximum volume? Did you distribute and sample a distribution of volumes?

PROF. SPERA: The range of volumes in this kind of system for these kinds of basaltic eruptions is .1, .01 to 1 cubic kilometer.

DR. WEINER: Okay. I don't want to engage in a tutorial.

PROF. SPERA: And a very, very tiny eruption would be of no consequence.

DR. WEINER: My other question, if I can boil it down into one, is wouldn't the lava and the gas above it seek the shortest path to the surface, and wouldn't that shortest path be Crater Flats rather than in the mountain itself, and connected with that is there a volcanic history within Yucca Mountain itself, rather than in the Crater Flats region?

PROF. SPERA: Right.

DR. WEINER: I mean, I simply don't know.

PROF. SPERA: No, there isn't in Yucca Mountain, except for the tuffs themselves that erupted

15 or 20 million years ago, and really are not the style and not really relevant.

As far as the shortest path, it is not actually like the propagation of a light beam or something. It is actually the stress field and how this pressurized fluid interacts with this heterogeneous host rock and the fuel rock, and exactly the way the magma moves.

Like the crack would tend to propagate so that the crack will open up perpendicular to the minimum composite stress. So it is really understanding the stress tenser as a function of location, and that is how the liquid will move. It is not necessarily the shortest distance.

For instance, it could come in and form a sill, or it could come in and go vertical. It depends on the stress field and the way the magma pressure field interacts with this preexisting stress field.

DR. WEINER: I have one final question, and that is the dispersion, the air dispersion model for the ash, is that a gaseon (phonetic) dispersion model? Did you make some assumptions about the particle size, aerodynamic diameter? If these are in the report, I can get the report if I have to.

PROF. SPERA: Yes. Everything that you

said is correct. The ASHPLUME model, which is not the panel's model, but is the model that had been used to predict the dispersal of ash, it is a -- yes, it involves a range of particle sizes, and it involves a wind model, velocity and direction.

It does the settling and it does all the normal things that you might think it is a PLUME type model, and it could be checked against other codes, and look at the quality of the selection.

VICE CHAIRMAN RYAN: I think that is an important area for the reason that we are interested in the behavior of radioactivity, and radioactive material.

You know, I don't know what fraction of a natural release was assumed, but I think that exploring the impact or the variability that would occur in looking at that model is real important, because at least in part the dosimetric calculations are of great interest, and I am not sure that if those are realistic, or frankly if they can be realistic.

Because I don't know how you would verify any models, check them against any other models in those circumstances. The data for distribution of radioactive in those kind of events, small or large, are even smaller, you know, in terms of dispersing

things and explosives, and so on, is more art than science. Do you have any comment on that?

PROF. SPERA: I think that your comments are a good point. What has been done in the volcanological community is to take known eruptions where we can measure the volume of the eruption, and have for instance radiological data on the height of the volcanic PLUME as a function of time.

And sample the volcanic ash after the fact so that we can get a handle on the size distribution, and for instance perhaps we would have the wind structure as a function of altitude, the speed and direction. And then basically try and forward model a previous eruption.

VICE CHAIRMAN RYAN: I recall a comment that I heard many, many years ago by Frank Gifford, and that is that the Pascal-Gifford-Sutton equation model is not worth much past a thousand meters.

And it is used to transport stuff across the country. So again I challenge everybody to think about the fact that what ends up in the less 10 microns, or really less than 20 microns, in a respirable range where somebody might be breathing, is really what counts.

And how do you get from an event to that

exposure scenario, I think there is a large uncertainty there, and typically an over-estimate, and that needs as much or more attention.

And I noticed that there was no one on your panel that was really that kind of a scientist. Am I right?

PROF. SPERA: It is a cutting edge problem in volcanology.

VICE CHAIRMAN RYAN: But there was nobody on your panel that addressed that.

PROF. SPERA: The dispersion?

VICE CHAIRMAN RYAN: Yes.

PROF. SPERA: There was some recommendations for looking at the earlier work done by the project --

VICE CHAIRMAN RYAN: But you had no expert in that area though?

PROF. SPERA: Not really.

VICE CHAIRMAN RYAN: Okay.

DR. WEINER: How did -- do you have any sense of this dog-leg eruption would compare to, for example, Mount St. Helene's? I happened to have seen the Mount St. Helene's eruption. I lived there at the time.

PROF. SPERA: Very extremely different

animals.

DR. WEINER: Bigger, smaller?

PROF. SPERA: Mount St. Helene's had a .5 cubic kilometer eruption, and that is the volume. A very different composition, and much more discus magma, and a higher -- probably a higher concentration of dissolved water and CO2.

The style of eruption is very different, and the conduit is much wider, and the viscosity of the magma, 7 or 8 orders of magnitude different than basaltic magma. So different pieces really.

VICE CHAIRMAN RYAN: Jim Clarke had a question.

MR. CLARKE: Just -- and this may be premature, and I guess this is probably a question for Eric, but there have been some recommendations made to reconsider possibly certain design elements, but as was pointed out the panel really wasn't charged with looking at the full range of risk events.

There was a focus on the high consequence and low probability event for understandable reasons, but I just wonder where you go from here on what might lead to recommendations for design changes for your plans?

PROF. SPERA: We are currently looking

into that, and if you are familiar with the design, the underground design, we have backfill in the design right now, and we are not currently planning to backfill the emplacement drifts, but we will backfill the access drifts, the banes if you will.

So the determinist of an emplacement drift, there will be backfill, and if the magma travels down the drift, you will encounter this backfill.

Now, if that backfill is not efficient in abating the flow if you will, this is where the idea of an engineered barrier could come in.

And in fact to provide assurance to us as we are moving through this, involving the uncertainty of the backfill that we do have in there, and the uncertainty of maybe the flow will move through that backfill or over that backfill or something.

We are looking into barriers, and in fact we are looking at the similar things that the panel had talked about in terms of a plug, and just a very simple plug, concrete perhaps, or moving into other areas of maybe key ways, where you have a notch in the ceiling, and where you backfill that notch, and as you get the pressure on the backfill from the magma, it will push up into this notch, and you will have a

front or a wall there if you will.

So we are looking into these things, and these are things that we intend to put forward in the next -- the prior (inaudible) actually.

VICE CHAIRMAN RYAN: Thank you very much. We have one additional presentation, and that will be Michael Cline discussing the responses to the igneous consequences and peer review recommendations. Thank you, Dr. Spera.

DR. CLINE: Good morning. I am Michael Cline, and I am the lead for volcanism for BSC, a Bechtel SAIC company. I would like to thank Frank for an excellent presentation. I will respond to the peer review comments in my presentation.

I would also like to recognize Frank Perry, and Frank, if you would put your hand up. Frank is the Los Alamos lead for the volcanism activities. As a geologist, we have to look at map, and so our first slide is to look at a map, and I would like to step back for a second, and address the issue of why volcanism is an issue.

We are at some distance here from the map, and so it is a little difficult to see, but there are six quaternary basaltic volcanos within 20 kilometers of the repository site. Those are marked in red, and

up in the northwest corner, or near the northwest corner of Sleeping Butte.

That is the northerly most of the six, and then the remaining five are defined in Crater Flat, which is the depression area southwest of the Timber Mountain there. The yellow is the repository footprint as you go south in Crater Flat.

The southern most if Lathrop Wells, and that has an age of about 75,000 years. The igneous event mean probability based on the 1996 probablistic volcanic hazard assessment came up with an intersection probability of 1.7 times 10 to the minus 8.

That being greater than 1 times 10 to the minus 8, we need to look at the consequences. While the probability is extremely low, the consequences are fairly significant.

I am going to skip to page 4, and Eric already covered the first slide pretty well. I would like to say that the report from the peer review was very beneficial to us. It defined two things.

It defined or gave us better confidence in terms of the path that we are on to address the issues, and also it gave us good recommendations for the path forward.

In the peer review, they were asked to address eight questions related to the adequacy of the models that the project is developing, the ability of the models to quantify uncertainties, and the local analysis necessary to adequately address the issues given the limitations of science.

The first sub-bullet was the quote that Eric mentioned in his presentation really gets at that first bullet. Considerable focus was given to the second sub-bullet there on the quantifying uncertainties.

As I say below the focus on addressing the uncertainties for a better understanding of dike propagation mechanics. The restrictive range of magma properties and eruptive scenarios, and what I mean by that are they looked at magma characteristics, and volatile content of magmas, PLUME height related to eruption, and that sort of thing. Frank went into that at some length.

And then also more realistic treatment of waste entrainment. Next please. The project or our evaluation of the recommendations considered their importance to addressing performance, and enhancing confidence on a technical basis.

We identified -- while Chapter 5 as Frank

indicated had I think eight recommendations, throughout the report, we identified 28, which we summarized into 10 recommendations, and those are what I will respond to.

You will see a very close relationship of those 10 to Frank Spera's presentation. Formal responses in preparation. We deferred that a little bit based on project priorities, and licensing issues, and funding, of course.

We wanted to make sure that we had our funding in place so that we could adequately address the peer review comments. Next slide, please.

The first recommendation or comment is that they gave -- they felt that our giving greater weight to the Plio-Pleistocene events in the Yucca Mountain area was reasonable. However, they recommended additional studies.

And in fact we are in the process of implementing new field activities to address potential buried volcanic centers in the Crater Flat area, and to the east of the Yucca Mountain area, the Jackass Flats area, and just to the south of Yucca Mountain and into Amargosa Valley.

We want to do this to better understand -- well, to determine if there are in fact buried

centers, and what their ages are, and also we are looking at relationships between the known volcanic centers, age relationships, and the volcanic characteristics. Next, please.

The peer review gave priority or suggested that priority be given to the three dimensional model for dike propagation, and related to gas vapor evolution, cavity length, three dimensional coupled models for study of drift and dike drift flow, and gas pressure loss.

If you look at all 28 comments and recommendations the majority of those are related to this summary comment. And without question these are complex phenomena. However, we have made progress dealing with a number of the aspects of the three sub-bullets that you see above.

We are in the process of developing a multi-phase computational fluid dynamics model, and a compressible fluid code to model a multi-phase flow, magma flow, and in a three dimensional component. Next please.

The panel believed that the assumption of extractions that are used for TSPA for evaluating the impacts of engineered barrier systems for an igneous event are overly conservative.

We agree that they are very conservative, but we also believe that they bound the range of uncertainty. Okay. As an example, we have a median value for conduct width, and that is the conduit coming up through the repository carrying the magma, of 50 meters, and that is a median diameter.

And in that five waste packages are captured and taken out on to the surface, or they are destroyed and taken to the surface. Next, please. Quantifying the probability that the dog-leg scenario remains an issue, and it is an issue, and it is very difficult to address.

We have in fact in our dike drift interactions AMR model report, we have addressed the diffusive flow aspect of the dog-leg, diffusive being the lava, the liquid aspect.

And we have found that it is not critical. We use essentially a one dimensional -- I'm sorry, a two dimensional modeling of a one dimensional flow with a diffusive aspect.

We have done some approximations on pyroclastic components. However, we are currently doing additional modeling to address that in greater detail. Our initial approximation suggests that the pyroclastic component is also not credible.

You can generate a crack if you arbitrarily increase the pressures, but to sustain that crack is extremely difficult. Next, please. The panel recommended additional laboratory experiments and analysis to reduce uncertainties related to the transition between bubbly magma and gas-filled cavity, and the chemical/mechanical effects on waste packages.

These are conservative assumptions, and we have made conservative assumptions. It is assumed, for instance, that all waste packages for TSPA purposes, that all waste packages that come into contact with magma are compromised.

That is a fairly conservative assumption, but we do believe that it does bound the uncertainty. There are no plans to test the effects of igneous activity on a waste package.

However, the modeling that we are going to be doing over this next year, and as I mentioned earlier the 3-D modeling, will provide a basis for any future testing in this area. Next slide.

The panel suggested that we consider a repository design modification to minimize impacts of igneous events. As Eric mentioned, we have in fact done analyses and they are also captured in the dike drift interactions model report, and in fact we are

modifying that report as we speak to add some additional calculations that address what we call a backfill plug.

It is a compacted tough backfill put in at the turnout or at the end of the drift, the replacement drift, and it is conceptual, but the calculations suggest that for a effusive flow it will impede the magma flow, or the effusive component will impede the flow.

It also comes with a -- or the concept also considers a notch in the ceiling of the drift that would have the compacted backfill put into it, and as the pressure of the magma approach or impact the backfill, it would in fact strengthen the backfill and contain the magma.

Next, to ensure confidence in the ASHPLUME results as Frank Spera mentioned, it was recommended that we look at additional models, such as ASHFALL and RAM/HYPAC.

Our work thus far does consider other models, and I think that we looked at 3 or 4 other models in terms of the limitations of those models, and comparing the limitations of those models to the limitations of ASHPLUME, and we conclude that ASHPLUME has the least limitations and we proceeded forward.

Now, this year we are also going to look, assuming that we can acquire them, we are also going to be looking at ASHBLUME and RAM/HYPAC this year.

In summary, we are -- I'm sorry, this is another recommendation. Consider further studies to constrain conduit geometry. We are in fact conducting or will be conducting field investigations of analogs in the region that are or that we think would be similar to that of what we might expect in Crater Flats or that would occur at Yucca Mountain.

Our primary analog of course is Lathrop Wells. We feel that is representative, and we would be looking at other analogs in the region and in the great basin essentially that would be similar.

Some of the larger analogs, or some of the analogs that we have looked at that had large diameter conduits, we believe may be polygenic. In other words, they are multiple eruptions, instead of looking at a single eruption.

So we want to go back and also look at some of those that we also looked at before. The range of conduit diameters that we have looked at range from about 15 meters to greater than 150 meters.

In summary, the peer review concluded that the overall conceptual model of dike drift interaction

is adequate and reasonable. Like a good peer review, they also made a number of recommendations for future work, which we are addressing for the most part.

Recommendations were considered based on their importance to performance, and the qualifying uncertainties. Plan work will focus on developing more sophisticated models to better represent magma properties, including multiphase flow.

We believe that the studies will lead to quantifying uncertainties and addressing the conservatisms that we currently have. I would like to jump to the backup slide if I may very quickly. Eric asked me to say a few words.

I mentioned this earlier, but we are also looking at -- going back and looking at the probability of intersection, and the probability of an occurrence event, and to do this we are in the process of securing a contractor to do high resolution/low altitude aeromagnetic, and an electromagnetic survey of the region around Yucca Mountain.

We will then drill the anomalies based on the results of those studies, as well as the work that has been done thus far. If basalts are encountered, we will be dating those basalts, and doing additional volcanology studies.

And then ultimately we will conduct a probablistic volcanic hazard assessment or an update to that one that was done in 1996. Thank you very much.

VICE CHAIRMAN RYAN: Questions? Ruth.

DR. WEINER: Yes, I just have one question. What was the particle size distribution that you used to look at the dispersion with ASHFALL?

DR. CLINE: It is a range.

DR. WEINER: What was the range?

MR. PERRY: Frank Perry from Los Alamos. This is strictly from my head, and it would have to be checked, but I believe it was .1 millimeter to 10 millimeters.

DR. WEINER: Thank you.

VICE CHAIRMAN RYAN: Any other questions? John.

CHAIRMAN GARRICK: I think in view of our schedule, I will pass.

VICE CHAIRMAN RYAN: All right. Me, too. Thanks very much. I will turn it back to you.

CHAIRMAN GARRICK: Okay. Thank you very much. All right. We are now going to move to the next item on the agenda, and we are 10 minutes behind schedule, and it is a topic that we have asked

Committee Member, Dr. Weiner, to lead the discussion on. So, proceed.

DR. WEINER: Thank you, Mr. Chairman. Since this is my very first attempt at chairing one of those sessions, please forgive any lapses in protocol.

Our next presentation is on the Inyo County Carbonate Drilling Program, and it will be led by Andrew Remis, and I believe that he will introduce any other speakers. And could you tell us what your affiliation is, please.

MR. REMIS: Sure. Good morning. I am Andrew Remis, and I am staff to the Inyo County Yucca Mountain Repository Assessment Office in Independence, California.

I am here today with Mike King of the Hydrodynamics Group. Mike is the county's leading contractor conducting hydrogeologic research for Inyo County, and research being conducted in Amargosa and Death Valleys.

Inyo Count is an Affected Unit of Local Government under the Nuclear Waste Policy Act. As an Affected Unit, we conduct regional studies of hydrology to determine the potential for radionuclides escaping the Yucca Mountain Repository to impact water supplies critical to Inyo County communities, Death

Valley National Park, and territories recently conveyed to the Timbisha-Shoshone Tribe at Furnace Creek and Death Valley Junction in Amargosa Valley.

I am going to provide a brief overview of the county's program, and then Mike will give you the details on our most recent findings. The County's science program began in 1996 with a study of spring discharge into Death Valley.

This study pointed to the possibility that the regional Lower Carbonate Aquifer contributed to potable water supplies in the Park, and by extension to the possibility that contamination of the regional aquifer up gradient and below Yucca Mountain could endanger the Park water supply.

In 1998, Nye County, through a 3 year joint funding agreement, provided funding to Inyo County to conduct further spring discharge studies in Death Valley National Park, and to undertake new evapotranspiration and geophysical studies in the Park. These studies were conducted by the Hydrodynamics Group and the U.S. Geological Survey.

Beginning in 2000, the County directed some of the Affected Unit of Local Government Oversight funding resources to joint with research with the Park Service, supporting the Park's own

program to study ground water behavior in and around the Funeral Mountain Range.

And we have worked collaboratively with the Park Service for the last three fiscal years of providing hydrologic expertise to the Park in their efforts to develop and test monitoring wells.

Inyo County applied to DOE for further research funding in the Fall of 2001 and in the Spring of 2002, was approved for a 3 year, $5 million deep drilling program to drill research wells on Park Service and BLM sites surrounding the southern Funeral Mountains.

Under the guidance of U.S. DOE staff in Las Vegas, the County developed a program designed to work cooperatively with BLM, Death Valley National Park, and USGC, to explore the hydrogeology of the region, and to generate data of interest to a wide range of research and regulatory bodies.

To this date, we have completed one of the five planned wells. DOE's Yucca Mountain Program in Fiscal Year '03 suffered a significant budget shortfall with respect to available research monies, the result of which was that DOE was not able to completely fund our grant.

We are, however, hoping to complete a

second well this winter. Information developed from our program will serve several functions. Of primary importance to Inyo County is the question of whether there actually exists significant subsurface continuity between the saturated zone below Yucca Mountain, and County, and Federal water resources in California.

If so, then understanding the nature of the connection, in terms of relative contribution and travel times, is of interest to us. Our program is designed to meet Yucca Mountain quality assurance and quality control standards, to ensure that the data generated by the county can be incorporated into the USGS regional ground water model, upon which relies DOE's total system performance assessment.

The total system performance assessment is as we know central to DOE's application to the NRC for a license to construct the repository. That is our program in short, and Mike King will give a presentation providing the committee with an update on our recent research.

CHAIRMAN GARRICK: That's fine.

DR. WEINER: I will take this opportunity to announce that the viewgraphs from this presentation. You have a CD that we have, and of

course the transcripts are available on the web.

MR. KING: Right. We apologize for not having any handouts. It was a matter of doing a presentation and catching an airplane, versus the printouts.

So we will leave a CD of our presentation for the board, and then you can always e-mail us at Hydrodynamics@ourconnect.com, and you can see me afterwards, and we can make sure that anyone that wants a copy can have one.

This presentation is similar to a presentation that we gave to the Nuclear Waste Technical Review Board. It is different in that we have completed a more thorough evaluation of the geological framework model of the Southern Funeral Mountain Range, and we have revised our ground water flow model through the Southern Funeral Mountain Range based on those results.

So some portion, if there are members from that board here, may see some of the same materials. As Andrew had indicated, Inyo County is obviously concerned like many other counties with radionuclide transport through the -- and in our case the lower carbonate aquifer system into Death Valley, and we think that is the most likely conduit for contaminate

transport.

The second item though that has importance to the repository is this degradation of the upper gradient in the lower carbonate aquifer in the Southern Funerals.

Now, this has also implications in terms of impeding radionuclide transport from Yucca Mountain into this hydraulic system. Next slide. Let me try and characterize the problem. Of course, we had the Yucca Mountain repository up in this area, and at that point we have one more hole that indicates the presence of the lower carbonate aquifer system, a highly porous carbonate system.

It is at a depth of about 6,000 feet below ground surface, and in this situation is overlaid by a classic material, the alieno shell. We know that this carbonate has a significant upper gradient in it at this point.

Further drilling down into the valley, there was an exploratory bore hole, and that did penetrate the lower carbonate in approximately this area. The Nye County drilling program is focused in this area, and I believe they had one well and they can address it better than I can, and that may have penetrated the lower carbonate.

But all of their wells, deeper wells, do show the influence of an upper gradient possibly from the lower carbonate aquifer system. We then have a number of carbonate springs in the Furnace Creek area of Death Valley.

So when this geological information was put into the regional ground water model, a number of potential flow paths were developed, and they are indicating that one of the more likely scenarios of the two models, which one was for the Nevada Test Site, and the other one for the Death Valley regional ground water model, was that carbonate waters from the Yucca Mountain area have a hydraulic connection to the flows in the Death Valley. Next slide.

This is a blow up of the simplified geologic map of the Southern Funeral Mountain range. The pink is the payonate carbonate rocks, which is of interest in our aquifer. We when have some medisediments, which are basically permeable rocks up in this area.

And to orient you, here is Furnace Creek Ranch when you come into the park, and where a lot of the tourist activities are in this area. This is Highway 190 running through here over to the Death Valley Junction in this area just to get you oriented.

The Amargosa River flows through this direction. We are going to talk about three areas. Area A, which is on the east side of the southern Funeral Mountain Range; and Area B, which is near the Travitine Spring area in the Furnace Creek fault; and then Area C, which is the alluvial discharge fan for these large carbonate springs. Next slide.

The program to this point involved mapping the surface geology of the Southern Funeral Mountain Range. Chris Frederick of the U.S. Geological Survey took the lead on that in incredibly detailed maps.

The second element was a geophysical program to help us locate where we could drill in our program to tag the lower carbonate aquifer system. We wanted to make sure that we could reach that point at a reasonable depth.

So our geophysics, and this is a 3-D model of that interval. We did a number of geophysical lines in here. As a point, we have four potential drilling locations on this nods, and the lower carbonate, which are overlined by tertiary rocks at the surface.

So the Amargosa River is in this area, and bedrock exposed, and carbonate bedrock is exposed at this point. So we are trying to see where we can

drill here to penetrate that lower carbonate. Next slide.

This is just a planned view of the same slide, and so we are seeing that our potential drilling areas are here, here, and possibly over here at the State Line area, where the State Line fault comes to. Next slide.

That was a characterization of Area A, which is the east side of the Funerals. This is Area B, which is around the Travatine Spring area, and with the Furnace Creek fault running through here. We have exposures of the payload carbonates in the Funeral range, and then this turseriary rock fill coming off into this span, with the Texas Travatine Springs.

These are some of the larger spring discharge areas in the Furnace Creek Ranch area, and represent a water supply to the park. Thus, the interest in this supply. Economic resources exceed $3 million a year just in the taxes on the -- hotel taxes and income coming into the county.

So this does have a significant impact if these resources are lost. Currently we have a -- the USGS had a shallow well in this area, and we have a number of geophysical studies through this spring area, indicating that there was a syncline, and then

the spring discharge.

Our program allowed us to drill a deeper hole in that area. Next slide. This is a little closer detail of the situation here. Here we have the spring discharge along this thrust fault area, and then our drilling program, where this is the shallow USGS hole and this is our deeper hole, which went to a depth of approximately 1,300 feet below ground surface. Next slide.

Here is the results. The USGS did a geophysical survey along our study area, which helped us guide where we would drill. This is the location of our well, and this is the Travatine Spring, and notice the stress fault running through here.

It is interesting as their profiling came out almost identical to what we observed in our drilling. Here we had a confining clay layer, with a shallow carbonate aquifer, and that supplied water into this spring area.

We also found at depth that there was another component providing water into this spring. So what we are trying to do is track how water moves from the Southern Funerals into this spring system.

So by doing a profile through here, and with this drilling, we have a better characterization.

One thought is that we could drill a well down here to better characterize this stress fault.

And I believe the Park Service is completing a well in the wash to figure out again what the discharge is for further down gradient. Next slide. Area C which is the Furnace Creek Ranch area, is composed of a large alluvial fan. This is the area going towards Bad Waters, and this is the turn off for the area for Bad Water.

To try and get an idea of what the underflow is below the springs, we had the spring discharge, and how much water is actually not being observed or captured by the spring orifice, and water is coming underneath out into Death Valley where the salt plants are.

So we did a number of geophysical lines just to do a first characterization, and this is just our first attempt. Next slide. We did a number of profiles through here and this is just in one direction.

The method that we used, which is gravity surveying, shows the deep basin. So we are seeing the depth to the lower carbonate, which is incredibly deep in this area, on the order of about 2,000 meters.

And there is quite a bit of depth, and we

also found some fault control in here that would allow the water or discharge from these springs to be captured. It is not well shown in this, but in our final report, we will be able to show you that there is kind of a (inaudible) structure here, so that the discharge from these springs goes into a fan, and the water is collected there.

And this is why you have this oasis area where all the dates are in the Furnace Creek area. Next slide. Chris Frederick of the USGS has been mapping this area, and he had a few theories on the conceptual hydrology as it relates to the geological framework.

What he has found is that there is a geological material in here that is basically impermeable. It acts as a dam to flow from the Amargosa Valley, and into this spring system. Now, why are we interested in springs?

Well, the discharge from these springs are significant, on the order of 2,000 gallons a minute, and some of them go up to 1 to 5 cfs total. That far exceeds any of the local recharge in the area. So there has got to be water coming through this mountain range, because you have Death Valley out here with essentially no ground water source coming in.

So the water has to be coming through this mountain range, and Chris suggested that there is a couple of spillways or pathways for this ground water to flow through is in the Naval Spring area, with an upper spillway coming into the Texas Travatine Narvara Springs. Next slide.

This is the new material that we have been working on. Chris thought there was -- he looked at two different scenarios, and one of them was a shallow fault system, controlled through the Furnace Creek Fault, and from the stay at lines on the other local faulting, which he put that theory forward.

So to kind of orient you, here is Navara Spring, Cow Creek, and there was a seep there, and we had a salt spring, Creek Spring, and we had the Texas and Travatine Springs in this area.

And then Naval Springs, which is a low discharge spring in this area. So he is looking at a spill way coming through his direction to support this spring flow, and then flow coming from the Amargosa through this spill way to the north into this system. Next slide.

He revised his model to say, well, what if these fault patterns are actually of a deep nature and not a shallow nature. We suggested to him based on

our geophysics, which showed that the angle on the faults were incredibly steep and deep in this situation, approaching near vertical in some areas, especially over in this district.

So again we have the Furnace Creek Ranch, and the Furnace Creek fault running through here, with our springs on this side, and then the State line fault, which doesn't seem to be acting as a hydraulic barrier for ground water flow.

This is the spill way area, and this is the dam area in here, and so the spill way would be to the north. Notice that we have a much larger spill way in this model than we did in the other situation. Next slide.

John Brederhof then took this information, and he collected spring flow data from starting back in 1965 to get a reasonable characterization of what is the discharge from these multiple springs in this area.

They then took and digitized, and modeled the deep geological framework model. So here we had this dam, and we had the spillways to the north and to the south, and what he tried to do was that we had had values up in this area based on the water tables in the Amargosa River.

We know what the elevations are of the spring, and what their discharge rates are. He then did an analog model or inverse model, and come back and calculate what the resulting water table would be.

What is interesting is that we do indicate based on this model that it is possible for ground water to transport from the Amargosa Valley area through the spillways, and that is what is supporting the spring flows in this area.

Now, what is the implications for Yucca Mountain? Well, again, geochemistry and other data suggests in the modeling, and the regional modeling suggests that it is possible that should radionuclides get into the lower carbonate over some unknown time period that they do have the potential for ending out in the Death Valley Regional System in this large discharge area.

So that is of significant importance to us. So let's look at the next slide, which is kind of a summary of what we learned from the model. Well, we learned that the shallow or fault system didn't work.

When we modeled it, the water table dropped below the bottom of the shallow carbonated faults. So we had no flow, which helped point us again to the deeper fault system.

The model was incredibly accurate in reproducing the spring flows accurately. Well, obviously if you do the inverse problem and you take the spring flows, and then you match the model to it, then it works.

Before we had in the earlier models an unrealistic permeability in transcivity to get that discharge that we wanted, we found that the discharge from the springs were much larger than what the Park Service was actually reporting in their modeling data.

And by doing that, we came up with a much more realistic permeability. So we think that we have a good understanding. The other thing that we found is that the model is pretty insensitive to the Furnace Creek fault, and so it is not acting as a hydraulic barrier to ground water flow.

So although the fault is there, you know, ground water discharge is across that boundary, and that is supported with some of our geophysics in the Southern Funeral Mountain Range, and in the Travatine area, which is why we wanted to drill in that area and do geophysics there. Next slide.

So what are some of our main issues that are coming from this research. One, we think that the lower carbonate aquifer flow path most likely exists

in the Southern Funerals. When they did first did the regional models, they said, well, we don't have any data to say that ground water flows through the southern Funerals.

So based on this preliminary work that we are doing short of the drilling program, which would be to tag that lower carbonate aquifer, we have a much better feeling that, yes, it does flow through this system.

What is important to the County and to Yucca Mountain is this upward gradient. Across that spillway, we are talking only a hundred foot head difference.

If there is a reduction in the water table, and the Amargosa on the southern -- the east side of the Southern Funerals by a hundred feet, it could significantly impact spring flows in Death Valley.

So this upper gradient in supporting the water table in the tertiary aquifer systems there in Amargosa are really important to us. This shows a hundred foot change, and the 50 foot, and the new model showed it was more like a hundred foot. So it was not as sensitive as we originally thought.

So it takes a little pressure off the

Amargosa farms area and their pumping, but it is still something to consider. The other important thing is this upper gradient is a barrier to radionuclide transport.

There are discussions about utilizing the more carbonate aquifer as a water supply for the growth in the Pahrump and Amargosa areas. Any reduction -- and we are obviously opposed to that because any reductions in that removes one of the potential barriers to radionuclide transport into the Death Valley Region.

So from a policy standpoint, this science is guiding our work, and suggesting that we need to maintain that gradient. Next slide. Let me summarize a little bit about what our program is.

The program was to drill five wells, three of them in the lower carbonate aquifer and three of them on the east side of the Funerals, and one in Echo Canyon right on the Furnace Creek fault.

We are going to drill right into that fault and see how it is behaving, and try and characterize if it is a barrier or not to flow, and how does water move through that mountain.

We constructed the Travatine Spring well, which is great, and we are on our way with that one.

We are also going to be conducting a water balance discharge study model of the Furnace Creek area.

Again, we know what the discharge is from the springs, and how much is actually not being -- how much are we missing, and its analysis. So we are going to be looking at ET analysis and try to come up with a balance, a water balance. Next slide.

Okay. I guess we are done. Good. The plan right now is because we are in a very sensitive environment for the Bureau of Land Management in the Death Valley Park, we got forced into doing an environmental assessment under the NEPA process.

If we were in Nevada, we would just go out and drill a whole. But this is sensitive, and so that has delayed our drilling by 6 months. We completed the wells that are permitted from an environmental standpoint.

We then found that we were going to go sole source on our drilling because of the experience of Echo Canyon. Our attorneys have now informed us that because of the Federal funding mandate that we have to go out for bid.

The bid package should be on the street before Christmas if we are lucky, with drilling in January or February. And with Year '03 funding, is it

adequate to drill the second hole on the east side of the Funeral. So we will have the Travatine hole, and the two east side wells into the lower carbonate, and I think that is important.

We are working with Abe, and we thank you for your support, and the DOE, in possibly getting adequate funding to drill the third hole on the east side of the Funerals.

The Echo Canyon well will most likely be drilled with oversight funding with Inyo County and support from the Park Service as well. There is some real value to have that bore hole there.

These are deeper holes and running in the 2-to-3,000 foot range. So they are of importance. So I am open to questions.

DR. WEINER: Thank you very much. Questions from the Committee? Dr. Garrick.

CHAIRMAN GARRICK: No questions. Thank you.

DR. WEINER: Dr. Ryan.

VICE CHAIRMAN RYAN: No thank you.

DR. WEINER: Dr. Clarke.

MR. CLARKE: You mentioned that your slides are available on the CD. Are you preparing a report as well? What is the schedule for that?

MR. KING: Well, we would like to prepare the report when we drill a well on the east side of the Funerals.

MR. CLARKE: I mean, in addition to what you have already done.

MR. KING: I'm sorry, but I had trouble hearing you.

MR. CLARKE: The report on what you have already done.

MR. KING: We will be doing a project report probably in January or February, and we can certainly make that available here. Basically providing the geophysics analysis from our geophysics and then we are finding that we would like to present our data under referee journals.

One, that it adds to the credibility. We are following the Yucca Mountain DOE QA program so that the data can be part of the licensing process. So any chemical analysis that we do, or the drilling program, will be under DOE QA.

So we find that will be made as part of the licensing process, and so we made sure that we had the money in there to make sure that DOE QA procedures. But the answer is that we don't have them yet, but we will.

DR. WEINER: Questions from staff? Hearing none -- oh, I'm sorry. Neil. Excuse me.

MR. COLEMAN: Neil Coleman, ACNW staff. Mike, I know from attending several of the workshops in Furnace Creek, there have been some studies on the ground water age, and I wondered if you were going to incorporate that in the report that you are working on, and if you were going to do any independent studies of your own on the ground water data.

MR. KING: Yes, we are. Part of the DOE grant was in part of the Inyo County oversight program, and it has been a big part since 1998, where we sampled 27 different high altitude springs through all of Death Valley, as well as some of the carbonates.

Selected springs samples were analyzed for radiocarbon dating, and right now we are using UNLV, the Harry Reed Center, to do that analysis for us. So we are going to publish that data, because we have a pretty good geochemistry base, and working with Zeil Peterman, and his chemical base, and what Klaus has at UNLV, we think we will have a pretty comprehensive geochemical analysis to identify the source of the water. That is where we are headed with it.

We are able to separate the surface spring

water chemistries from these older carbonate springs, which again helped us realize that this wasn't local spring water recharge.

DR. WEINER: Thank you. If there are no further questions, even though we are a little behind schedule, we have a 15 minute break, and so we will return at 25 after 10:00.

(Whereupon, at 10:10 a.m., the meeting was recessed and resumed at 10:25 a.m.)

DR. WEINER: Our next speaker is Dale Hammermeister, who will tell us about the Nye County Early Warning Drilling Program, and I would like to ask the speakers to please stay within the time limit to the best of your ability just to give everybody a chance to answer questions.

And, Dale, could you identify yourself and your affiliation, and tell us who else is going to speak.

MR. HAMMERMEISTER: Sure. My name is Dale Hammermiester. I manage Nye County's technical activities regarding Yucca Mountain. Also here today is Jamie Walker, who is not in the room right now, but he had better come back. He is a senior geologist and principal investigator in the area of geology, and if there are any difficult questions, he will help. The

next slide, please.

I would like to give you some background briefly. I have not been before the Board, and I don't think that Nye County has given a talk on drilling for a while.

So very quickly I would like to go over funding goals and justification, and just describe some of the wells that we have drilled to date, and then pick out a few of the more significant findings and future plans. Next slide, please.

Funding comes exclusively from the Department of Energy, and it started in 1998 with a cooperative agreement, and the Early Warning Drilling Program Cooperative Agreement. That was under the umbrella, or was put under the umbrella of an existing science program that Nye County had in place, and that was the Independent Scientific Investigations Program that was started in 1994.

Right now were in the bottom bullet, and we are in the second year of a 5 year agreement, and the majority of the activities are associated with the Early Warning Drilling Program. However, we are also conducting an important design performance -- design and performance issues, particularly on ventilation, and natural ventilation modeling.

And at some time we would like to talk to the board or the committee, I'm sorry, about that. And recently, I believe in July, John Walden, who is a consultant to Nye County, talked to you folks about EBS water chemistry ranges that can be expected in the EBS, and I think that was a pretty stimulating presentation. Next slide, please.

The goals of the Early Warning Drilling Program are to protect the folks that live in Southern Nye County, and particular Amargosa Valley, and specifically we are interested in carriage rise and potential flow pathways between Yucca Mountain, of course, and Amargosa Valley.

We are interested in reducing the uncertainty in DOE Performance Assessment Models, and I would like to give the folks in Amargosa Valley a little more confidence in these performance assessment models, and finally we would like to work on designing a ground water monitoring network. Next slide, please.

The justification is a no-brainer. There was prior to 1998, there was very little data south of Yucca Mountain, between Yucca Mountain and Amargosa Valley, where there was drilling, hydrogeological subsurface data. Next slide, please.

This slide shows the repository up here, and of course Highway 95 right along here, and there are or there were some wells, or rather these were actually seismic holes, and so you can see that there were few wells south of Yucca Mountain.

And there were some wells located around Lathrop Wells, and Amargosa Farm Wells, but generally the region was -- there were no wells in the whole region. Next slide, please.

We have drilled holes in four phases since 1998, and each phase corresponded to a year, or up to a year-and-a-half, and the first phase focused -- the first and second phases that took place over the first 2 or 3 years, focused along Highway 95, and characterizing the hydrogeology around Highway 95.

We focused in on a couple of locations, particularly spring deposits were of interest to a whole lot of folks, and so there were a number of spring deposits. The slide is so far away that I can't even point to the right location.

We also drilled a carbonated well, and we actually penetrated the carbonates at Site 2DB, and I believe it is at this location. The third phase moved on up into the actual yellow triangles, I believe, are in the alluvium 40 mile Wash, and would characterize

the hydrogeology in that area.

And the fourth phase, we look directly south of Yucca Mountain to Fractured Rock pathways, and this unnamed basin just north of the cylinder cone and we call this basin Flat Tire Flat. It is not an official name. It is a Nye County name.

And also we have drilled a couple of wells on the western margin of 40 Mile Wash to look at the flow from fractured tuffs into alluvium. Next slide, please.

The major activities of the Early Warning Drilling Program are typical of most large scale hydrogeologic characterization programs. We drill, we sample, we log in a geologic log, and construct wells, and we bore hole, and we connect geophysics surveys, and lab testing, and aqua pump testing, and ground water chemistry sampling analysis, and of course water level monitoring.

We are going to talk today primarily about the first two activities here. There are some backup slides if you have any questions; and particularly the data generator from some of these two activities up here, and how this was incorporated into some interpretative geologic cross-sections, which we will get to shortly. Next slide, please.

Our approach, we in fact do have a QA program in place. It was reviewed by the NRC folks, which said if we did a good job of following it that it would probably be okay. Well, we are working hard to follow it, and we are doing -- I think we are doing a decent job.

Our philosophy has been to share samples and share data. We share samples with DOE and other interested parties, these geologic samples and water samples. We make the data available to the public. It has been Nye County's policy to put data as rapidly as possible up on the website.

And also we try to get technical reports out. We put out a recent report on the Phrase IV or rather the Phase III drilling effort, and we are trying to get a comprehensive report in this winter or spring out on the Phase IV efforts. Next slide.

The first three phases, we focused on the upper aquifer wells. We generally drilled to 1,500 feet or less, with several exceptions. We used a variety of drilling methods, but where possible we used methods that minimize screwing up the formation, and minimized messing up the actual samples, the drill cutting samples.

And we took a lot of pride in trying to be

cost effective and doing things efficiency. When actually building the wells and constructing the wells, they were designed to determine a particular hydraulic radiance, and variations in permeatability, and water chemistry with depth, and how do we do that? Next slide, please.

We drilled a number of smaller diameter wells, where we would have piezometers, and in this case what we called dual piezometers. We have well screens that are basically separated by a grout seal, and so we have a number of these smaller diameter wells in place, and piezometer wells in place. Next slide.

We have also drilled a number of larger diameter wells, where we have multiple screens in a single well, and we pack these off with westbay packer systems and are able to sample at different depths. Next slide, please.

Times got hard in 2003, and funding constraints really caused us to exclusively use in Phase IV, to exclusively use expiration drilling on technique, minimal expiration drilling technique that was used a little bit in previous phases, and we actually defined some of the actual methods.

It is relatively inexpensive, and it

produces good quality samples, and we can drill fairly deep, and which we did. So our focus was to drilling much deeper in this phase, at 2 to 3,000 feet, just as in the previous phases we collect geologic samples.

We didn't complete a well to 2,000 feet. We actually backfilled and completed a piezometer screen across the water table in Phase IV. Drilling and obtaining representative samples and not messing up the formation is important, and this is the exploration drilling method that we used. It is called a dual-wall reverse circulation drilling method.

We have dual-wall pipe shown here, and here is just a center discharge bid, where it comes down the outside and goes up the inside. The end result is that we get very little mixing of geologic samples, and we get good high quality samples, and we really don't mess the formation up too much. Next slide.

We collect the samples from the unsaturated zone and the cyclone separators, and from the saturated zone, we collect an anoconated wet spitter, as shown in this slide. Next slide, please. These slides are getter than all those word slides aren't they? Not really.

We did collect in Phase IV some collected core samples using dry core methods. This is basically just a tube that we beat into the ground with a percussion hammer. It is not a method that can be used for continuously coring to get representative samples over long intervals.

It is very expensive and very time consuming, but we did get the first core ever from alluvium and 40 Mile Wash, and we realized that we had to have a little different coring method, and we will talk about that later. Next slide, please.

I want to focus just as I said before on a couple of cross-sections that were developed, and the geophysics data that helped locate these cross-sections and helped maybe interpret these cross-sections. Net slide.

The first cross-section was built primary from bore holes drilled in Phase III in the lower 40 Mile Wash. Again, this is Highway 95, and this is the main access to the 40 Mile Wash Channel.

We actually forgot to label these cross-section, but this is an A prime and this would be B prime. Next slide.

Also, I apologize, but this should be about five times larger in order to understand it, but

the top cross-section is along the principal access. It is paragrallel to the principal access of 40 Mile Wash, and the B Prime, which sit he second cross-section down below it, is perpendicular to the cross-section. This is the east and this is the west, north, and south.

Some features of this cross-section, you increase silt and clay with depth, and virtually every bore hole, and on the bottom cross-section that is perpendicular to the principal access of the wash, we actually increase in silt and clay, or fine content, as you move to the east.

This latter observation suggests that perhaps load is focused more in the central part of 40 Mile Wash, at least in the labial aquifer. Finally, another interesting feature is that the volcanic tuff rocks, we have only showed the volcanic -- I can't even read it, but at any rate, it is volcanic conglomerate, which is located down here.

And these volcanic tuffs really change as you pass or get near the Highway 95 and they really change into much older rocks, volcanic plastic sediments, and this is possibly due to the Highway 95 fault, which is a very poorly understood fault, inferred fault. It runs parallel up the hill a little

bit from 40 Mile Wash. Next slide, please.

We have already talked about this. Next slide, please. I want to talk about one other cross-section, and that is in Flat Tire Flat. Again it is that unnamed basin just north of the cinder cone right now, and south of course of Yucca Mountain.

I believe this well on the south is 28, and Well Number 16, and then Well 27, the third well in this cross-section that is showing -- the cross-section line that is shown here. Next slide, please.

Jamie located -- actually Jamie Walker, who as I said was our principal geologist located the wells, and based on some geophysics survey data, and specifically aeromagnetic survey data, that was produced by the U.S. Geological Survey, but under sort of a joint agreement, funding agreement, between Clark County and Nye County, who funded the U.S. Geological Survey to conduct his data.

And this proved to be one of the better projects of Nye County, and it has really helped us direct drilling and helped us understand a little more of the complexity of the subsurface geology.

At any rate, the aeromagnetic data, if we do see anomalies, or lineaments, they may be related to faults that off-set shallow volcanic units, and/or

they may be related to strong and magnetic basement rocks, and/or a whole host of other things. But any way let's look at some of the aeromagnetic data. Next slide, please.

Again, this is produced by the U.S. Geological Survey. The delineations or the anomalies were drawn in by the U.S. Geological Survey. The cross-section is shown right here, and I want to focus in, as there are some northeast trending anomalies, and Jamie located the first two wells.

The southern most wells in this cross-section line are on either side of the anomaly. Again, it might be a fault, and are interested in looking at the rocks on either side of this.

And 27 was located just at the south of this strong east-west feature. By the way, we have three of these, one corresponding to possibly the Highway 95 fault, and this feature that passes through or near this cross-section that we are talking about, and then another very deviated, deep-seeded feature here just south of Yucca Mountain.

Getting back to the actual cross-section line, there is a couple of planned bore holes that are on the north side that we unfortunately ran out of money, and were not able to drill, but hope to drill

some day soon.

Let's look at some other geophysical data. Let's look at the gravity data that the USGS has produced. Next slide, please. This is the gravity data, and this is depth to basement rock with this cover legion here, and what this is actually showing -- and again this is Highway 95.

This is the Crater Flat Basin, and this deep, extremely deep basin, is in some cases as deep as 3, 4, or 5 kilometers deep. And on top of that is overlaid these aeromagnetic lineaments shown as the lines.

Again -- I have got to get glasses. That's all there is to it or change my slides. The cross-section line that is shown here, and Jamie was interested in looking at the rocks, and at the edge of this precipice, this basin that drops off into never-never land here.

So, anyway, that was some of the logic behind the location of those wells, and bingo, we got lucky. Next slide, please. This is a cross-section from south to north, and this is Well 28, and Well 16, and Well 27.

We see over in the northern part of this cross-section, we see the complete package of volcanic

rocks that exist around Yucca Mountain. The Timber Mountain tuffs, the Paintbrush tuffs, and the Crater Flat tuffs down at the bottom here.

However, over here we see something very much different, and this well in the south penetrated -- I should say the Crater Flat tuffs, or the upper Crater Flat tuffs are absent over here. They disappeared, and we actually go into the bottom of the Crater Flat tuff member, the tram unit.

And this is at about 1,300 feet, and we penetrate the tram over here. But over in this well, we penetrate the tram at about 2,800 feet. There is roughly a 1,300 or 1,400 foot difference in the tram location over here and here.

Also, when Jamie drilled this hole, it was the most god-awful gooey stuff. It is highly weathered clay, very difficult to drill, and highly impermeable, and really, really rotten rock over here.

Some of the conclusions that perhaps we can draw from this cross-section are -- and the next slide, please. The well to the south is located or is drilled on the foot wall of a large buried growth fault down in the very deeps of the basin, and in the deeper Crater Flat Basin.

While the immediate well on that cross-

section is drilled on the apparent hanging wall, and the furtherest and most northern-most well is also drilled on the hanging wall. Next slide, please.

Actually, can you go back two slides, please. Since these rocks are so impermeable, any water that is flowing in some of these deeper Crater Flat members, if it is flowing southward and hits this, which we think is a buried fault, if it hits this highly permeable rock, it would be actually diverted or actually focused a little bit into the actual slide that we are showing.

The plane of the slide that we are showing you is in a southwest direction, and it would not tend to actually penetrate this very, very impermeable barrier here.

However, north of the water table is much higher, and the upper most aquifer is not really affected. Water would continue flowing south. Can we go ahead two slides, please.

We would like to point out some conclusions from this cross-section. The cross-section differs significantly from recent USGS interpretations. We can say that the fault is active, if present there is active during the deposition of the Crater Flat and early Paint Brush tuff members.

And I think that we can say -- well, that it is likely that the fault that we are showing in this cross-section is related to some of the magnetic and the gravity data that we saw previously on the geophysical surveys.

And finally there is a likely -- if you go towards -- down towards the deeper part of the Crater Flat Basin, there is likely additional faults in related sub-basins that eventually get you to the bottom of the Crater Flat Basin. Next slide, please.

I would like to talk just briefly about these two other wells that were drilled here on the western margin of Forty Mile Wash. Next slide. The northern most well that I just showed you, it may be in a somewhat similar location as the southern most well in the previous cross-section.

That is, on the foot wall of a perhaps syn-volcanic fault. Again, the upper Crater Flat members are missing, and this time we hit the -- we are missing the Calico and the Propass, and we actually -- right underneath the alluvium, we actually hit the Bull Frog member, and the older rocks, the pre-Crater Flat tuff rocks underneath, we hit at a relatively shallow depth of 700 feet.

So perhaps this well also is located on --

as I said, it may be in a similar stratigraphic position to the well in the previous cross-section. However, it is really difficult to draw any cross-sections in this region because the wells are of a different depth, and there is a lack of continuity of units, and we are not ready at this time to draw a cross section.

I won't even talk about 29. It was a bust. We made it to 790 feet, and we could not go any further. However, we did hit Topopah Spring -- I'm sorry, we did hit the Topopah and Achieva Canyon in this well, and we actually lost the well in a pre-Topopah, and we weren't able to go any deeper.

There is one conclusion though at the very bottom, is that these results that we have been looking at recently suggest that buried faulting may be more complicated than previously expected. Next slide, please.

We have already talked about flow focusing, and these are some of the major findings that I just put down. We talked about flow focusing in 40 Mile Wash due to textural and permeability contrasts. We talked about a buried fault and possibly the effect that this may have on flow paths.

Some other major findings is that we found

the permeatability of the alluvium. We have done aquifer tests, and the permeatability of the alluvium underlined volcanic aquifers, can be extremely high.

It is a very general statement, but it is true. Upper hydraulic radiance that Mike King had mentioned that we found along Highway 95 and up the gradient of Highway 95 are generally from the deeper to shallower aquifers. That is correct.

And finally this is not really -- and it is maybe a methodology kind of conclusion or finding. We found that particle distributions in saturated alluvium differs significantly from drill cuttings and core samples.

The alluvium drill cutting samples get ground all to heck when you are drilling below the water table, and we have decided that the only way we are going to get any reasonable estimates of what the subsurface looks like below the water table is the core, and we will talk about this year. Next slide, please.

In the many years of our grant, we have 3 or 4 years left in our 5 year agreement with the Department of Energy. We are in the process right now of constructing a sonic bore hole, where this will be the first continuous core hole, and sonic methods can

produce reasonably undisturbed material.

It does disturb sonic methods due to the density and porosity of material, but generally the laying is intact. So we actually started in yesterday a sonic core hole, and we plan to drill 300 feet of continuous core from the alluvium.

And also we soon plan -- and we are already to go to conduct tracer tests in alluvium at a site, at Site 22, which is several miles up from Highway 95, and up 40 Mile Wash, and all permits are in place.

And we are just awaiting funding, and if funding comes through, then we will conduct a cross-hole tracer test, and single hole tracer tests at Site 22.

As you know the Department of Energy has been shut down at the alluvium testing complex, or as you may know, and they were not able to complete their cross-hole tracer tests. And Nye County is very much interested in this data, and also is of interest to the State, and to all folks that are involved in this whole effort.

We will in the future would like to conduct more airborne geophysical and surface geophysical survey data to help us focus our drilling

program. Again, the aeromagnetic survey that was conducted with Clark County's help and USGS actually did the work, it has been extremely important.

How much more airborne stuff we do really depends on the success of the -- if the juxtaposed is going to be done, the airborne juxtaposed is going to be done by the folks that are working on the volcanic intrusion issues.

We also want to construct a lot more wells. We like to drill wells and we are good at it, and there is a lot more information that needs to be obtained and we would like to construct 30 or more additional vertical wells. Next slide, please.

We would like to continue ground water monitoring of water levels and water chemistry as part of our program, and we have not even talked about that we don't have time.

And we would like to move up the hill and conduct another tracer test, and if we could pull this off, we can do a decent job of the alluvium, and we would like to do in the fractured rock, which is closer to Yucca Mountain, Site 18, which you don't have a map, but it is closer.

And we have not convinced people to do this. We have not got funding for this, and so we

have not convinced the interested parties, all the interested parties that it is worthwhile to do.

And we would also like to construct and test horizontal wells up to 5,000 feet long. We would like to -- clearly the petroleum industry is doing this routinely, and there is no reason why we couldn't do it at Yucca Mountain, and we would love to intersect a lot of those vertical features that exist out there, the geologic features.

And we just have got to do this. We have got to convince people to do it. The only problem is that it costs an awful lot of money, and money has been short recently.

And finally we would like to do some large scale aquifer tests in wells spanning the fall systems. Clearly the falls systems are important, whether they are barriers or whether conduits. We have got to understand more about the system.

I can say in summary that we are just beginning to understand how complex things are, and mother nature is always difficult. We have a lot of work to do to really understand the flow systems from Yucca Mountain. Next slide, please. Do we have time to talk about the sonic core, or should we just open it up for questions?

DR. WEINER: If you don't mind, I would like to open it up for questions. I want to thank you for absolutely zooming through those slides with the speed of light. Questions? Dr. Garrick.

CHAIRMAN GARRICK: Well, really only one question. From a standpoint of findings, and if you can offer this in a succinct sentence or two in one minute, what do you consider to be the most significant findings relative to the capability of the mountain to contain radioactive material?

And I realize that the emphasis is on flow paths and transport, but how does it boil down in your mind in relation to the performance of the mountain?

MR. HAMMERMEISTER: I am not sure that the --

CHAIRMAN GARRICK: Well, maybe another way.

MR. HAMMERMEISTER: I understand what you are saying. It is just that the Department of Energy's performance assessment analyses have shown that the saturated zone doesn't really make that much difference, the actual pathways.

It is important to Nye County whether the contaminants get there in 2000 years or 10,000 years. That is important to Nye County folks, but it is not

important to the Department of Energy.

So the progress that we have made on perhaps potential fast pathways, the importance of water moving in fractures and in faults, I think that is really important.

Jamie, can you add anything to help me out here?

DR. WEINER: Could you use the microphone and identify yourself for the reporter?

MR. WALKER: I am Jamie Walker, and I work with Dale Hammermeister as a geologist on the Nye County Early Warning Drilling Program. I never really thought about that question before and I don't think that my expertise could really answer that.

CHAIRMAN GARRICK: Well, maybe just to characterize the question just slightly different. I don't want to dwell on it. If not from the point of view of the performance of the repository, what have been the principal surprises in your work with respect to findings?

MR. HAMMERMEISTER: The complexity of the system, Jaime.

MR. WALKER: I would say that the complexity of the flow system to the south end, both in 40 Mile Wash and in the volcanic aquifers to the

south of the mountain, those are perhaps the largest surprises.

For example, the Stage 4 drilling where we are showing the varied growth faults and the nature of that system, and make generalizations about the flow system probably less valid than they are.

MR. HAMMERMEISTER: And we have almost come to the conclusion that we may have to drill -- to really understand this system, we may have to drill in a grid system almost. It is a very, very complex well system.

CHAIRMAN GARRICK: Okay. Thank you.

DR. WEINER: Mike.

VICE CHAIRMAN RYAN: No, that was a good answer for me. Thanks.

MR. HAMMERMEISTER: Thank you.

DR. WEINER: Jim.

MR. CLARKE: Dale, just a couple of questions John mentioned the flow paths when they came up, and it strikes me -- and by the way, there is really a lot of really good information here. It is going to take a while to digest, but it strikes me that it would be good to superimpose the existing flow paths or at least where those flow paths are believed to be through your transsects.

You have got two very different linethologies that you have tested. So I guess one question would be is to what extent do the predicted flow paths today go through those geological formations?

And, secondly, is there anything that you have done that would impact on those flow path predictions? That is one line of questioning.

MR. HAMMERMEISTER: Well, some of our water level data -- and, Jamie, please jump in will you -- suggest that the flow paths to the south through Flat Tire Flat may -- you know, that may actually occur from Yucca Mountain. Do you want to add to that, Jamie?

MR. WALKER: Well, I think the first part of the question was whether the flow path matches what we are seeing.

MR. CLARKE: Well, to the extent to which they intersect the transects that you have defined.

MR. WALKER: In the alluvial cross-sections that Dale put up, the current flow paths are essentially staying in that western part of 40 Mile Wash. They seem to match.

Now, there is no flow path recognized in the Phase 4 area, and in that rock section that we

show, although I think the jury is still out on that as far as whether there is any flow directly south. Most models do not show that, of course.

But we were looking at that from some recommendations from structural geologists, recognizing that if the north-south faulting patterns that we see do focus any flow, and the flow does not go southeast from Yucca Mountain, but truly south, that maybe we should be looking at that area. I hope that answers the question.

MR. HAMMERMEISTER: Also, we have a square raised rescivity program et to go with the -- it has been set to go for a year with the U.S. Geological Survey to look at the flow paths on the western edge of 40 Mile Wash, and flow paths out of the volcanos, which is sort of the standard cluster of flow paths that are coming out of the volcanics into the alluvium in 40 Mile Wash.

We are looking at that a lot more closely with the square radius rescivity technique that should help us at least look at the contact between saturated alluvium and saturated volcanic rock. At least we should be able to get at that contact a little bit better. It is a good question, but we didn't answer it very well.

MR. CLARKE: And just another quick one. You are planning on doing transport studies of both of those methodologies?

MR. HAMMERMEISTER: Yes.

MR. CLARKE: KDs and --

MR. HAMMERMEISTER: Right. And with the sonic core hole we are drilling right now, we plan to do hydraulic tests and we have offered to share -- we are going to repack these core samples and it is a very small scale kind of test, but we will send them off to Los Alamos if they are interested.

And Los Alamos has been doing most of the transport parameter stuff on geologic material. But, yes, we do plan to do tracer tests, larger scale tracer tests, in both methodologies.

MR. CLARKE: Thank you.

MR. HAMMERMEISTER: Thank you.

DR. WEINER: Sher.

MR. BAHADUR: I have one question on your Slide 30, where you summarize the major findings. And what I am defining is that the second bullet says the upward hydraulic radiance generally observed from the deeper to shallow aquifer. How do you think this would influence the effect of repository in the area?

MR. HAMMERMEISTER: Well, it certainly

would keep the connect contaminants near the upper-most aquifer I would think, because we see these gradients, although they decrease significantly as you get into more permeable material as you come up from the more deeper rocks, and as you come up in the system.

There appears to be an upper hydraulic radiance in most of the areas that we looked at so far, except right along 40 Mile Wash, where there may be some evidence of ephemeral recharge, or a recharge from ephemeral flows that occur there.

There may be some slight downward gradience right around the principal axis of 40 Mile Wash. It would definitely keep or help to keep whatever contaminants that leave Yucca Mountain, it would keep them in the upper Aquifer, and that is nice, and I guess we all agree with that. It helps to limit the spread of the contaminants. It would make Mike King happy.

DR. WEINER: Any further questions from the staff? Hearing none -- yes, I identify yourself for the recorder.

MR. HUDLOW: I am Grant Hudlow. John asked if there were any more surprises on your Slide 24, and --

DR. WEINER: Excuse me, but could you identify your affiliation, please.

MR. HUDLOW: I am the CEO of Allied Science, Incorporated.

DR. WEINER: Thank you. On Slide 24, there shows a deep hole right there at Lathrop Wells, and that yellow spot down there at the intersection. The USGS did a study, and unfortunately that is the top end of their study, and that is the end of a compression fault that goes clear down through the Amargosa Valley, and clear down through Pahrump, and it stops down around where the Toporah Road crosses Pahrump.

And right at that point at Lathrop Wells, there is a spring that discharges into the alluvium, about 2,000 meters deep, and it is 5, 6, 7,000 acre feet a year.

And it comes out of the carbonate. So that provides about half of the water for the Amargosa Valley, and with a complex system where they are drilling up there, heaven only knows what it does, because the Alluvium has layers of impermeable rock that is a conglomerate, I guess.

So the stuff moves around in all different kinds of directions, and it is hard to say what it

would do up in there, but that was a major surprise for this whole system.

DR. WEINER: Thank you very much. Having no further questions from staff, I will turn it over to the Chairman.

CHAIRMAN GARRICK: Thanks, Ruth. Excellent. All right. This committee has been told many times about the value of analogs in evaluating the performance of geologic units in areas and regions.

And recently there was an important workshop on that subject, and we are going to hear about it from John Kessler. The only thing I would say to John since I know him is that I would greatly appreciate it if he would compress his 45 minute presentation into approximately 30 minutes.

MR. KESSLER: Okay. I had it for 30 minutes to give you time for questions. All right. Let's roll it. First of all, what is an analog. There is lots of definitions out there. I have got a couple up here.

From something more specific in terms of the occurrence of materials and processes that resemble those expected in a proposed waste repository, and provides information or behavior, or

any natural system that provides a warm, tummy feeling in terms of a more subjective thing.

We talked about all three potentially being something that you would use as an analog, depending on its use. In terms of what EPRI's interest is in analogs, we recognize that some sort of analog information is going to be provided to support the repository total system performance assessment models.

The NRC expects and they made that clear in the workshop, that DOE will provide some analog work in their potential Yucca Mountain license application.

One of our concerns going into the workshop was that there are a lot of expectations around the use of the analog information. Sometimes -- in some parties there may be too much expectation that you are going to get huge amounts of quantitative information out of analogs, and sometimes too little, and that they are really worthless.

That there is no analog. You get the idea. There, we are concerned about the appropriate use of analogs. So we were interested in exploring how that analog information could be used optimally and appropriately.

For example, in the development of models or simply in multiple lines of research. So back to this question of what is a natural analog. It is in the eye of the beholder perhaps. It does depend on your expectations and interests of the audience.

More importantly, it depends on the application, and I am going to get into that a little bit briefly, but it is different in the sense that if you are doing features, events, or processes, screening of models, you may have almost -- any natural system can help you get some idea of what process it is at, and what features there are.

And therefore your criterion for what constitutes a good analog may be a lot looser if you are looking to just try to identify what processes or models there are. On the other hand, if you are looking for something that is very much performance assessment specific, you may have to look at a subset of that huge number of options, in terms of analogs out there.

Perhaps the regulator is interested in those and perhaps the general public is interested in all of them, and the workshop that we did here from Tim McCartin, that the regulator is interested in all of them as well, and not just the ones that are

specific to the model.

Analog information, in essence, why are we after this. Well, we are looking at things that get the time scales of interest for these problems. So you can look at different kinds of analogs that span the time scale.

Starting on the left here, here is a uranium glass I think from bohemia from about a hundred years ago, and maybe a little longer. Some Roman helmets that were buried, and then you get into some archeological evidence from maybe a thousand years ago, and then of course geological evidence.

So analogs can work on different time scales that might help you. How can analogs be applied to performance assessments. This idea of can we match performance assessment requirements with natural analog information, and maybe you want to put one on the other side, in the sense can you come up with natural analog information that develops performance assessment requirements.

We talked about the chicken and egg of which comes first, your analogs or performance assessment requirements. Next view graph, please. One of the things that we had in the workshop was analog uses and performance assessment outside the

U.S.

We specifically invited people from outside the U.S. to come in. The leader of the workshop was Bill Miller from Envirus Consulting U.K., who was managing some European Commission funded work, and one of the things that Bill was talking about was in these non-U.S. performance assessments, analog information was used in terms of developing concepts, and all of them used some data, and in some cases they used testing.

And that represents the majority of the European efforts, as well as I think there is a Canadian one up there. We spent quite a bit of time in the workshop talking about this particular conceptual flow chart, in the sense that as you develop a performance assessment, you start with your disposal concepts, and then you work through your features, events, and processes, and EFEPs is external FEPs.

You develop scenarios and you start to develop conceptual models, and then you get your math model that you feed in with data, including the uncertainties. You develop the results, and then you interpret.

Well, what we talked about was where can

analog information feed into these various stages of development and performance assessment. And we talked that certainly at the up front end that there are a lot of opportunities, at least in terms of identifying what features, events, processes might occur from analog systems, and at what time scales they occur, and there is a lot of information.

When you get down into developing data and uncertainties. The quantitative information tends to be more in the sense of, well, it probably can't be any worse than, or more of a bounding approach using data.

And it also gives you some sort of range of your uncertainties that you might use. Next view graph, please. So the goals of the workshop were to explore the ideas and potential approaches, and I want to make it clear that we were not attempting to reach consensus.

We had a diverse group, which was very helpful, and we just wanted to discuss these issues. We discussed what made a good analog, and the different criteria for the different uses that I have sort of walked you through already.

We examined both the U.S. and international approaches to the use of analogs, and I

will talk a bit about the international ones, and I leave it to others to talk about the U.S. approach, and there is certainly a lot here.

But remember that this was sort of the general application, and we definitely avoided trying to in a sense name names. We wanted to avoid specifics. To explore potential analog roles, such as informal decision making, and such as repository licensing, or just in confidence building, and those are sort of the general goals of the workshop. Next, please.

So things that weren't goals, such as achieving consensus, we were after open discussion, and as I mentioned examining specific analogs, or passing judgment on them, was not something that we tried to do in the workshop.

So we tended to keep the discussion more general. Next, please. In terms of the workshop agenda, we set the scene a bit, in terms of a general discussion about the uses and limitations of analog systems.

Abe van Luik gave a presentation of the DOE Yucca Mountain analog program. David Pickett from the center talked about the NRC approach to analogs. Then we had a couple of talks on international

perspectives.

There is a European commission, NAnet, that I will talk about in a minute. SKB in Sweden had a different approach to natural analogs and was discussed by Patrick Selin, and finally CSN, the Spanish regulator, funded some work on collecting and presenting analog information that will also go through, because it was quite interesting. Next view graph.

Also on the agenda, John Stuckless talked about the USGS work, and Mick Apted and Ben Ross, who were being funded by EPRI, talked about two particular analog projects that they are working on related to volcanism.

And then we sort of ended with a review of the Yucca Mountain licensing process and those opportunities for using analog information was done by Bob Bernero.

And there was a general discussion sort of all through the meeting. I was quite open. Just to give you an idea of the participants that were involved, we have quite a diversity there. From your shop, I guess, on his last day on the job, Milt Levenson was at the workshop and we really appreciated him being there.

As I mentioned, Tim McCartin from the NRC and David Pickett from the Center, represented sort of your side of the life there. Next viewgraph, please.

The main themes here, and I want to talk about themes, because I want to avoid using the word conclusions, but these were sort of topics that we sort of kept coming back to.

And these might approach what you call consensus, but again that is not what we were trying to achieve, and so I will call it a theme. The use of analog information should be part of a toolkit used to form the technical basis for the evaluation.

And what we mean by toolkit here is this. Everything that you use to develop and support your models. Laboratory studies, which tend to be small and space time scales, and the repository site investigation, the models, and analog information.

So analog should be considered just part of that whole kit, and not something separate. And we discussed in the workshop that the use of analogs is often not part of the main stream. There was discussion about the fact that there is reluctance sometimes of modelers to directly incorporate analog information.

Again, they are looking for that really

quantitative stuff, and if they don't see the quantitative stuff, they don't really see the value. Of course, I am exaggerating a bit, but that has tended to limit how analogs are used or even documented in studies.

Analog studies often are conducted separately. That is, they are not part of a focused effort to develop and test models, and hence they sometimes are a little out of focus if you are looking for very specific uses of them. Next view graph.

Continuing with the themes, analogs have great potential to provide qualitative input. As I mentioned earlier the body of analog information is out there, and it really underpins all the basic sciences, and as technical people walk around with thousands of analogs in our head that form our conceptual approaches in models, and really forms the basis of science, and sometimes that is not recognized.

I know that it sounds pretty general or squishy, but some of this can be documented to provide additional measures of confidence. More specifically, analog sites indicate which processes might occur.

Hence, you should consider including particular processes. Next view graph, please. There

is an expectation by some that analog information is only useful if it can be used quantitatively.

And when it is used quantitatively, we talked about the fact that quantitative information requires careful comparison to the site to make sure that it is a good analog. We talked about what is a good analog.

We also discussed a potential problem with the big international efforts and that the work scopes were not always well defined for significant quantitative use later on.

That they almost came like let's go out there and see what we can see and then figure out what to do with it later. And that tended to be or to cause some difficulty in terms of their actual and even more quantitative use.

In practice quantitative information from analogs is used more to bound some processes and it is used in very specific processes only in general terms of when it is used quantitatively.

And in those cases it requires a more careful collection of the appropriate analog information. Next view graph, please. We also talked about analog information being used to not only support, but to challenge, models. That is, there is

a lot of discussion about don't just pick models that your conceptual model is.

But look at all the analogs that might be relevant and use those, the body of the analogs, to challenge or to evaluate your model. So we talked about a variety of analogs that should be used and those analogs that don't seem to support the models in TSPA need to be discussed.

If you want to defend a particular model, and you have got some potentially counter-looking analogs, you have to define, well, why isn't that relevant, or what does that mean in terms of your confidence in that model. Next view graph.

There was a lot of interest in the meeting about collecting analog information in one place, and giving a -- I call it an approachable format, and I will talk briefly here about two European efforts that were thought to be of high potential value to the world industry so to speak in terms of a use of analog information.

There were two European efforts that were presented at the workshop, the NAnet, which is Network to Review Natural Analog Studies, and the CSN study as I mentioned. Next, please.

In the NAnet study, it is a two year study

that began this year, and to be completed at the end of next year. Its aims are listed here; review past and present uses, and promote more considered applications, and for future safety assessments, and public communication, and derive added value from previous analog studies.

Next, please. I am not going to read through this, but you get an idea of what is in that database and the different kinds of analogs. We have got industrial, and we have got archeological, geological, and they tried to compile that, and that was discussed in the workshop. Next, please.

Unfortunately, there is a lot on here from this great distance, but this was actually one of which we felt was one of the most useful things about these two studies, both the CSN and then the NAnet study.

In the sense of how can you organize your analog information to see how it could actually be applied. So sort of the X-access here, you have your repository system components. You know, the actual pieces of it.

Remember that this is for a generic site, and so it is not Yucca Mountain specific. So they have glass waste form, spent fuels, cement, bitumen,

and different package types, buffer and backfill in the case of non-Yucca Mountain applications and different kinds of rock.

And down the Y-axis here, they have the different processes. So if you have got a particular system component and a particular process, then in the body of the table here they have listed which analogs might provide information on that.

And in both NAnet and CSN, they want to use drill downs here, and so you can see that this is in the blue here, and you can drill under that and say, well, what about copper for corrosion does this particular analog provide you. Next viewgraph, please.

CSN was an even larger study that is much more mature. There is a large amount, and what they noticed for starting their study was that there is a lot of literature out there, but it is dispersed all over everywhere about analog information.

They decided to launch their own study for putting it together, and their goals were similar to the NAnet study. Next, please. They again, just to give you an idea of the catalog of information, and the different kinds of places that they looked and where they looked. Next, please.

Okay. This one talks about basically what CSN viewed in terms of how the analog information here can be fed into different processes, and different components, and in the particular case of analogs and processes here, and they have cataloged all of this in a proprietary database. Next, please. Keep on pressing.

Okay. And then what they have also developed are sort of one page information sheets discussing all these analogs, and how they apply. Unfortunately, they are all in Spanish at the moment, but we are discussing with them to find a way to maybe get those into English as well.

And they have them both for geological and archeological information here. Next please. Again, keep pressing that button. What we have got here from CSN again is how they put all of that together to support the various PA stages for the analog studies here, and I am not going to go through it, but it is in your handout to give you an idea of how they organize things. Next slide, please.

And then this is the last one that they yanked from us from the presentation and so I can't show it to you from here, because this is where it was really cool.

They have a huge database that sits under here, and so you start with a table similar to the NAnet, where you have the X-axis that lists the system components, and a Y-axis that lists the relevant processes, and you drill down underneath with the analog studies that complete that table. Next, please.

As part of the workshop, and also sort of separate as an add-on to the workshop proceedings that are going to come out, EPRI put together a panel on analogs that also was going to write a bit in the report that is going to come out soon.

And here are a list of the members of the panel, and as I mentioned, Bill Miller was the Chairman from Invirus, and I won't go through listing the names there. But in terms of the tasks of the panel, it was to provide input at the workshop, and provide general observations in the workshop, and then to make recommendations to EPRI on the use of analog information.

After all, we were not trying to achieve consensus in the workshop, but we wanted to try and reach some sort of conclusions, and we used the panel to do that. Next, please.

So some panel observations and

recommendations. Certainly the panel supported all the major workshop themes that you just saw, and ideally the performance assessment community should collectively -- and what we call buying into analog information right at the start.

In the sense that it has value in underpinning the conceptual models. The repository developer should integrate analog information with a normal laboratory and site specific field investigations; that is, make it part of the toolkit, and don't make it a separate thing.

Incorporate it right in your planning from up front. And while analog information is useful to the public, there was a lot of discussion about how analogs tend to make things more approachable to the public.

The information presented to the public must first pass muster with the technical community. What was discussed during the workshop was a concern, well, you may be using certain analogs to do outreach to the public, but they really have not gone through the rigor.

And if you want to make sure that the analog that you use for communication purposes are good ones. Next, please. In terms of observations

related to Yucca Mountain licensing, we said that the potential use of analog information through the licensing process should not be underestimated.

Again, we recognize that the NRC doesn't formally require the use of analog information, but it certainly expects that such information be provided, and it would be at DOE's peril if they came in with a license application that had no analog information in it.

Multiple audiences are in or around the licensing process, and not just highly technical people. Similarly, there is the NRC staff and contractors, and there is yourself, and there is the technical review board, and there is the technical community at large.

And then there is going to be at least one atomic safety and licensing board out there, and there is one non-technical person usually per board, and sometimes more than one.

Bob Bernero gave us some ideas of where in the past analog type of information is really influential in the approaches that some of these ASLB's took in previous licensing decisions.

And then there is the general public, including the media. Analog information can provide

confidence and complex, often less than fully intuitive, models. That was discussed a lot.

When you get into these details models, you can't really understand how you get the output that you get, and analogs can help you at least have some more confidence in those models, or less, depending on what you have for analog information.

So, hence, analog information would be a great benefit in the higher level licensing documents, and not just down in the analysis model reports down below, but the use could be made of how analogs support the general approaches, and the general safety of the site.

That would be great if that could be done. Next, please. Okay. So where are we going? We are going to be generating a report on analogs to be released in January of 2004, and I understand that it is going into our publication system this morning. What will be in it?

A summary of the discussion from the workshop, and again that summary will be without attribution and talking about the theme and what was discussed. Making it clear that there was no attempt at consensus.

In another chapter, we will talk about

observations and recommendations from every panel. There is a bit on EPRI's views on the use of analogs, which really just takes the panel's views. There is a description of some analogs that EPRI is pursuing that I didn't have time to talk to you about today, and then there is the summary, and I think that is it.

CHAIRMAN GARRICK: Okay. That was wonderful. Very good. Ruth, do you have any questions?

DR. WEINER: A quick question. Did you discuss using analogs to actually benchmark models, like a PA model.

MR. KESSLER: To benchmark models? Well, we discussed it in terms of the quantitative application. I think that we said that there are -- one thing that I should mention is we said wherever you look, wherever you turn around, there is a potential analog.

The one that was presented by one of the EPRI contractors talked about the partitioning of radionuclides in magma, and so you know what is in the ash component versus what is in the more liquid component.

And where did he go? He went to the smelter literature, the metal smelter literature,

because you have got slag, and you have got the liquid phase, and you have got the right temperatures, and you have an ash component.

And there is lots of data out there that he collected that gives an indication. That prompted Milt Levenson to say, oh, yeah, and there was once a case where we had some volatiles that came out of a particular storage system, and we thought they were going to go, and as it turned out, they played it out all over everywhere. They never made it out.

And while that is more subjective, it is a process that you know that you want to include for the volatile components as part of a volcanic release center.

So what we talked about for quantitative uses, you need to design a very specific study and know your boundary conditions very well, which is often difficult to do with analogs, and quite honestly that tends to be costly and keeps their broad application down. And that was talked a bit by DOE.

CHAIRMAN GARRICK: Mike.

VICE CHAIRMAN RYAN: Just a quick add-on question, John. You mentioned a process related analog, and there is also temporal analogs. I mean, did you discuss that the short term analogs and long

term analogs, and that kind of thing?

MR. KESSLER: Yes. I showed that one, and my one pretty picture in not keeping up with Nye County by any means, but we talked about that some of them applied for certain time periods, and that you can get certain information, and again, you have to look specifically at what it is telling you about that time period, but we talked a bit about that.

VICE CHAIRMAN RYAN: Right. Thanks, and could you just refresh us on the report and where it is available, and when?

MR. KESSLER: The report will be available, and we will put it basically outside our fire wall when it comes out, which I expect will be by the end of December, and I will be getting paper copies printed that I will be sending to a large bunch of you.

VICE CHAIRMAN RYAN: Okay. I just wanted to make sure that we could get a copy. That will be interesting reading. Thanks.

MR. KESSLER: Absolutely.

CHAIRMAN GARRICK: John, I realize that the workshop was primarily with respect to uses outside the U.S. But as you know, of course, the NRC and DOE have both sponsored studies at the Pina Blanca

analog site.

MR. KESSLER: Right.

CHAIRMAN GARRICK: Was there any discussion about the results of those studies and how they are being used in the current PSPA?

MR. KESSLER: Not that I can speak to. Abe van Luik, you might want to talk about that from the DOE perspective. I feared that I was going to get this question. If you want to talk specifically about how well aligned DOE is with these general observations, I am not the guy to ask. That would be Abe.

I can tell you that Abe did present the really fine analog work that they have undertaken, and what we weren't able to see was exactly how that is going to be released, because they are Rev. X and Rev. Y on that. So maybe Abe can talk a bit about that.

MR. VAN LUIK: Abe van Luik, DOE. In fact, we did do a preliminary modeling of the Pina Blanca sites, and what we learned from that is that we really lack information in the third to downward up and down direction.

And so we drilled three bore holes, and we are basically awaiting the chance and the funding to fully analyze those cores. This will be part of the

performance confirmance activities, and basically that will continue past the license application.

But we fully intend to take advantage of all of the opportunities that are offered there. As you know the NRC itself, the staff, has built an alternative waste form degradation model based on the information from Pina Blanca.

CHAIRMAN GARRICK: Right.

MR. VAN LUIK: And we hope to be able to basically do some other things at Pina Blanca, and looking at the signature of uranium and the water going down and out. There is a fresh water well a kilometer away that shows no signature.

So we are looking into those kinds of phenomena to see what we can draw from that that applies to Yucca Mountain.

CHAIRMAN GARRICK: Okay. Thank you very much. Jim.

MR. CLARKE: Just a quick one. John, as you know, there is a lot of interest in using natural analogs for near surface waste management systems as well, a more forward-looking echo system, ecological session and things of this nature. Did your workshop get into that at all?

MR. VAN LUIK: No, we did not talk

specifically about any near surface analogs in this workshop.

CHAIRMAN GARRICK: Any questions from the staff? Well, that's terrific. You have got us almost back on schedule. We do want to protect the schedule this afternoon. We are going to adjourn right after the session on stakeholders interactions.

The committee is working on a couple of letters and they are not far enough advanced that we want to take the time to discuss them at this point. We will defer that to our next meeting. We will be writing a letter on the preclosure safety assessment effort, as well as on the drift degradation issue.

There are a couple of other issues under consideration that we might want to write a letter on. We might even want to write one on the igneous panel activity, even though it has not been asked of us at this point.

And we are always interested in trying to improve the outreach activity of the committee and the staff with respect to the public. And whether or not we want to reflect on the experience of this time around is something that we have yet to discuss.

But it may be something that we want to write about. So let's adjourn for lunch, and we will

be back here at 12:45.

(Whereupon, at 11:35 a.m., a luncheon recess was taken.)

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

(12:45 p.m.)

CHAIRMAN GARRICK: Our meeting will come to order. We have two remaining items on our agenda. The first one has to do with presentations or comments from representatives of affected units of local government; and the second one is stakeholder interactions, and we have received a couple of requests for people to make comments on the stakeholder interaction section.

Others that would like to do so, if they would just contact one of us, we would certainly make that arrangement. I believe as far as the affected units of local government are concerned, we will start with Irene Mavis from Clark County.

MS. MAVIS: Good afternoon. It is my pleasure to address the advisory committee today. I know that this is the third opportunity this year that Clark County has had to address you on various topics, including performance confirmation, quality assurance, and other key technical matters.

Today I am going to talk to you a little bit about some other areas of concern for Clark County, and mostly centered around many of the socio-economic studies that we have developed over the last

15 years.

Just by way of background, Clark County is an area of over 8,000 square miles, and we are less than 100 miles from Yucca Mountain, and we are the fastest growing region in the United States, and have been for most of the last 12 to 15 years.

In 1963, the population of Las Vegas or of Clark County was 50,000 people. As of the 2000 census, our population skyrocked due to all of our growth to over a million-and-a-half people, and here in 2003, we are over 1.6 million people.

We have been growing at a rate of 5,000 per month for the last 10 years, and we have a visitor volume of over 36 million people annually. Any given holiday weekend, you can expect to see 200,000 to 400,000 visitors in the Las Vegas area.

And it is easy to see why in Clark County the economic engine that drives the economy of not only our region, but in fact our entire State, is tourism.

Associated with that are the jobs that come along with the gaming industry, and the construction industry, and that is basically an offshoot of our tourist economy.

Yesterday, I was at a conference where our

Fire Chief of Clark County made a presentation, and he made an observation that there are more hotel rooms at the corner of Tropicana Avenue and Las Vegas Boulevard than in the entire city of San Francisco.

So just at one intersection of our internationally famous Las Vegas Strip, we have more rooms than many other major cities. One of the things that we are concerned about, and that we have incorporated into our socio-economic studies is this whole notion of stigma, and what the notion of a potential accident at Yucca Mountain, or related to transportation to Yucca Mountain, would do to our local economy.

And we have many studies on record and I can certainly provide you with the details of those studies, and the full studies themselves if you are interested as a committee in receiving them.

One of the things that people don't know about Las Vegas is that Clark County is really the government that governs the Las Vegas Strip. The Las Vegas Strip is not really within the City of Las Vegas' purview.

So our economic base, our focus for what drives the economy in our entire State is focused on a very small area within Clark County that needs to be

balanced with our urban and our regional planning needs, and interjurisdictional capabilities, and our infrastructure support.

One of the other things that I wanted to point out to the committee today is that because cities within Southern Nevada are not designated as affected units of local government, nor are the Native American Tribes designated as units of local government under the Nuclear Waste Policy Act.

Clark County has taken a leadership role and formed partnerships with those entities in order to address and cover their impacts, their impact assessment, and their needs as far as public safety preparedness, emergency management capability, and other government service needs.

We also have a number of studies that relate directly to those relationships and cover what, for example, would be the needs of the Moapa Tribe and the Las Vegas Paiute Tribe, and also the City of Las Vegas, North Las Vegas, and Henderson, and Mesquite, and Boulder City.

One other important aspect that I would like to point out to the committee is that there is a lot of conversation about transportation of high level waste should never come through the Las Vegas Valley.

It is a bad idea, and of course then Clark County would not be affected.

One of the reasons that I like to point out that Clark County is 8,000 square miles is that I want to give everyone concerned the idea that Clark County is not just the Las Vegas Strip. It is not just the Las Vegas urban area.

It is not just Interstate 15 coming through downtown. It is in fact a unique mix of urban service provider areas and governance, and we have in fact first responder status for the entire region.

Clark County has mutual aid agreements with every city within Clark County, with other counties surrounding Clark County, and also with other States surrounding us.

So we have mutual aid agreements with California, Utah, and Arizona. Should an accident happen on the Arizona side of Hoover Dam, Clark County is there.

Should a severe accident or incident in San Bernadino County in California, Clark County is there. So I want to leave you with the notion that it is important to separate the transportation responsibility from the first responder responsibility, because regardless of what routes are

chosen to Yucca Mountain, Clark County is involved in a very significant way.

On final note that I want to leave you with, because this is something that hit the media this week and the crash at the Nevada Test and Training Range for Nellis Air Force Base, Nevada -- excuse me. Nellis Air Force Base operations do impact Clark County.

This week's crash occurred less than 20 miles away from the community of Indian Springs, which is in Clark County, and Indian Springs actually is across the highway from Nellis Air Force Base property, where those kinds of tests do occur.

And so we have a vested interest in monitoring the decisions of Nellis Air Force Base as this project moves forward, and so we have very much at stake in monitoring and weighing in on Nellis Air Force Base operations as they relate to Yucca Mountain.

That is really all I had today. I wanted to just point out those key things, because I was not sure if as a committee you had heard those aspects of Clark County's program. And I wanted to open up now my presentation to any questions that you may have, or requests for additional information that I can provide

to your staff.

CHAIRMAN GARRICK: Thank you very much. Ruth, do you have any questions?

DR. WEINER: Yes, I have a couple. Do you have some numbers as to how many shipments of hazardous materials and gasoline, which is not considered a hazardous material for some reason, go though Clark County every year?

MS. MAVIS: I don't have that information with me today, but I can certainly provide them to the committee.

DR. WEINER: I think it would be instructive. I mean, I can appreciate your problem with the emergency planning, but we are talking about accidents with materials where you need a first responder, and all the first responders, as far as I know, have HAZMAT training.

MS. MAVIS: We have a certain amount, and we do have a certain amount of capability, but what we have done is look at the gap between what we have today for what we are dealing with today, and what we would deal with respect to any potential shipments to Yucca Mountain.

We based those studies because we don't have anything like a record of decision that talks

about a preferred mode for now. We know that the final environmental impact statement talked about rail, but the assumptions that we used at the time that we did those studies was that it would be a mostly truck scenario.

So all of the numbers that relate to gaps in preparedness and emergency management, and emergency planning, and what would be needed for personnel and training, and those sorts of things, are based on mostly the truck scenario.

And as the DOE comes forward with more concrete plans related to transportation, those numbers could change and the impact could certainly be less should they come forward with another solid scenario.

But certainly I would be happy to do that research, and our emergency management office for the county does keep track of those. So I can get them fairly easily.

DR. WEINER: It would be also interesting to get numbers on how well prepared you think Clark County is right now to handle emergencies with HAZMAT by rail, and hazardous materials by truck, and gasoline --

MS. MAVIS: I can get you those numbers

with no problem.

DR. WEINER: And my other question is that at the rate with which you are growing where is your water going to come from?

MS. MAVIS: Well, that is an issue certainly of grave concern. We are in a drought condition right now, and we have employed in Clark County and in the various municipalities within Clark County, we have employed drought measures through ordinances and through enforcement and conservation to try and shore up our water resources.

I know that our water district is in negotiation with other communities, other States, to try and reallocate the water that comes out of the Colorado River, which is our main source of water.

And we are also looking at improving our ground water strategies to make that resource stretch as well. So, yes, it is a problem, and our current capacity allows us to grow out to 2035, and beyond that, we could be in some serious trouble with respect to water.

DR. WEINER: And my final question is if people are really so concerned about Yucca Mountain that it provides the stigma, then why are they moving here at such a rate?

MS. MAVIS: I think it is because of the quality of life that is provided today, and a lot of the people that we talk to, no matter how old they are, or what position they have in the county, and even in our development community, they see this as something that is far in the future for their normal time frame.

For a home builder, 2010 or 2015, when shipments are likely to start, seems very far away. For people who are of retirement age, or advanced senior years, and they don't even think they will be existing when the shipments start.

So it is very easy for them to say that it is far enough in the future that I don't have to worry about it today, and because of our strong economy in other parts of the country, and job opportunities, and sometimes people see this as their last best hope for a good quality of life and continue to move here at 5,000 people a month.

CHAIRMAN GARRICK: Thank you.

MS. MAVIS: Thank you very much for your time.

CHAIRMAN GARRICK: Well, wait just a moment. We might have some more questions.

MS. MAVIS: Okay.

CHAIRMAN GARRICK: I did want to ask one or two questions. One was that given the rapid growth of the county what legislative activity has occurred in the last few years, or months, or whatever, that would impact something like the transport of hazardous material through the county?

MS. MAVIS: Are you referring to State legislation within Nevada, or --

CHAIRMAN GARRICK: Well, legislation that would certainly affect Clark County. It could be either local or State.

MS. MAVIS: Well, there are a couple of different levels. One interesting thing that occurred in this last Congressional, and in this current Congressional session is that the House put in some appropriations bill for energy and water, and referred to some very specific transportation decisions.

One of which was to make sure that transportation did not occur through what the bill referred to as the Las Vegas Metropolitan Area. I am not really sure what that area means to somebody in Washington, D.C., but that is a designation that does not really even exist here locally.

There are some other designations of the southern Nevada region, and so I am not really sure

what that would have done for us had that language remained in the bill.

Ultimately the language was removed, and there were some pieces of language in that bill that would have benefitted, for example, Lincoln County, and Nye County, and all of the language related to specifics with respect to transportation were removed.

For the last three years or so language like that has been sort of popping up, and not at the urging of Clark County, but I think on behalf of the Members of the House trying to help the decision making process along and trying to narrow the focus of the transportation.

So I don't know what is going to occur from the Congressional side of things. The Senate doesn't normally put language in that in their appropriations bills, and so we keep a watchful eye on what comes out of the House every year.

This year was the most specific. As far as State Legislation, Clark County actually did a report that looked at State legislation across the country with respect to transport of high level waste and hazardous materials, and I certainly can provide that to the committee as well.

Within Nevada, there was very little,

because of the very pressing subject matter of the state of the economy, and medical malpractice, and some other very hot issues at the State Legislature this past year. Yucca Mountain didn't receive a lot of attention.

In previous years, the last 2 or 3 sessions, there were some attempts at providing some guidance or support to the DOE's effort to focus on a mostly rail scenario to try and designate certain routes and those efforts were not successful in our State legislature.

CHAIRMAN GARRICK: Do you have any direct evidence with either businesses moving into the area or people moving into the area that the Yucca Mountain project has had an impact on their enthusiasm towards moving to Clark County?

MS. MAVIS: Occasionally, we get reports from realtors or people in the development community that people ask about it. They wonder where the routes are going to be, and they wonder how close to a potential route they might be.

As soon as they hear that routes have not yet been selected, they are more at ease about it, and again because it is a decision that seems far off for many people.

We have had occasionally calls to our office about that topic, and also questions from businesses about what is happening, and where is it, and so I don't have a lot of concrete data about that because Clark County has not go so in depth into that question.

But we do have contact regularly with the Nevada Development Authority, for example, and when we talked to them a year and a half or so ago, they reported to us that that was not usually a question or a concern for businesses moving into Southern Nevada.

So that was good news for us, and so far that the latest look that we took at property values and the real estate market, and also the development community. So far the decisions that have been made on Yucca Mountain have not impacted people's decisions to buy property or invest in real estate.

CHAIRMAN GARRICK: Now, when you get a request for information on Yucca Mountain do you attempt to present information packages that have multiple views?

MS. MAVIS: Yes, we do. In fact, one of the things that we have done is that on our website, we list all of the major stakeholder groups related to the Yucca Mountain project, including the NRC, the

Department of Energy, and the other counties, and the State, so that people can get a variety of views.

We also provide information that allows them to assess our reports for themselves. We have fact sheets, and we direct them to the Department of Energy for questions that we don't feel comfortable answering.

And we also work with the Department of Energy 4 or 5 times a year to do a joint tour of Yucca Mountain, and so citizens or folks within the Clark County Government are City Government who are interested in taking the tour, we work together to provide joint information in that venue.

CHAIRMAN GARRICK: Very good. Any other questions from the staff? Anybody? We really appreciate you coming in and giving us this briefing. It was excellent, and we hope to see you again.

MS. MAVIS: Thank you. Absolutely. Anytime you invite me, I will be here. Thanks.

CHAIRMAN GARRICK: Thank you. Thank you very much. We are still in the session in our agenda that is with respect to affected units of local government. I don't have any other names, but I am open to suggestions. We are having a follow-on session on stakeholder interactions, and if we don't

have representatives from other -- okay. We do have one more. Sally, are you going to speak on behalf of an affected government?

MS. DEVLIN: You had better believe it.

CHAIRMAN GARRICK: All right. Go right ahead.

MS. DEVLIN: Thanks, Mr. Chairman, and members of the board. I am Sally Devlin, from Pahrump, Nevada. And I don't see anybody here from our local government, but of course I am very well versed in this.

I don't know if you are aware, but there have been two meetings, and there will be another one on December 3rd, with Lincoln County, Esmerellda, and Nye Counties. They met two weeks ago Sunday at the airport, and there was a prior one.

Now, these meetings again of course are on transportation. And, of course, no one was invited, but they got caught, and that's why I know about the third one going on, because Mike McHaney from Esmerellda County is the secretary of the group.

These were not open to the public. They were open to two of our commissioners, and I believe one commissioner from Lincoln, and I think there are only three in Esmerellda, and I am telling you these

things because this back door stuff is going on all the time.

And when the public finds out about it, we yell and scream. As a result, at our commission meeting on Tuesday, all of the Commissioners go to these meetings and they will be public.

Now, the reason that it is so disturbing is Nye County has just formed a -- you can almost say a CAB group to talk about the test site, and not so much Yucca Mountain.

And you will hear later in the next item on the agenda regarding the stakeholder agreement, that most people don't know the background as so many of us do, and I have been on this to tell people about this for over 10 years, and I grew up in it, and I went back to school for it.

And what bothers me the most again is public information. We are seeing, particularly with transportation, CPP's written by Nye County which are totally unacceptable. And not only did they have one accepted by the Commissioner, they plagiarized it for the next 3 years.

So that nobody seems to be watching what is going on, and nobody seems to be accountable, particularly in Nye County, and you know that we have

many major problems there.

But one of the things that I think is the most important thing is the announcement of the meetings. Nobody knew and nobody knew in Nye County, except that I got an invitation from Washington and informed the world about last week's meetings. Nobody got that invitation.

I did of course get this one, and of course the 23rd and the 30th. And what is important to me again is how is this presented to the public for information as to when the meetings are so that we can plan our lives.

I had a meeting yesterday, and so of course I could not be here yesterday. But I am just saying that we want this information. None of this should be hidden, and it has been hidden. Lester Bradshaw is supposed to notify the commissioners, and of course he doesn't. He didn't know about last week's meeting.

So something is wrong communication wise. Now, let's get into the money business, and that is the funding on particularly transportation, and I am addressing this to you, Ruth, and that is that we have had 87,000 (sic) transportation plans proposed.

The most recent one occurred at the CAB

meeting, which was held in Pahrump, regarding the WHIP shipments. Now that is high level waste and I know that it has nothing to do with Yucca Mountain, but because the Governor of California said no, this shipment will go an extra 400 miles from the test site through Tonopah, and so on, and through Wyoming, and then to Carlsbad.

Now, on the high level waste shipments, we have no idea how, what, or why. And I have reminded this board for 10 years that Highway 99, our only intrastate highway in all of Nevada, is a nine hazard. There is none higher.

And 160 is a 7, and so that we are talking about what is really going on. I just did a report for INDA, and it went to NEPA, regarding the widening of Rainbow. They want to make it eight lanes to I-15, and still remaining two lanes to Pahrump.

That is not only an unbalanced highway, but if anything ever happened to 95, they would have to use 160. We have no emergency preparedness, and we have very few firemen, and we have enormous distances, and I always give statistics.

The test site is 1,370 square miles. Nye County is 18,300 square miles. So you can compare sizes. They are enormous. I don't care how you cut

it and what you cut it with, and so on.

And, of course, there is no rail transportation, and the reason that I got into this, and John can remember, is that I said over my dead body will you put a railroad through Pahrump when that was the only one proposed.

And that was from Jean, down Sandy Valley, down through the Longschmitt line, through Ash Meadows, and then up to Amargosa. So now that is eliminated, and the other one now crosses 160 and goes up on the flood plane Flat Fan, and over the mountains.

So not only were we not considered on these plans -- the Carlin Plan, the other plans, and so on, and even though I have seen topographic maps that cost a quarter-of-a-million dollars on all these plans, there is nothing discussed -- and I do mean nothing -- regarding the funding, regarding emergency preparedness, regarding communications, and particularly telecommunications.

In our last legislature, I proposed through Senator Rajeo a broadband bill and that was $300 or $400 million that PUC could have gotten for this. Well, you know that our legislature was a mess with taxation, and so nothing went through.

We are going to continue to propose that, home security and what have you, and these are the things that are important to the public, and we have nothing. We have nothing here in Nevada.

Now, I respect Las Vegas, and Mayor Goodman's attitude, because of the 2 million people in Las Vegas, and they have enormous problems to surmount over the years, everything from transportation, water, you name it, but we also have the same thing in Nye County, and Nye County unfortunately, which contains this entire mess, is not even considered.

In your press releases, it is always 90 kilometers from Las Vegas, 60 miles, or whatever. Never in Nye County, and I do thoroughly want to protest this, because you are not only insulting us 40,000 in Pahrump, but the entire 18,300 square miles of Nye County.

So you are getting a picture of pubic relations, and that is one of the things that I am here for today, is to say that I really feel that you are extremely remiss in not including Nye County, Esmerellda County, Lincoln County, and of course major friends in Clark County, because no secret meetings should be held, and we should all get together.

And one of the reasons that they are not

getting together is because there is very little communication. Our county seat is 200 miles from us in Tonopah, and we do not have teleconferences, because we don't have the intracommunications.

So you see that one of the major problems that I just mentioned is that on any transportation scheme, whether -- and I have talked extensively with the railroad engineers, and if you were at the last NWTRB meeting, I proposed to the new head of transportation, and I married the two railroad engineers, who told me that it would cost $4 million a mile to put a railroad in.

We are talking kingsized numbers any way you look at it. So we have all these things to look at, and I love to communicate with you because you always, and especially John, as he is my pal, and he always gets stuff back to me, and we do need this intracommunication.

We do need to know what is going on, and of course everybody wants top dollars, and at this point nobody knows any program. You just heard the Nye County presentation on the wells. Somewhere in this mountain, and John knows that I have studied volcanology and that will be my next thing, and that is that those wells at Lathrop wells go up to 360

degrees C.

So isn't there a volcanic lake or something underneath there? You know, you don't hear these things. We do because this goes back to 2000 when Nick Stelazeler (phonetic) was alive, and drilled them originally.

So there is a lot of background stuff that we have. All of my information, I would have a room this big full of stuff. It goes to UNLV, and I have the 20, soon to be the 40 foot shelves, with the history of Yucca Mountain in it since the day really that it started in the early '90s, with John Countland, right?

CHAIRMAN GARRICK: Yes.

MS. DEVLIN: So we go back a long way. But I am just saying that it has got to be public information. No secret meetings between counties, and certainly communication cooperation with anything that we can do with Clark County.

Pahrump is 40,000 today, and we are going to plan, and we have it in the works, for 120,000 people. Now, in comparison to any super fund site, we don't exist. But in our minds, we are terribly important. And that is about it. Do you have any questions regarding transportation, or highways, or

anything like that? As you well know, we have no rail lines.

CHAIRMAN GARRICK: I don't know. Do you have any questions?

DR. WEINER: How do you handle accidents with gasoline trucks and hazardous materials now? Do you have any kind of first responder system?

MS. DEVLIN: We do have a small first responder system. We have something like -- as you know, Nevada works in a different manner than most States. The only agency on call 24 hours a day in the entire State of Nevada is the Highway Patrol.

So any accident that happens, be it hazardous or radioactive, or jus plain chemical spills, the local sheriff or whoever, we are closest, and we are the first responders to the test site, and I include Yucca Mountain on that.

And as a result the local sheriffs must go out and go to the accident, and wait for the Highway Patrol to come. Then the Highway Patrol does whatever the Highway Patrol does, and then they submit a report, which goes to the Department of Motor Vehicles.

And somewhere in one department of the Department of Motor Vehicles, the Highway Patrolman's

report is looked at, and the Motor Vehicles' person decides the claim. So it is ridiculous, antiquated, and very slow, and not nice.

We have had some serious accidents, particularly with hydrochloric acid and so on, where our highway has been closed. We were up at a labs thing in Carson City in '99, and 95 was closed for 18 hours because of a diesel gas spill.

That is 18 hours, and I don't know where you all are from, but I think you are far more civilized than we are. So this is a major problem. And did that answer your question?

DR. WEINER: Yes, thank you.

MS. DEVLIN: We have none. Thank you. Any others?

CHAIRMAN GARRICK: We always appreciate hearing from you, Sally. Thank you. Please introduce yourself and your affiliation.

MR. ELZEFTAWY: My name is Atef Elzeftawy, and I am an independent worker, but I am here to say a couple of words for myself, and a couple of words for the Las Vegas Paiute Tribe, and maybe some other tribes in the southern part of Nevada.

First of all, I think I would like to thank you for you guys holding the meeting here in Las

Vegas, and I think it would be nice to have a little bit more visibility for it. I just learned about it the night before last night.

So there is a communication problem I think, but my personal comment is really to the Board with regard to the technical issues for the last year and a half or so. I thought I could dig a little bit deeper into the program.

And since I am a hydrogeologist, to be honest with you, my personal views with regard to the unsaturated/saturated zone, hydrogeology, and with regard to the information that the Department of Energy has generated so far for the last 20 years, I think I agree with some of the NRC staff that we don't have enough information yet to tell us or to give us a good understanding on how the unsaturated zone hydrology or the saturated zone hydrology, in addition to the transportation, that it would really give us a handle on what is going to happen for this 10,000 years of ground water flow business.

And including using the modelers and all of that, and so to me I think with this issue, I think the jury is still out. The point that I really wanted to make on behalf of the tribe is, number one, I think that the board and especially the chairman needs to

understand that the Native American tribes are -- call it a semi-sovereign nation.

There are nations in trust funds, or they are in trust with regard to the Congress, and as such they need to be invited, and they need to have the position of a government-to-government relationship.

The way that they have been treated for the last 10 years probably, especially with the Department of Energy, that we don't see any communication.

And I think, Ruth, yesterday said something with regard to communication with the public. The Department of Energy basically has not treated the tribes, especially here in the west, with regard to being equal partners, and to either provide them with the means to understand what the project is all about, or to listen to their concerns.

I thank the Commissioners, Merrifield especially, and the previous Chairman, for coming here to Las Vegas and meeting with us, and as a result of that 2 years ago, a consultation, the NRC people held a meeting with about 15 tribes about 2 or 3 weeks ago, and they listened to their views and so on, and I think that might be helpful for you to see the transcript of that meeting or to hold a meeting by

yourself.

And it would be closed to the Native American Tribes in this area to solicit their views with regard to this program. As a result of that meeting, I think most of them are concerned about the transportation issues, especially with regard to the period after 9/11.

And every one of them was surprised, me included, with regard to who takes control of the transportation of these materials as it leaves the nuclear power plant and comes here to Yucca Mountain.

And I was surprised by hearing one of the NRC lawyers that only the Department of Energy will be in charge of that. The NRC will make sure that the package, or the waste packages, is well packaged and so on.

But the trust and the regulation goes back to the Department of Energy, and that raises a lot of concern with regard to the tribe's point of view. So I thank you for listening to me, and again I invite you, and I understand that the Chairman lives or has a house in St. George close by here, and so maybe that will be a good chance for you to stop by here every once in a while and have a closed meeting with some tribal chairman or some chairwomen, or whatever, to

listen to their point of view, because I think this issue is heating up with them with regard to the Yucca Mountain, especially with regard to transportation. Thanks all I want to say. Thank you very much.

CHAIRMAN GARRICK: Thank you very much. We do have a question or two.

MR. BAHADUR: In you opening remark where you were thanking the committee to hold the meeting here, you mentioned that you wished that there were more visibility and that there were some communication problems.

I was just wondering if there was a specific communication problem that you encountered when we were noticing this meeting in Las Vegas, and if there were some specific suggestions you would want to make to improve those?

MR. ELZEFTAWY: Well, working with some tribal members and some tribes in Arizona and Nevada, and California, you have got to understand that there is a different culture and a different system there.

If you send a letter to them saying tribal leader, that letter probably just went to beyond the sun, beyond the solar system. You are lucky if you are going to get it back.

So if you send a letter to some of the

tribes' people, you need to be very, very specific, number one, to who the letter is going to go to. Say the tribal chairman and list his or her name.

In addition to that, I think you need to send another letter, with the same content, but another letter to the tribe people, either environmental program manager, or even the council member, or whoever is in the tribe.

So you get sort of two letters and one of them will arrive to the tribe. Some tribal people are -- yes, they have a Post Office, and they have an address, and sometimes mail takes a long time to arrive.

So that is really my basic point. The second point is that as to the contact, as tribal people, I have seen it during the last 10 years that they refrain from dealing with me and you. They need to deal with either the administrator of that agency, the EPA, or the Secretary of Energy, or the Chairman of the NRC.

They basically do not relate to the people like me and you down there. If you send a letter and you sign it, that letter has probably gone someplace else.

The government to government relationship

issue is very, very difficult, and if you need a hint for that, you need to look at the example of Region 9 U.S. EPA on how they handle the government to government consultation between the U.S. Government and the tribe, and I think that would give you a hint on that. So that is all that I can say.

CHAIRMAN GARRICK: Thank you. I think we have another question. Ruth.

DR. WEINER: Sher actually asked it.

CHAIRMAN GARRICK: Any other questions? I guess that's all. Thank you very much. We always enjoy hearing from you.

MR. ELZEFTAWY: Thanks.

CHAIRMAN GARRICK: Now unless we have any other representatives that wish to speak on behalf of local government, I think we will move directly into the stakeholder interaction session.

And I have two names that have been brought to my attention of people who would like to make comments, and of course others are welcome, and they are Judy Treichel, and Don Shettel. So, Judy, since I got your name first.

MS. TREICHEL: Judy Treichel, Nevada Nuclear Waste Task Force. Yesterday, I mentioned briefly about the performance confirmation program

that we had hoped to see, and a lot of the presentations that you had earlier in the day about the volcanism work, and some of the county work going on in Inyo and Nye County, I don't believe fall into or should fall into a confirmation basket as I mentioned before.

And up until this meeting when we saw that bar graph that was shown yesterday about KTIs remaining to be done, two of those that come in quite a while after the license application date was to be on volcanism.

That was not mentioned yesterday. They mentioned work on C-22, but I don't know if that has changed or if it is still out there, and it just did not get mentioned, but I think you should check into that.

And I really think that you should clearly set yourself some guidelines as to what you believe confirmatory work is and what you believe new work or work that should be fed into a TSPA that would accompany a license application would be.

I also take exception to the term that was used yesterday when it was talked about a dose being frequency weighted. There are doses given that are modified by either frequency or probability, and I

know that you and I have gone around and around on this, John, because this falls into the risk-informed stuff.

But I think that if you want to be transparent with the public that you need to say what a dose is. If you have a volcanic event that hits a repository, it would result in a dose of.

And then you can follow up by saying this is very unlikely to happen, for that reason, for the work that we do, we consider it as a risk and we modify it by its probability or by its frequency, or whatever.

But I just think it is misleading when you use a term that is weighted or modified by either frequency or probability. I also think that once again it is important to mention how the design is still evolving and changing, and in very big ways.

And you still see things like when Mark Board was standing up and talking about the new lining that they have to go into the tunnels, and at the same time today there was still talk about backfill when it comes to something else.

And these are huge changes. There was a discussion about retrievability yesterday, and Ruth had mentioned that this could be rather complicated.

We have said that all along, and we would probably demand or try to demand that there be some sort of demonstration of the ability to retrieve.

And I have never heard that suggested that they would to that. It is usually just very quickly in one sentence determined to be the opposite of emplacement, which it is not, or the reverse.

As far as the various metals that are going together, that is still changing. Each meeting we find that there are different kinds of metals that will be in contact with each other, and Ruth also yesterday mentioned that she thought that there should be tests done on the whole system, and that's true.

When you have various metals and you suggest that there is heat involved in those things, there should be tests rather than on each specific little thing on a systematic basis, because as DOE talks about unknown unknowns, those perhaps could be somehow -- either the numbers of those reduced or something.

There has been a lot of talk about economic impacts, and I know that there were questions asked of Irene, and there has been the perception or the stigma mentioned, and in Nye County at the dairy works, it is unfortunate that Ed Goodhart was not

there, but he has already run into this, and it has gone past a perception and a stigma.

In that he went into the bank because they would like to do a force dairy or a larger operation out there. He has dealt with the banker out there for years and years, and they have a very good relationship, and he has got excellent credit.

And for the first time the banker told him that the kind of loan that they had gotten before would not be available now. He would have to be completely paid off by the year 2010, and it was directly tied to Yucca Mountain.

So I think that is something that is no longer in just the possible realm of possibility, and that it is a reality. You should also note that many of the Native American representatives that would usually be here are not here today because there is a large meeting of NCAI in Alberquerque, New Mexico, right now.

So many of the tribes are there, and I know that there is an attempt by the Western Shoshone and perhaps some of the Paiutes, as I am not sure, to come up with an anti-Yucca Mountain resolution at that meeting.

The question always comes up about other

hazardous materials that are on the road, or possibly gasoline, and I don't think it should ever been considered to be one or the other that you deal with.

What we look at here, and what mostly comes up, is that if you introduce high nuclear waste that you could very well have a combination of the two. So if you have a gasoline truck out there and you have an incident that involves that with a waste truck, then you have the means to distribute radionuclides, and if you have a breach of a canister, you would have smoke and fire that could carry that along.

As far as the legislation that is in place, as you certainly know the State has laws opposing the storage of waste in the State, and the City of Las Vegas has an ordinance making it a criminal offense to drive nuclear waste in through and to the city limits, and many of the things having to do with emergency response and other things that would have to be dealt with as a result of this, because DOE does not take stigma or perception at all seriously, many of us both as citizens and as local units of government, believe that there is an unfunded mandate here.

And that they are expected to protect

themselves and take whatever measures have to be taken out of their own funding in order to do this. And to finish up, you talk very often about public interactions.

We right now are having essentially a ground war with the NRC because there are secret meetings going on between the NRC and the Department of Energy right now.

There is a meeting this week and there are two more planned, in which they allow no observers. That has never happened before, and I don't believe it should happen now, and I think that before the NRC does any more talk about wanting to involve the public and wanting to have an open and transparent program, you should make an advisory letter to the Commission advising against this sort of thing.

There is absolutely no basis for the NRC and the Department of Energy to be meeting secretly and to not allow observers. That's it. Thank you.

CHAIRMAN GARRICK: Thank you very much. Ruth, do you have any comments?

DR. WEINER: No.

CHAIRMAN GARRICK: Mike.

VICE CHAIRMAN RYAN: Judy, would you explain this. You mentioned that there were secret

meetings and there was one this week. Could you be a little more specific on what it is, or where it is, or what the schedule for it is so that we could get focus on that a little?

MS. TREICHEL: There is a meeting all during this week which is talking about at the DOE, and maybe we have a better answer on that.

CHAIRMAN GARRICK: Mike Lee.

MR. LEE: Mike Lee, ACNW staff. The NRC has decided to conduct an independent QA review or an assessment of selected analysis model reports that the DOE has put together, and it is my understanding that following a judgment from the NRC's Office of the General Counsel that a decision was made that the independent QA assessment or audit, or however it has been characterized by the NRC Staff, would not be subject to public observation.

However, it is my understanding that the NRC intended to conduct a public interest meeting prior to the conduct of the QA evaluation. It is also my understanding that after the QA evaluation is conducted that there will be a public exit meeting that the NRC will conduct with the DOE.

MS. TREICHEL: The first notice that came out did have a first hour that was supposed to be open

to the public, and they have since changed that and that is not allowed.

They now say, yes, it is about QA and it is also about quality and effectiveness of AMRs, and they say that they would be doing a report of the meeting at some future date, probably in the spring.

But one of the very nasty parts about this whole thing is that they are considering whether or not they should revise the policy for having a meeting like this.

And that consideration, and any revision or new policy to allow what is actually going on now would never be decided upon until these meetings are all over. So that is really quite ridiculous.

MR. LEE: Right. Well, I can't speak for the advisory committee nor the NRC staff. However, the on-site rep may have more information about the evolution of that policy if you will. I can't speak to it.

MS. TREICHEL: Well, if you want any public trust and confidence, do not treat the DOE as though they are already a licensee. That is a really bad thing to do for an already skeptic public.

VICE CHAIRMAN RYAN: Judy, I appreciate the detail, and that has helped me to understand

specifically what we are talking about, and I wanted to learn about that. Thanks.

MS. TREICHEL: Okay.

CHAIRMAN GARRICK: Ruth.

DR. WEINER: This is a little bit off the topic of your talk, but it is something that we have been discussing, Judy. I have attended a number of meetings in Las Vegas, and during the day, and day into evening, and evening meetings, one of the problems that we face is that we never get very many members of the public.

And I was wondering if you as a member of the public could give us any suggestions as to how to get more public, more people, involved in these meetings. I would very much to have liked to have seen this room full of people, and I do understand having done this myself for a number of years, I do understand that it is difficult for people to get away during the working day.

But we have had the same experience in the evening that we have evening meetings, and all kinds of different venues, and they are poorly attended also. So do you have any suggestions as to what we can do to get better public attendance at these meetings?

MR. LEE: Before Judy answers, I would just like to note that in preparation for this meeting that we gained access to the high level waste standard distribution list, which includes 103 organizations and entities, including Native American organizations, and issued or prepared a form letter if you will inviting and making them aware of the meeting, and inviting them to participate.

In addition to that, we took out an ad in the local paper, I think the Las Vegas Journal, last week for 2 days. In addition to that, we also post our agenda on the NRC website. We have received some recommendations on how to make the Nevada meetings more transparent in that regard, but I will let you answer now.

DR. WEINER: Thank you, Mike.

MS. TREICHEL: I would guess overall that one of the jobs that the task force that I am with does and that is unusual or different from other grass roots organizations as we are a liaison group.

I am in these meetings, and I am in the technical exchange meetings, and I am in all of the bureaucratic meetings that go on. I am then in a position to come back either to write a report or to answer questions for people who are not here.

Everybody sitting in this audience most likely, and certainly you up there, are paid for their time to be here or certainly paid expenses, or per diem, or whatever.

And I don't think you can expect the public to do that, and we are coming into our 17th year of this. So it is a very difficult thing to expect people to come to these meetings.

I don't expect for these meetings to be well attended, but there is absolutely nothing that you can tell the public that they can do to make a difference. As you know, Nevada is about at any given time between 75 to 80 percent opposed to Yucca Mountain.

There is absolutely nothing that they can tell you or that they can tell the Department of Energy that changes anything, and that gets their point across.

And for years they have been in a position where if they want to say yes, yeah, we like this idea, they are welcomed in. There is no ability to say no. So I would suppose that the public is probably keeping their powder dry and waiting to see what happens and when there is a possibility for taking this thing on.

And there certainly is not during licensing, and that's a very closed process, and it is a very difficult one. So most of them are looking at the lawsuits.

But until there is a way that it means something to come to a meeting and that you can actually get your opinion respected and have people understand that if you live here and you don't want to take this risk, and you have not bought on to this, and you do not approve, that you can get it to go away, then why would you come?

CHAIRMAN GARRICK: Thank you. Thank you very much. Don Shettel.

MR. SHETTEL: I am Don Shettel, a consultant to the State of Nevada, Agency for Nuclear Projects, and I have one comment and an observation. And I apologize, but I am going to take you back to the technical aspects of this meeting, as opposed to the previous speakers.

My first comment regards natural analogs, especially archeological ones, and perhaps this applies mostly to metallic artifacts, but the one reason that artifacts are found in the first place is the environment that they are in.

And specifically I am referring to a very

low temperature environment, and usually very close to the freezing point of water. And the other aspect of this environment is that it is relatively dry, especially if you are looking at the floors of caves, or rock shelters, where a lot of things are found.

But when you get to Yucca Mountain, we have really a totally opposite situation. That is, we have a fairly aggressive environment. We have a high temperature, and it is going to be above boiling for a relatively low period of time.

And it is going to be as wet, and as moist, and as humid as is allowed by time and temperature. So that implies that if you are going to try and compare natural analogs with Yucca Mountain, you are not comparing apples and apples, but you are comparing apples and oranges.

You don't have the same environments to compare, especially archeological artifacts, with to Yucca Mountain. My second comment, which is more of an observation, is that you may know that there has been a debate going on in recent years between the State of Nevada and DOE regarding the corrosion of the canisters.

And this also involves the center in San Antonio and lately or most recently the Nuclear Waste

Technical Review Board has stepped into this, and upped the ante in this dispute.

And I think on the basis of or until this dispute is resolved, I find it rather amazing that the DOE is putting so much time and resources into the design of a repository. That's all I want to say. I will take any questions if there are any.

CHAIRMAN GARRICK: Thank you. Mike, do you have any questions?

VICE CHAIRMAN RYAN: No, thank you.

CHAIRMAN GARRICK: Ruth.

DR. WEINER: No.

CHAIRMAN GARRICK: Staff? We appreciate your comments. I don't think there is any questions at this time.

MR. SHETTEL: I think that Steve Frishman wants to make a few comments after me.

CHAIRMAN GARRICK: Okay. Very good.

MR. FRISHMAN: I am Steve Frishman with the State of Nevada. Yesterday, you heard a couple of pieces of information having to do with the thermal load that I think were important, because you can go through a thought process with them that takes you to a couple of areas where there is going to have to be an awful lot more thinking.

But I think if I point these out and sort of point the direction of the thinking, you may find them important enough to start pondering yourself. And first what we were told by Mark at Yucca Mountain and again yesterday is that the thermal line load is 1.45, or designed to be 1.45 kilowatts per meter.

And we also were told yesterday that the heat output limit of a waste container is 11.8 kilowatts per package. Well, if you do some very simple arithmetic, you found out that at 1.45 kilowatts per meter that the waste package would have to be 8 meters long if that were the only thing that was the heat in the line heat.

Well, we know that they are not. We know that they are only about 5 meters. So something else is going on to bring you to the 1.45 kilowatts per meter. If you take the 11.8 limit and divide it by 5 meters, the size of the waste package, then you are looking at 2.36 kilowatts per meter.

So there is something else happening, and the other thing that is happening -- and it is not just the spacing between the containers, because we heard that the spacing between the containers was only a tenth of a meter. Something else is going on.

And what else is going on is the defense

high level waste. But the defense high level waste packages are designed to also put out some heat, because remember that they are mixed. They are borocylicate mixed with a center portion for defense spent fuel. So they also have a heat output.

What this leads you to is very roughly around 40 to 45, or maybe more percent of the containers in each one of these 600 meter drifts is going to have to be something less than a spent fuel container that is putting out the maximum limit of heat.

This raises two different questions that I think are important to think about, and sort of two different things that have been talked about in the last couple of days.

One is just a design logistics question. When the repository is set to be open, the Department has very little, if any, control over what the waste containers are going to be.

And they have lost even more control by saying that they now think that almost all of the fuel will be canisterized when it arrives. So they have completely most control over the heat output of the containers that will be arriving early, and then all the way through the process.

The other question is that we have yet to see any real information that tells us about the time and rate of production and availability of defense waste packages.

But it looks like in order to meet that 1.45 kilowatts per meter, there is going to have to be a lot of that stuff sitting around. So from the design and logistics standpoint, it looks as if there is going to have to be a very large inventory on-hand at the time of the opening of the repository in order to meet this really very low thermal goal.

I don't see any planning going on, and maybe there is somewhere, but I don't see any planning going on that actually says that there is a way logistically to meet that in the loading of even the first four years of drifts, when not a lot is planned to be in place and adding up to 3,000 metric tons a year.

And we also for the first time yesterday saw now a 20,000 ton aging facility or actually 19,000, plus 1,000 sitting at the surface facility. So there is some type of a problem here about the thermal design, where all of the pieces are probably not going to come together.

And that sort of raises the other side of

the question, and the other side of the question becomes a performance assessment question, and actually not a performance assessment question, but a performance question.

And there are a couple of parts of that. No matter how you design the line heat output for each of these drifts, it is going to be spotty. You certainly are not going to be in a position where you can have a spent fuel canister and you can have a defense waste canister, a spent fuel canister. It just is not going to happen that way, because they are not going to be available that way to start with.

So the line load is not going to be anything near homogeneous in a 600 meter drift. So you are going to end up with hot and cold spots, and hot and cold spots related to as little as maybe 1 or 2 canisters, and maybe as many as 10 or 15.

So if we have learned anything from the heated drift test, the main thing that we have learned is that the model is only as good as the homogenate of the rock mass, because the very answer that we see between the model and data has almost everything to do with inhomogeneity in the rock mass that was not accounted for.

Now, we also are going to add another

factor here that the model -- that the data coming out of the drift test suggests also, and that is that you have to understand your heat source, and the model is sort of a reflector of the heat source.

In this case, the model is not only going to be not only representative of inhomogeneity in rock, but it is also going to be not reflective of the probably pretty large variation in spots of heat sources along the line.

So if the purpose of the drift scale test was to validate the model, which has become the latest stated purpose of it, well, sure, the model works fine. It is just that the variables get in the way of the model.

And the variables we know are going to be there, and there is going to be variation in the rock three-dimensionally, and now we also know that there is going to be significant variance in heat output if you start doing sort of a point count through the drift.

Now, what is the significance of this? One, the first question that comes up is what happens to various elements of the design if you have places that are much higher than the 1.45 kilowatts per meter in the same drift, and places that are maybe even

quite a bit lower than that.

What does this do, especially if you are in the lower lid, where Mark has told us, and I believe correctly, that porosity is sort of the biggest influence on mechanical properties of the rock. And now you are going to add to that rock that has variation in porosity, ranging from about 5 percent to -- he said most of it is below 20 percent.

And so you know that the mechanical properties of the rock are changing because of that. Now what happens when you introduce an unknown heat variation throughout the drift, which is also going to have variations in porosity.

So that raises a question for the designers on how they are going to be able to deal with this other than just sort of a standard overkill approach, which I don't think they are in a mood to do, because it is going to cost.

And it also raises another very serious question having to do with the sort of dispute that is going on that Don mentioned about the near field chemistry, because what we have seen sort of suggestions of from people who have looked at the corrosion work that we are doing, and some of the approaches that we are taking to the range of what the

near field chemistries can be, that at least some of the response that is coming back is that there is going to be a range of chemistries having to do with a range of temperatures.

And trying to look at probablistically in terms of how likely is it that you will have these very harsh conditions, or these conditions, or these conditions,

Now what the variation in thermal load is going to guarantee is that you have at any given time not only do you have thermal load as a transient, but at any given time you have it as an inhomogenium in the system. So a wide range of these possible chemistries that are dependent and responsive to temperature is going to exist in any one drift at any time.

And this becomes a very serious performance question, because it says that performance is essentially unpredictable because all of us in a dispute over the near field chemistry, and its effect in the corrosion process, all of us are going to be right.

So we are going to have a range of possibility for corrosion way down at the very optimistic low level that the Department is looking

at, and all the way up to some of the extreme corrosion that we have been able to produce in the laboratory based on conditions that are not impossible under the temperature and chemical conditions that are there.

So just a couple of little pieces of data that came out yesterday can lead all the way to this sort of string of thought that take you back to design and logistics questions, where what if it doesn't work the way the designers have been told it is going to work.

And in performance, it is going to give us essentially a wide and unknown at any point in time or space effect on chemistry, that then affects the corrosion of the containers. So I wanted to sort of walk you through that, because this is the kind of thinking that we are having to do all the time now.

And I don't see other people doing it when the Department is giving its shows, and people sort of looking at one presentation at a time, and maybe asking one question on one page at a time.

I don't see this type of thinking going on among some of the groups that are trying to look pretty hard at this program, and I guess doing what Mark did when the question was asked, well, why are

you in the lower lid.

The real answer to that question is we have got to work with what we have and make the best of it, even though it is not the best place to be in terms of the lower lid versus the middle non-lid.

You know, just because of its physical characteristics, the low lid is not the best place to be in that pile of rock. but Mark's answer didn't go all the way to what I am saying, and that is what we have to do the best with what we have.

So I am just encouraging the same kind of thinking that I just walked you through in about maybe 10 minutes, to go on a continuing level, because we are getting to the point where these types of questions are going to become the unanswerable questions in a licensing proceeding.

And it is going to be very difficult to get beyond a licensing board having to try to decide who is their favorite expert, rather than who is closer to right, and I don't think we can afford to be in that situation.

So now is maybe even too late for these types of questions to be coming up. I am sure that you don't have any questions.

CHAIRMAN GARRICK: Well, we may. I think

that it has been very clear to this committee that for some time that we have been very interested in ultimately how the thermal management process is going to work.

And you are correct that yesterday was one of the more revealing presentations in that regard, and you will recall that we picked up on the issue of the dry handling, and the implications and the basis for moving in the direction of a surface facility handling system that was based on dry fuel.

But I don't think that we have heard enough information or seen enough to draw any conclusions at all about the overall thermal management.

But this is an issue that I think has to be addressed and has to be clarified, because we know that very few waste packages can impact the dose in the compliance period, and even the models that are in place now, very few flawed waste packages result in a visible dose. And not a dose that is a problem, and not a dose that is necessarily a threat to the standard.

MR. FRISHMAN: But it is not insignificant. If you look at the performance assessment that shows 1 or 2 juvenile failures, but

the effect is linear. Go up to about a hundred, or maybe 300 or 400 out of a possible 11-to-17,000, you are starting to see does that are approaching the standard.

CHAIRMAN GARRICK: Yes, and we have indicated on several occasions the importance of getting a much better handle on the juvenile failure issue. Do you have any comment, Mike?

VICE CHAIRMAN RYAN: I appreciate your thought processes, Steve, and it was interesting to hear you develop it, and I appreciate it. We have different formats for our meetings as you well know.

And I think the criticism that we hear in little bits and in short presentations, and have a few questions, is the reason that we kind of went to work in working group sessions, where we can dive into more detail on specific issues and have a panel discussion, and have more of the interchange and dialogue that you mentioned.

I know that you participated in a couple of those, and I get a lot more when there is that kind of dialogue, and so I appreciate you sharing your thoughts today. Perhaps this will evolve into a working group session of some sort. Who knows. But I just wanted to make note that we have made an

attempt to have more in-depth discussions and have all different points of view brought forth with that exact limitation of short presentations in mind.

MR. FRISHMAN: Well, perhaps it would be helpful to maybe not have as many presentations, but be able to let it be known that you are going to engage the presenters in thinking like this, and that you want to hear some real answers rather than, oh, we are running out of time.

VICE CHAIRMAN RYAN: I appreciate the comment.

CHAIRMAN GARRICK: Now, we do have a rule that we try to implement, but we have not been as successful as we would like, which is basically the 50 percent rule.

You will notice that our instructions to people who made presentations to allow half the time for questions, even in our sessions, and sometimes we are successful at that, and most of the time we are not, because of the eagerness to give us information. But the thermal management question is very much an open question, and --

MR. FRISHMAN: Well, it is not open. They decided what they are going to do.

CHAIRMAN GARRICK: Well, maybe from that

perspective, but from the standpoint of understanding the issue, and being in a position to advise the Commission, it is clearly an open question to us.

MR. FRISHMAN: Well, just to sort of wrap up, perhaps it would be useful if maybe your staff started going what the Commission staff is doing, and that is asking for the handouts sufficiently early so that you have a chance to go through them before you get the presentations, and not just in a cursory way, but you have a chance to really look at them, and that may lead to developing sort of these questions that reflect a sort of continuum line of thinking. That might be very useful for you.

CHAIRMAN GARRICK: Yes. Well, we have tried a number of things, and we have some criticisms of that approach, too, because it seems to make the presentations very often so pro forma that the opportunity for exchange and interaction doesn't or isn't as stimulating or as stimulated as you would like. But we are open to suggestions on how to achieve that.

MR. FRISHMAN: Well, it is up to you to make it as stimulating as you want it to be.

CHAIRMAN GARRICK: Right. Any other questions? Well, thank you very much. It is always

a pleasure to get your input. Anybody else wish to make a comment? Yes.

MS. DEVLIN: Again, thank you, and again welcome. I will be very brief for me, and that is the first thing that I want to invite you to our Indian Pow-Wow, which is tomorrow, Saturday, and Sunday, in Pahrump all day long, starting at 9:00 until the evening.

And we have a wonderful time with many, many tribes; lots of dancing and lots of kids, and it is a very exciting time, and so I hope you will come down.

CHAIRMAN GARRICK: Talk about short notice.

(Laughter.)

MS. DEVLIN: You didn't call me, John, and the other thing as you well know, I am a complete neophyte, and I feel very much that many of these things, even though I have studied them, I don't know what you are talking about.

And when Ruth said about the public, I do understand most of it. I understood what Steve said, I have been around so long. But you get someone from the public that walks into a meeting like this, and they will not understand one word particularly of the

vocabulary.

I used to talk about hypothecating and fungibility, and all kinds of things, and nobody knew what I was talking about, and I found out that doesn't work. You keep the language as simple as you can.

Well, at this late stage of the game, you can't. So I think it is a waste of time to try and get the public here on this, unless they are technically involved or something, and you don't get the public because they won't understand a work that you are saying.

The other thing that I did want to mention was that the Indians up at Duckwater and Railroad Valley, that's where there is a ton of oil, and there are about 132 Indians up there, and the State of Nevada has stolen all our oil royalties from Nye County, about $170 million worth.

So these are very political things that go on here in Nye County, but there is the question that I am bringing up is that they are going to be drilling for oil again and that oil might run right into Yucca Mountain. I want you aware of that.

The other thing is having attended the other NRC meetings and all that, and the question that I was asked, and I brought with me, and I wrote it

down, so I am not going to take your time, is all of these reports that you do, and that you bundle, I introduced the colloids, and the bugs, and microbial invasion in '95 to the Board.

And I see that there are five reports on colloids, and there are bundled, and I have the ENFs or whatever it is in the waste package and so on. Now, I want to see those reports, and the other number that I want to see, that is number 8, and I want to see number 13, which is the volcanic events.

And I don't know how you get the 1, 2, 3, and 7 of the volcanic events, which is number 13, and I have looked through everything that I own, and there is no address, and there is no name, and there is no phone number. There is no nothing to get this information.

So I am throwing it at you because maybe you can direct somebody to me that can get these to me, and we do have a problem with the internet in Pahrump. I have to use the community colleges when I can when the kids aren't using it, and it is a little hardship.

So I like hard copies, and that's what I am going to talk to you about last, but not least, and of course you are very welcome, and that is this is

the FFACO agreement. And Russ Dyer has it, and everybody on a lot of the board have it. I sent it to Washington and so on.

And this is the Federal Facilities Agreement between the State of Nevada and the test site, and you noticed that I didn't mention Yucca Mountain because Yucca Mountain does not believe it is on the test site, nor do they communicate.

And I have been screaming about that for years, and I really feel as long as I am bringing up my pet peeves, that the 7,000 or 14,000 metric tons of Defense of Defense waste, which is classified, cannot go in my mountain, and I don't hear you talking one word about that.

And I do say it at every meeting and I get no response on it, and I hope that everybody is writing it down, because they are extremely arrogant and I do see this. This by the way is DOE and DoD.

And what it tells you in that 600 pages is not only the 41 page agreement, but the formation of the CAB groups, the transportation groups that I told you about. This started in '96 and is continuing on. So it is an enormous volume of education and information, and so on.

But this tells you every shot in 400 pages

that was done on the test site, and in the printout, and of course I don't know how to read any of this stuff, and so as everybody knows, I don't rely on me. I go outside of me and I go to the experts.

And according to my expert friends who have looked at this in detail, we are hotter than Rocky Flats, and whether this will affect the Yucca Mountain project because of the colloids, the bugs, or who knows what, will affect it.

And that's why I want the colloid reports, because I have been trying for 4 years to get the final resting place at the EPA farm, and I won't bore you with that, but I have never known where they put 30 years of manure and 30 years of building that. That was so hot with thorium that I didn't even want to see the word.

And that is the stuff that you are going to see on the test site, and be sure that you get the accompanying map. It is 1992, but it is as close as I can get you to all of the shots. So any questions?

CHAIRMAN GARRICK: Ruth, do you have a question?

DR. WEINER: I do have a question. I quite understand that many people don't want to come and sit through hours of the technical presentations

that we need to hear, and that is not what my question was addressing.

My question was addressing the situation that we would like to hear from people what they think. I appreciate the fact that Judy represents a number of organizations, and I appreciate the fact that you and many other people here represent a number of groups.

MS. DEVLIN: I do not represent anybody. I am the public.

DR. WEINER: Fine.

MS. DEVLIN: I have paid for myself for over 10 years. I don't represent any group whatsoever.

DR. WEINER: The my question is how can we simply get people to come to these meetings? Should we have them at a different time, or is there more or different advertising that we should do? You heard what Mike said.

I believe that the staff has gone all out to certainly make this available, and I used to attend meetings like this as a citizen simply out of interest.

And I would like to know what your opinion is on what we can do that has not been done that we

can attract more people here to give us their views, and not to hear ours, and not to hear presentations.

MS. DEVLIN: Ruth, in Pahrump, for example, when you have an NRC meeting and you recently did on canisters and some other stuff, we had 60 people from the town.

They had less than 40 from Las Vegas. Now, why? Because I made them feed us. Food helps. It has to be after working times. Whenever there is a meeting, you feed us, or nobody will ever come. Number one is the time and number two is food, and number three is what you are going to present. And all I can say is that they had the same meetings in Las Vegas and in Pahrump, and in Topopah.

And unfortunately, and Grant can testify to that, and Judy was there, too, I think, but these meetings were not only of the Board, but all the presentations were passe.

They showed us canisters that were passe, and they told us this, that, and the next thing and it was very bad. Chip was the facilitator, and you could hear our comments about it. So we are being shortchanged by the meetings to begin with, at least in my opinion. So that is number one.

When you bring stuff, and just like Steve,

as I love what he says, and I have just followed him for all of these years, when he says that you have one subject and a round-table, and the details.

How many times have I heard these same people go through 40 or 50 pages. And your sitter is broken, and your brain is gone, and so on. And nothing really comes out. And you know my resistance to the modeling term.

What people really want to see is the real thing. Now when I talk about my bugs, and the colloids, and the effect on Alloy 22 and what have you, do you think that anybody is allowed to go in the mine and see the fungus, and the testing, and the this, and the that, and the tritium being eaten by my bugs and so on? Absolutely not.

I get all of this from people who work there, from reports that are sent to me, and so on. And I can digest them because I have got 10 years behind me, but who else does, and who will take the time, the effort, the money, and so forth that it takes to attend these things.

I don't know anybody in their right mind, and I think it is very important especially at this late stage, I do want to see these reports, and I know that you will help me to get them. Thank you very

much, and I hope we will see you at the pow-wow.

CHAIRMAN GARRICK: All right. Thank you. All right.

MS. JOHNSON: I am Peggy Maze Johnson, and I am the executive director of Citizen Alert, and Ruth and I used to sit in those meetings a long time ago as citizens when we worked together in Seattle a very long time ago, which we won't have to go into, Ruth.

DR. WEINER: We won't say how long.

MS. JOHNSON: We won't say how long, just a long time. I have been involved for a very long time in community and citizen participation, and I have to tell you that the Department of Energy and its outlying organizations, the NRC, nothing is given enough information in a timely manner, and published in a place where people are looking at it.

And I think that is one of the biggest problems that we have. It is kind of like everything is done behind closed doors, and personally if you just came out to hear what the citizens want to hear or want to say, instead of having to subject them to what DOE has to say, because I have to tell you frankly that they have been listening to that for years.

And they don't believe it any more than

the rest of us do, and so they get irritated because they just don't want to come and be part of. So I think if you came and said we want to talk to you, the citizens, and we want to hear what you have to say, and do it in a way where maybe you even place ads in the newspapers, and let them know when it is going to be.

Maybe have one during the day and one during the evening so that people can get there. So that you truly can hear what people are saying. I know what people are saying to me, and I will tell you that when I sit in some of these meetings what I am hearing is not at all what people are believing.

And I think that there is this credibility gap. And I go way back a long time ago with levels of government, and there is this credibility gap that exists, and for very good reasons.

If you look at DOE's history going back a very long time, there is a huge credibility gap with what they are saying and what is true. And people in our communities know that. So when they say that something is safe, they don't believe it.

I have an opportunity to sit down with Margaret Chu when she was first appointed to her position, and she just told that you all just don't

understand this. There is nothing wrong with this. It is very safe.

And I said, you know, Dr. Chu, not everybody agrees with you. And she said, well, they just don't get it, and I said there are scientists who don't agree with you. She said, well, I am a scientist, and she said that scientists always disagree.

And I said that I have to tell you something, that until that gap is closed, and there is more unanimity among scientists, you are going to have people out here not believing.

And when I walked out of that meeting the first thing that flashed across my mind was the vision of all the tobacco executives sitting in front of Congress with their right hands sworn saying, oh, no, this doesn't cause cancer. Oh, no, you don't get sick from this. Oh, no, you won't die.

And that is exactly how we feel about what we are being told. We are told that this is perfectly safe. We know that there are scientists who are telling us that it is absolutely not safe.

DOE went to MIT to get a scientist that agreed with what they wanted, but they didn't go to the scientists that are running the Yucca Mountain

project at MIT, Dr. Alison McFarland, and her partner, that believe that this is absolutely the wrong place to put nuclear waste.

So I think when you are looking that you need to talk to us, but you also need to get differing opinions than the scientists that DOE is rolling out.

And as a resident of Nevada, and as a resident of this country, I am horrified by this kind of a project being forced down our throats, and being ram-rodded through without the science being done. I sat yesterday and I listened to the safety survey of the employees, and they said they got a 65 percent return on that survey, and I thought that seems really strange to me, because if I am an employee, and somebody gives me a safety survey, I am going to fill it out because it is expected of me to fill it out, because it is my job.

And when they get only a 65 percent, it makes you wonder what the 35 percent had to say. Was that factored into their conclusions. I think that there is a real problem with that kind of a return. You know, in politics, when you are putting out a survey or a community survey, you expect a low return.

But when you are paid to do a job, and you only get a 645 percent return, it makes me wonder what

the other people are saying and what they are thinking, and I think that would be a good thing to find out.

I think the quality assurance questions that are still out there are of troubling concern to us, especially since our two Senators in this State had a hearing and invited DOE employees that were "whistleblowers" and they were strongly encouraged not to attend.

And that troubles us that are out here, and I am not a scientist, and I am not a transportation expert. However, I bring 30 years of experience to my job, and when I am in TRB meetings or anything else, then I say that makes me the expert in this room today, because every single decision that has been made has been a political decision and that troubles me as a citizen of this country, and as a citizen of the State of Nevada.

So if you have any questions, I would be glad to answer them, and I thank you for your time.

CHAIRMAN GARRICK: Thank you very much. All right. Let's take one more. Please go ahead and introduce yourself and your affiliation. We know you, but maybe everybody else does not.

MR. LUDLOW: I am Grant Ludlow, and I am

the CEO of Allied Science, Incorporated. The first thing I wanted to say is that this board gets results, which is very unusual in this project until recently anyway. And I think the reason for that is that you have some industrial turnaround experts on the board.

I have noticed, and like Lee Iaocccoa, for example, they do make things happen. John Arthur is a breath of fresh air, and the DOE for the same reason. He has that kind of experience also.

I watched him turn the very cumbersome DOE around a couple of months, and that is the mark of those kind of people. So I am really happy to bring things to you because I now that you will do something with it.

The GAO is also starting to notice and especially in the negotiations between the NRC and the DOE. They expressed some concerns when I was talking to them, and whether or not they will have guts enough to publish it or not we will see, I guess.

The NRC is driving this license application and that is something that I am very concerned about. One example of that is that we had maybe 6 months or a year ago where we had one of these presentations where the mountain was not going to stop any radiation at all.

It was too leaky, and the various methods, and chemistry was not going to stop it. And the next thing that somebody notices is that the NRC demands that all systems work.

So the very next presentation we got, and we went back 10 years, and got an old presentation where the mountain is going to stop everything, and all the reasons why it will, that over the 10 years we had found that was not true at all.

The problem with having the NRC drive this system is that typically regulators don't now the details, and on this kind of a project people that don't know the details are going to make the biggest mess you ever saw in your life.

So now since the regulators typically don't know the details and in my observations that is true in this case, too, that means that whoever is getting the license has to take the responsibility to make sure that they know the details and make sure that the project works.

And so far the DOE has not shown that they don't know the details either, and what they do know is what you have taught them. And kept them honest. On another subject, there is no safe dose of radiation.

There is a scientific conference in May in Atlanta, and we are going to talk about the pre-radicals that are formed, and we are going to talk about the DNA damage, and we are going to talk about the RAD proteins, and we are going to talk about the hormone disrupters.

And while our body has defenses to that stuff, if your defenses happen to be down, then you start a process that ends up in sickness and death. And so aren't we saying that radiation is like the chemical industry?

It's okay to splatter hormone disrupters all over the place because our body can defend against it and you can't prove that it does any damage, and so it kills a few people and so that's life.

I think we need to be a little more responsible about that. On another subject, the investigation into the murder of Paul Brown is showing that the Mafia, the mob, the gangsters, whatever you want to call it, have been draining money out of the Yucca Mountain project.

And the way they do it is they get a contract, and they don't do the work, and they write a phony report, and they go get another contract. And so that is one of the reasons that the technical basis

and the technical details that we have been working on for the last 20 years are a real mess.

Anybody that knows anything about technology of new projects, and applying new technology, could see that something was very radically wrong and all of us assumed, oh, well, that is government bureaucrats messing around and not paying attention to what they are doing. And with the mob in there, that takes it to a whole new level alone.

And what the results of that are is that many of these 293 or however many there are now KTAs are irrelevant. They don't have a good technical basis, and people have built their models on phony tests, and we need to get into that and get that straightened out because again the details of this project will determine whether it makes a big mess or whether it is somewhat successful.

And then you asked a question, or Ruth asked a question of how do you get more people, and there was an interesting answer to that in Carlsbad and the WHIP project.

Now some people from Pahrump are going to go down there and study it, because Carlsbad turned around, and I think I heard the comment, gee, they are

paving streets that don't even need to be paved. And that was never the case in Carlsbad before.

So the assumption was that DOE pumped a lot of money in there, and that is not true. Several people pointed out to me that what happened and the way that they phrased it, was that people were brought in that have a higher education level, and also a higher socio-economic culture.

Those people took over the local government, and the governments in the area, and straightened the place out, and it is wonderful. It is like Boulder city or Los Alamos, where those highly intelligent people did the same thing.

And what we are trying to do in Pahrump to follow that pattern, we have a woman there who teaches CEOs how to be leaders, as opposed to managers, and we are trying to get her to take the first 15 minutes of every meeting and do a process that brings people's levels up so that all of a sudden they can see that they are getting results.

They become more effective, and therefore the town starts to turn around, and the county starts to turn around, and so forth. And I think that is the answer to your involvement in the meetings, is that you have people that have that level of education,

expertise, and interest, and they are successful in making things happen. I think that you will draw people in here by the ton and you will have to get bigger rooms.

Another thing is that the problems that we have is that the schools are down, and there are very few people in the country that can understand what goes on in these meetings at all, technically anyway, and also the citizens over the years have tended to let the government take over doing their job.

This country does a lot better when citizens do things instead of having bureaucrats and politicians do things. The way you get that started is in Demmings work, and it is called Quality Circles, and I am sure that some of you are familiar with those.

Basically what you do is you ask people every day what do you think, and how can we do this better and what made you mad today, and what is working really well, and that focuses people's attention on whatever they are working on.

Plus, the information that you get back is something that you would never think of yourself in a million year, especially as an engineer I can say that.

And the key to getting things done is to guarantee that you will run a test on whatever anybody says, and as an engineer, I have had people come in and talk to me about highly technical subjects and they had no idea what they were talking about, and it took me a couple of weeks on how to run a test on what they had to say, and the results are spectacular, and fortunately that happened early in my career. So that is something that I have used ever since.

And I thank you again for being the effective part of this project.

CHAIRMAN GARRICK: Thank you very much.

MS. MAVIS: I just wanted to make a very quick offer, and this is Irene Mavis from Clark County again. We have been working with the NRC for quite some time in helping market their local meetings a little better and help them find venues that are more accessible to the public and more appealing to the public to come to.

We have offered them the use of county facilities, including the County Commission Chambers. Every meeting that we have assisted in, helping market what is in it for the public, and I am happy to say that we had a great turnout.

So I am offering on behalf of Clark County

the ability to assist you in helping market those portions of your meetings that are for engaging the public, and we have the staff that is expert in doing that. We are in a planning department and our information is highly technical, and highly dry, and not necessarily appealing to the general public.

But we have found ways to engage and promote our meetings and bring hundreds and hundreds of people to neighborhood meetings to talk about land use. So if we can do that, I think we can help you, too.

CHAIRMAN GARRICK: Thank you. We will probably take you up on that.

MR; PARROTT: Jack Parrott, NRC staff and on-site rep out here in Las Vegas. I just wanted to inform the committee relative to Judy Treichel's comments earlier about NRC staff activities that are occurring out here this week.

I have got a memo dated November 4th that announces this evaluation that is going on, and it may help you understand what that activity is, and I would like to submit it to you.

And I should point out that there is a distribution list that is a page-and-a-half long on here. So to characterize this as secret is a little

bit strong, but the evaluation was closed to the public, but I wouldn't call it secret.

CHAIRMAN GARRICK: Thank you. Well, this has been very encouraging today. We have had a good cross-section of comments from a variety of people, which we welcome. But maybe most importantly we have had a couple of offers here of how we can stimulate the future meetings of this type.

The committee has tried a number of formats, including evening sessions, and including sessions 100 percent devoted to just interacting with the public, and so it is not as if we are not anxious to find the right way to achieve this very important communication.

But I think we have received a couple of ideas today that we are going to discuss with the staff and may be the model for future meetings. Does any of the committee have any comments to make? I think that we are all kind of worn out, and probably to a point we can think about adjourning the meeting, but I will offer one last chance if anybody wishes to make a short comment, after which we will adjourn.

MR. SHETTEL: I would just offer -- Don Shettel, consultant to the State of Nevada, in regarding getting information out to the public, I

think that the County's offer of facilities is a good idea.

One thing I have not heard is the possibility of interactive webcasts with the possibility of interactive e-mail, so that people don't have to travel to a facility. They could watch at home on their computer, and submit questions by e-mail, or something like that. Just an idea.

CHAIRMAN GARRICK: Okay. All right. Thank you very much. We are adjourned.

(Whereupon, at 2:48 p.m., the meeting was concluded.)