Official Transcript of Proceedings ACNWT-0167

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Nuclear Waste
147th Meeting

PROCESS USING ADAMS
TEMPLATE: ACRS/ACNW-005

Docket Number: (not applicable)

Location: Las Vegas, Nevada

Date: Wednesday, November 19, 2003

Work Order No.: NRC-1198 Pages 1-259

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON NUCLEAR WASTE

5 147TH MEETING

6 + + + + +

7 WEDNESDAY

8 NOVEMBER 19, 2003

9 + + + + +

10 LAS VEGAS, NEVADA

11 + + + + +

12 The meeting was called to order in Dallas

13 Ballroom D, Texas Station Hotel, 2101 Texas Star Lane,

14 Las Vegas, Nevada, at 10:30 a.m., by Dr. B. John

15 Garrick, Chairman, presiding.

16 MEMBERS PRESENT:

17 B. JOHN GARRICK, Chairman, ACNW/NRC

18 MICHAEL T. RYAN, Vice Chairman, ACNW/NRC

19 RUTH F. WEINER, Member

20 STAFF PRESENT:

21 SHER BAHADUR, ACNW/NRC, Designated Federal Official

22 JAMES H. CLARKE, ACNW/NRC

23 NEIL M. COLEMAN, ACNW/NRC

24 HOWARD J. LARSON, ACNW/NRC

25 MICHAEL LEE, ACNW/NRC

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

2 (10:30 a.m.)

3 CHAIRMAN GARRICK: The meeting will come
4 to order. This is the first day of the 147th Meeting
5 of the Advisory Committee on Nuclear Waste. My name
6 is John Garrick, Chairman of the ACNW.

7 Other members of the committee present are
8 Michael Ryan, Vice Chairman, and Ruth Weiner. Also
9 present is the consultant, Jim Clarke, and George
10 Hornberger is absent.

11 In today's meeting the committee will hear
12 an introductory briefing on the status of the Yucca
13 Mountain, receive an information briefing on the
14 status of the Yucca Mountain repository design, and
15 receive a status briefing on the DOE approach to drift
16 degradation analysis at Yucca Mountain; and we will
17 reserve some time for interactions with stakeholders
18 and meeting participants.

19 Sher Bahadur is the Designated Federal
20 Official for today's initial session, and this meeting
21 is being conducted in accordance with the provisions
22 of the Federal advisory Committee Act.

23 We have received one request for time to
24 make oral statements. We will honor that in the
25 afternoon session dedicated to that activity. Should

1 anyone else wish to address the committee, please make
2 your wishes known to one of the committee staff.
3 It is requested that the speakers use one
4 of the microphones, identify themselves, and speak
5 with sufficient clarity and volume so that they can be
6 readily heard.
7 And there is a couple of items of interest
8 that I want to note. On January 2nd of this year, or
9 on January 2nd of 2004, I'm sorry, after 40 plus years
10 service with the Nuclear Regulatory History, Carol
11 Anne Rowe, administrative secretary of the Executive
12 Director, ACRS/ACNW, will retire.
13 Her 32 plus years of experience with this
14 office will be sorely missed. It won't be quite the
15 same.
16 Dr. Hossein Nourbaksh has been selected as
17 an ACRS Senior Staff Engineer. He has been serving
18 both committees as a Senior Fellow, concentrating in
19 the risk assessment area.
20 As you can see from our program our first
21 topic will be the Yucca Mountain Program Status, and
22 as I understand it, John Arthur is caught in an
23 airplane, but is expected to get here probably before
24 our meeting ends today, and will drop by I am told.
25 But in the meantime, an able replacement

1 will be Russ Dyer to kick off the first presentation,
2 and he will be followed as I understand it by Joe
3 Ziegler. So, Russ.
4 MR. DYER: Thank you, Mr. Chairman. Yes,
5 unfortunately, John Arthur sends his sincere regrets
6 to the committee and to the members of the audience.
7 He got trapped in Washington last night, and was on an
8 early flight this morning, and we do expect him to
9 drop by sometime today.
10 But he pressed into my -- I happened to be
11 in Washington with him last night, and when we found
12 out that he was going to be detained, he gave me his
13 talking points, and asked me to give this presentation
14 today.
15 I am going to skip over some of the
16 initial points that he was making because they are
17 quite personal, and I think he wants to bring those
18 personal views to you whenever he does get a chance to
19 stop by.
20 But his objective and mine was in part
21 today to provide you with a high level summary of the
22 Yucca Mountain project, and where we are and what we
23 are doing the way that things stand.
24 And that is what I intend to do here in
25 the beginning. There is going to be quite a few

1 presentations over the course of the meeting that will
2 add much more detail to my brief high level summary.
3 But our highest priority for John and the
4 project remains the submittal of a complete, high
5 quality license application in December of 2004,
6 including the completion of the necessary design work,
7 and demonstration of an operating environment
8 appropriate for a licensee.
9 At the same time, we remain clearly
10 focused on what it takes to open a repository in 2010.
11 Now, we are going to talk about several things in
12 here, and the first thing that I would like to address
13 is what is the status of the license application.
14 And this is one of the management tools
15 that we use, this chart that is upon the viewgraph
16 right now, and there are five major components that
17 constitute what needs to go into the license
18 application.
19 KTI agreements, of course, and the LA, the
20 license application document itself, and the
21 Preclosure Safety Assessment, the Postclosure Safety
22 Assessment, or the TSPA, and the design components.
23 And what you see on the left-hand side is
24 kind of a weighting that we provided each of these
25 areas. This is somewhat judgmental, but it is based

1 primarily on our feeling of how much effort each of
2 these constituents of the overall licensing effort.
3 And then there is a couple of columns that
4 have the percent complete, and we have given a
5 comparison here between where we were in June of '03,
6 and where we stand at the end of October of '03, and
7 you can see that we have made progress in all areas.
8 Overall for the LA itself, we are about 43
9 percent complete now, some things being further along
10 than others, but we do have confidence that we are
11 going to be able to submit a license application
12 compliant with 10 CFR 63 and the applicable QA
13 requirements. And we have increasing confidence that
14 we are going to meet the schedule of the December '04
15 submission date. Next slide, please, Carol.
16 One of the things, of course that lies
17 behind the license application is the pedigree, the
18 quality, of the underlying information, the data codes
19 and models. This is a snapshot in time of where we
20 stand in the qualification and verification of data
21 codes and models, and data being on the upper left,
22 and codes being in the upper right, and model reports,
23 the AMRs analysis, and modeling reports, being at the
24 bottom.
25 And this is another area where we have

1 been making steady progress. Again, the commitment is
2 to have all of the necessary codes and models verified
3 for BLA. The next slide, please.
4 KTIs, the key technical issues of the
5 progress on those agreements, I know that the
6 committee received a pretty substantial briefing a
7 month or two ago about a new approach that we have for
8 organizing the KTI agreements.
9 And from the schedule that we are
10 currently on, you can see some real high blips on
11 there. We had very aggressive targets in the
12 September/October time frame, and we are actually a
13 little ahead of our schedule right now. Our intent is
14 to have over 200 of the KTI agreements submitted by
15 the end of this calendar year.
16 And of course we will have addressed all
17 KTI agreements at the time of the license application.
18 Next slide, please. We have a new organizing
19 principle for the KTI agreements, and these are the
20 technical basis documents.
21 I know that you received a substantial
22 briefing on these 14 buckets or areas if you will,
23 where we have taken essentially the TSPA story for the
24 nominal and disruptive cases, and broken those down
25 into sections if you will that integrate and provide

1 a context and framework for the KTI agreements, and
2 then fold up to tell a coherent story of the total
3 system performance assessment. Next slide, please.
4 Now, as you are well aware, it is just not
5 our goal to have a good quality assurance program, but
6 also to operate in an environment that is conducive of
7 being a credible and deserving NRC licensee. In this
8 context, there are a couple of topics that I want to
9 talk about.
10 The Corrective Action Management System,
11 and the Corrective Action Program, and Safety
12 Conscious Work Environment, and Accountability, and
13 Procedural Compliance.
14 First, let's talk about quality assurance
15 and management processes. We developed on September
16 29th of 2003 of this year, we implemented a single,
17 improved corrective action program that actually
18 subsumed and swept up about 4 or 5 different systems
19 that were in use for addressing corrective actions of
20 various kinds.
21 This single system will increase our
22 confidence that all issues will be treated
23 appropriately, and they will be properly prioritized,
24 addressed, and tracked to closure.
25 The key to this approach is this single

1 entry system that is on the slide here, where anybody
2 can generate what is called a condition report, and it
3 can be generated by an individual, and it can be the
4 outcome of an audit or surveillance.
5 It can be the result of an evaluation of
6 a trend analysis, and it will all go into the system
7 and be evaluated for its importance and urgency, and
8 drive, or ensure that proper management attention is
9 provided to each issue so that management resources
10 are identified to deal with issues as they arise.
11 The corrective action program will be used
12 by management at all levels as a tool to drive
13 continuous improvement of products and processes, and
14 to track, prioritize, and status issues for management
15 use. Next slide, please, Carol.
16 A safety conscious work environment has
17 been a very high visibility element throughout the
18 nuclear industry over the last, oh, 5 to 10 years or
19 so, and one of the challenges that we have as we move
20 from a research and development culture into a
21 licensee's culture is making sure that we are making
22 adequate and appropriate progress to being up to
23 industry and NRC expectations.
24 We are continuing implementation and
25 assessment of the a safety conscious working

1 environment committee to providing a work environment
2 where employees feel free to raise concerns without
3 fear of reprisal.
4 We engaged external experts from
5 International Survey Research, who conducted a
6 program-wide safety conscious work environment survey
7 beginning in July, and those results just came out
8 recently.
9 The results were distributed throughout
10 the Office of Civilian and Radioactive Waste
11 Management during the week of October 6th, and they
12 are being presented by -- they were presented by ISR,
13 International Survey Research, to the NRC staff at the
14 last management meeting last week.
15 And they have been discussed with
16 managers, and we have distributed them to all of the
17 staff throughout the project, and there are some
18 follow-up meetings actually going on this week.
19 This is just an overall high level view of
20 percent favorable response in a number of categories.
21 At the top of the list, 82 percent of the employees on
22 the project felt positive about the level of
23 engagement that they had in the project.
24 Some of the other ones that were I think
25 pretty powerful is empowerment. Approximately 77

1 percent of the employees felt that there was
2 appropriate empowerment throughout the program.
3 Similarly, goals and objectives, a strong majority of
4 the employees on the project felt that there were
5 clear goals and objectives laid out and understood
6 throughout the project.
7 Down near the bottom, safety conscious
8 work environment training and programs, and that is at
9 about 70 percent, and that is a place where we have
10 some opportunity for improvement.
11 Down at the very bottom, you see reports
12 and recognition, and obviously these are areas where
13 we need to look at opportunities to improve those
14 particular areas.
15 CHAIRMAN GARRICK: Russ, is there any
16 other national programs that you are able to benchmark
17 this performance against?
18 MR. DYER: ISR was able to benchmark us
19 against two different populations. One is their
20 overall general industry population, which include a
21 number of Fortune 500 companies, and then there is a
22 another population that we were benchmarked against,
23 which is government R&D organizations.
24 So the national labs, NASA, Naval Research
25 Labs, organizations of that type, and the report laid

1 out how we stood against those norms. A question that
2 we have is actually how we stand up against the
3 nuclear industry also.
4 And ISR did not have the database to allow
5 that kind of comparison. We have asked for help from
6 IMPO to seek if they can provide us with some
7 comparison of how these results would compare against
8 the utility industry. Next slide, please.
9 This survey went out to about 2,300 people
10 throughout the project, and that includes the Feds,
11 the contractors, national labs, the U.S. Geological
12 Survey.
13 We had a return rate of about 65 percent
14 margin of error, about 1.5 percent, and so we had a
15 large enough population to do some meaningful
16 statistics on quite a bit of this.
17 This is a good report that we are going to
18 be able to use to really determine where we need to
19 put some of our emphasis over the next year or so.
20 Next slide, please.
21 Rather than going through each of the
22 individual results, and there were quite a few areas
23 that were delineated for us. The report essentially
24 gave us an area where there was a recognized strength,
25 and where we need to maintain that strength in areas

1 where we have challenges to improve some of these
2 areas.
3 So on the strength side, there is a clear
4 recognition of an emphasis of quality and a commitment
5 to quality. I won't read the list. You can read down
6 the list. Keeping a safety conscious work environment
7 is a priority.
8 There is a clear recognition that a safety
9 conscious work environment is a priority, and
10 maintaining that environment is going to be important
11 and critical for us.
12 In the areas for improvement, of course we
13 are going through an enormous amount of change within
14 the project, and changes are a time of turmoil for
15 all, and one of the keys to successfully navigating
16 through change is very frequent and communications at
17 all levels.
18 And keeping all involved in the form of
19 where we are and where we are headed, and that is a
20 challenge for us as it is I think it is for any
21 organization going through change.
22 Looking at organizational performance, I
23 will talk a little bit later about some of the issues
24 that we already had in place to look at and
25 communicate organization performance, and ensuring

1 sufficient authority at appropriate levels, and so
2 aligning rolls and responsibilities, and
3 accountability of authority appropriately and at
4 appropriate levels is an area for improvement.
5 And one of the areas that came out
6 reasonably negatively in the survey was the
7 effectiveness of the corrective action program, and
8 the existing corrective action program, where he
9 talked about the new program that was put in place.
10 That program was put in place after this
11 survey was accomplished, but one of the things that we
12 have got to look for is to make sure that just putting
13 a new system in place and of itself doesn't solve the
14 problems.
15 It is going to take continued management
16 attention and looking at increasing the effectiveness
17 of the corrective action program. That is going to be
18 a large challenge for management here over the next
19 several years. Next slide, please, Carol.
20 In the realm of accountability, we are
21 continuing our work to ensure that all employees
22 understand the expectation on compliance with
23 procedures and quality in other key areas. Our
24 performance matrix --
25 CHAIRMAN GARRICK: I hope you can

1 summarize that. This one has gone beyond my age.

2 MR. DYER: Oh, yes. I am going to talk

3 about this a little bit here, and there will not be a

4 test at the end of this. Getting a set of meaningful

5 performance matrixes at the appropriate level for

6 management to essentially see the top level, and

7 rolling up appropriate indicators of performance to

8 something that management can look at has been a

9 challenge that we have had for quite a while.

10 And about 6 months ago, we started using

11 what we would call an enunciator panel approach, where

12 we have got a number of areas laid out, and the way

13 that this is laid out here, the left-hand column is

14 the top tier of important things if you will.

15 So the license application, the work

16 execution is the box on the left, and it is not the

17 top line, which is white. But it is the next line, or

18 series of lines below, about 5 or 6 lines there, and

19 those are the things associated with the license

20 application or the safe operation of the site itself.

21 And in each area, going from right to

22 left, each of the areas such as license application,

23 there will be a number of sub-tier metrics that roll

24 up to an overall metric.

25 So in the license application itself, some

1 of the feeders to it would be the things that we
2 talked about earlier; the total system performance
3 assessment, the design, the preclosure safety
4 analysis, the license application document itself.
5 Each of those we evaluate on a monthly
6 basis on how we are doing in that area, and actually
7 this overall enunciator panel has hundreds of subtier
8 metrics that we collect, evaluate, and roll up into
9 this overall look at the -- if you will, you can use
10 this as a visual to focus on the areas of the project
11 where there are issues and that we need management
12 attention.
13 We used a color coding on here, where
14 green is something that is running pretty much on
15 schedule. Yellow is something where you have issues
16 that are deserving of management attention.
17 Red are areas where management attention
18 is urgently needed, and you will see that there are
19 four areas on here, and actually one at the top level
20 shows a red indicator, and that is the quality
21 assurance arena.
22 And although there may be -- and if this
23 happens to be in the licensing area, there is a red up
24 towards the top. In the other areas, and that is an
25 area that needs management attention, but overall in

1 that area the overall summary if you will is that that
2 is a yellow.
3 Yes, there are issues, but you don't need
4 literally day to day top management attention on those
5 areas. You will see that there is a lot of light on
6 this graphic, because this has been an evolutionary
7 process finding out which metrics really makes sense,
8 and what gives you useful information.
9 And we have gone through some metrics that
10 are there because the data was there, but we find that
11 the data is not really very conducive to finding out
12 how effective your program is, and that is one thing
13 that we are looking for here, is not level of
14 activity, but level of effectiveness.
15 So some of the areas that show white are
16 areas where John Arthur has said yes. That is an area
17 that we need to track that I am not happy with the
18 metrics that you have established in that area yet.
19 So this is still a work in progress, but
20 we hope to populate these other -- the white areas --
21 soon with meaningful metrics, but it will change with
22 time as we learn more and find better ways to do
23 things.
24 And we hopefully will be improving this
25 continually because this is going to be one of the

1 major tools that we use to focus management attention
2 on the program itself. Next slide, please.
3 And this is kind of a wrap-up slide.
4 Fiscal Year 2004 will be a very, very busy year for
5 us, with an approved budget sufficient to meet our
6 schedule, and a good management team to ensure
7 progress to achieving our goal.
8 We will continue to focus or will continue
9 our focus and vision on submitting a quality license
10 and a national -- let me start over again here. We
11 will continue our focus and vision on submitting a
12 quality license application and on meeting the
13 national need of operating or opening and operating a
14 repository in 2010, and what I show here is the as is
15 if you will.
16 If you have been out to the site recently,
17 this is the current status of the site, which of
18 course was all put together to support the site
19 characterization effort.
20 There are many things that need to be
21 changed, constructed, and brought into operational
22 status before this station has an operating
23 repository. Next slide, please.
24 And this is a concept at this time, but at
25 the time that we have an operational repository, we

1 expect that Yucca Mountain would look something like
2 this, with transportation coming in, with a new set of
3 operational buildings capable of receiving, and
4 handling, and disposing of waste here at the surface,
5 and of course with the attendant subsurface facilities
6 in place.
7 And with that, Mr. Chairman, if the
8 Commission has any questions of me.
9 CHAIRMAN GARRICK: Thank you. Any
10 questions from the Committee? Ruth.
11 DR. WEINER: I have -- I wrote down a
12 number of questions, but I expect the answers to them
13 are pretty quick. How do you determine percent
14 complete? What is the benchmark that you use?
15 CHAIRMAN GARRICK: Joe Ziegler is going to
16 get into that quite a bit more, but in general we have
17 laid out a plan with a number of deliverables in it.
18 You can look at the number of deliverables that come
19 in and how many have been accepted.
20 We also use an earned value system so you
21 can get an estimate of how you are doing for things in
22 preparation.
23 DR. WEINER: Okay. I will wait until Joe
24 makes his presentation, but that essentially answers
25 it. Your corrective action program, how does this

1 compare with ordinary standard QA CAR programs? How
2 is your program QA? Do you have an external QA? This
3 is my ignorance showing by the way.
4 MR. DYER: Help me here, Ruth. What is it
5 that you are looking for exactly?
6 DR. WEINER: Well, on other programs that
7 I have worked on, we had a QA plan and QA project
8 plan, and identified where you submitted a corrective
9 action request, a CAR, and then you did a root cause
10 analysis.
11 MR. DYER: Right.
12 DR. WEINER: And I just wondered if your
13 corrective action program followed along those lines.
14 MR. DYER: It does, but it goes a little
15 bit further, and what we are doing is importing some
16 of the lessons learned, and the knowledge from the
17 nuclear utility industry.
18 One of the challenges that we have had is
19 that with 4 or 5 different systems in place, whether
20 it be what we used to call the condition information
21 reporting system, the QA system, the NCR system, the
22 various systems that we had, if somebody came across
23 a deficiency, a perceived deficiency, they first had
24 to make a judgment as to what system they would take
25 it into. And then what set of processes would be

1 used.

2 What industry went to some years ago is to

3 take that monkey off of the individual's back and use

4 a single entry system, where you identify an issue,

5 and you get it into the system, and it becomes the

6 system's responsibility to figure out what the level

7 of severity is, and what the urgency and importance of

8 that particular action is, and to get it before

9 management for action.

10 And also to do the follow-up to ensure

11 effectiveness of whatever action was taken. So this

12 is something that we have imported from industry.

13 DR. WEINER: And you have some industry

14 examples --

15 MR. DYER: Yes.

16 DR. WEINER: -- that tells you that was a

17 preferable way to go?

18 MR. DYER: Yes. Yes, we do.

19 DR. WEINER: On your safety or on your

20 questionnaire that you handed out to employees, was

21 there any significant difference between the responses

22 that you got from the Feds and from contractors, or

23 were they pretty much the same?

24 MR. DYER: No, there were some significant

25 differences, and we were able to break it down by

1 organizational elements. So, in Feds, there are
2 differences, because we surveyed the entire OCRWM
3 population.
4 We looked at Feds in the east, and Feds in
5 the West. We looked at -- you can break out each
6 laboratory, for instance, and look at differences in
7 laboratories, and see that some laboratories feel
8 better about rewards and recognition, for instance,
9 than some others do.
10 So that can identify areas where you can
11 focus some management attention.
12 DR. WEINER: Do you as overseerer of the
13 entire project, do you get down to the laboratory
14 contractor level and say, look, this is where you need
15 some improvement, or this is okay, or something like
16 that?
17 MR. DYER: Well, we recently about 2
18 months ago established a leadership council, one of
19 the things that John Arthur put in place, which
20 involves the leadership from the Feds, contractors,
21 labs, and U.S.G.S. sites.
22 So there are principals for all of those
23 organizations sitting in that forum, and things like
24 this are discussed in that forum, and we can discuss
25 what works in some places, and what or if somebody

1 else might need some help.

2 DR. WEINER: On your I-Chart slides, what

3 are the other red areas? You pointed to quality

4 assurance, but there were a couple of other reds.

5 MR. DYER: Well, quality assurance, and

6 there was one up in -- and Joe is going to have to

7 help me here, but surface design.

8 MR. ZIEGLER: Yes.

9 MR. DYER: Yes.

10 DR. WEINER: And there was one other, I

11 think.

12 MR. DYER: Well, there were two in the

13 quality assurance area, and there was one in the QA

14 roll up.

15 DR. WEINER: Okay. And my final question

16 is do you have a metric for how well, or in what

17 detail management knows what the technical staff being

18 managed are really doing, and how familiar they are

19 with the technical work? Is there a metric for that?

20 I mean, my experience as a managee and as

21 a manager that very frequently the managers,

22 especially the higher up you get in the management

23 level, really becomes removed in some sense from the

24 technical work.

25 And I just wondered if you have a metric

1 to measure how good that connection is. If you ask a
2 manager of some department, can that person tell you
3 about what his stuff is doing in any detail, and how
4 familiar he is with it, or she?
5 MR. DYER: Well, that is one of the
6 expectations that we addressed in the roles and
7 responsibilities area. Of course, you don't expect
8 a reasonably high level manager to be able tot ell you
9 all the technical details, but they should have a
10 general idea of what is going on, and know who to go
11 to very quickly to get the details.
12 DR. WEINER: So you do have some sort of
13 metric that measures that connection?
14 MR. DYER: We do. It is more in the
15 effectiveness area I think.
16 DR. WEINER: Okay. Thanks. That's all.
17 CHAIRMAN GARRICK: Thanks, Ruth. Mike.
18 VICE CHAIRMAN RYAN: Thank you. Actually,
19 Carol, if I may ask you to put up that chart that show
20 the responses. I had a couple of questions and it
21 might help if I saw that again. Thank you.
22 MR. DYER: Is this the overall SCWE bar
23 chart?
24 VICE CHAIRMAN RYAN: The results.
25 CHAIRMAN GARRICK: The results.

1 VICE CHAIRMAN RYAN: And while Carol is
2 putting that up, one that caught my eye was the
3 integrity and ethnics one, and it is for 73 percent.
4 And I turn that a different way, and I say that 1 out
5 of 4 people don't think very highly of that category.
6 So I may be picking on it the wrong way,
7 but what I would like to understand is how do those
8 results bear up against your benchmarking and things
9 like that, because I really don't know what to make of
10 that on its face.
11 MR. DYER: I think the one that he wants
12 is the bar chart.
13 VICE CHAIRMAN RYAN: The bar chart, yes,
14 please.
15 (Brief Pause.)
16 MR. DYER: The one that has about -- yes,
17 that one. Right. It is hard to take this out of
18 context. Whenever you do the benchmarking against the
19 two populations, it turns out that in every one of
20 these areas that we are at least at or significantly
21 above in a positive sense the norms for both the
22 national population and for the government R&D
23 population.
24 There are none where we are statistically
25 significantly below the norms.

1 VICE CHAIRMAN RYAN: And the norm being
2 what, what most industries think, or -- well, for
3 example, the nuclear power example, I wondered how you
4 -- because they have been detailing with a safety
5 conscious work environment.
6 MR. DYER: Right, and we don't have that
7 comparison yet.
8 VICE CHAIRMAN RYAN: That would be an
9 interesting one, because it would probably be a little
10 bit closer to home.
11 MR. DYER: But for these areas, for
12 instance, there is one population that we would
13 compare it against, that would include people like
14 Boeing, and Proctor and Gamble, some of the Fortune
15 500 companies.
16 And you could see how -- and certainly
17 this report could be made available to you. We have
18 made it available to the NRC, and the report is much
19 more exhaustive than this.
20 VICE CHAIRMAN RYAN: Yes, I know, I
21 figured that it was. It just caught my eye, and I am
22 glad to have your additional explanation. Thank you.
23 MR. DYER: Just a minute. Joe Ziegler
24 would like to add something here.
25 MR. ZIEGLER: Joe Ziegler, DOE. One thing

1 also is that in all of these areas there is a
2 significant percentage of I have no opinion, and so
3 all of the questions had an option of saying that I
4 have no opinion, or I don't know on each question, and
5 I don't know what the percentage is on that one.
6 But in almost every one of these, there
7 was a fairly significant percentage that fell into
8 that category. So a lot of people just had no opinion
9 about mentioning that.
10 VICE CHAIRMAN RYAN: So part of that 25
11 percent would be they have no answer?
12 MR. ZIEGLER: No opinion. My recollection
13 is that the greater part of that 25 percent is like
14 that.
15 MR. DYER: Yes, that is a very good point
16 to make, is that most of the questions had a five
17 point scale, with a three being somewhere in the
18 middle, and with no opinion.
19 So you go from highly positive, to
20 positive, to neutral, to negative, to highly negative.
21 This is only the positives. It does not count the
22 neutrals or the negatives.
23 VICE CHAIRMAN RYAN: And that is real
24 important for understanding this graph, and I am glad
25 that you clarified that, Joe, because otherwise you

1 would have to conclude favorable means one-quarter is
2 not, because there is no other choice there.
3 MR. DYER: Right.
4 VICE CHAIRMAN RYAN: And I just didn't
5 want to leave that out of the detail.
6 CHAIRMAN GARRICK: Now, one of the things
7 that I was looking for on this chart were those things
8 having to do with public outreach issues of ethics and
9 integrity.
10 In the other chart, on the results, you
11 have building trust and openness, and all of these are
12 important factors to that. But I guess I was a little
13 surprised to not see public outreach as I would call
14 a primary category.
15 Is that in your judgment covered in these
16 other categories, or was this intended to do something
17 else?
18 MR. DYER: I am thinking back to the
19 structure of the survey, and I don't believe I could
20 say that that was an element that was evaluated.
21 VICE CHAIRMAN RYAN: I am just curious
22 about the difference in changes.
23 MR. DYER: Well, this program has a more
24 than 20 year history as an R&D organization, and the
25 site recommendation (inaudible), and so this has

1 changed to becoming a credible licensee.

2 VICE CHAIRMAN RYAN: And so the phase that

3 you are in now as opposed to where you were?

4 MR. DYER: That's exactly right, and of

5 course that is not a one time change. As one moves

6 from R&D, to licensing, to construction and

7 operations, each of those is a change, and you have

8 different skill needs in each area.

9 You have different management focuses in

10 each area. So this is not a one-time change, but it

11 is kind of a harbinger of continuous change.

12 VICE CHAIRMAN RYAN: That clarifies that.

13 Thank you.

14 CHAIRMAN GARRICK: Any other questions?

15 DR. WEINER: Yes. Carol, could you put up

16 the bar chart? This is kind of a tough question. In

17 my other life, I took one of these surveys as a Sandia

18 employee, and it occurred to me as I was taking the

19 survey that some of the questions that I most wanted

20 to answer were not asked.

21 I think John touched upon one of those,

22 which is the public communication, and I wanted to ask

23 you are you sure that your survey asked all the right

24 questions, and how can you be sure of that? What can

25 you use?

1 I know that you used other surveys as a
2 benchmark, and I wondered if they don't all miss the
3 same question.
4 MR. DYER: Well, now there was a focus on
5 this particular survey, but there was an opportunity
6 for people to add additional information. There was
7 like an assay block at the end if you have additional
8 comments or questions.
9 And we got, if I remember right, around
10 400 written comments that came back. So that is an
11 area that we need to mine, and to look for things like
12 you are talking about.
13 CHAIRMAN GARRICK: Any other questions?
14 Anybody from the staff wish to ask a question? All
15 right. I think we can move to the next speaker, which
16 I understand is Joe Ziegler.
17 While I was making introductions, I failed
18 to acknowledge an alumnus of this committee in the
19 audience, namely Charles Fairhurst, and we are pleased
20 to see him again.
21 Charles served on this committee some time
22 ago, and is still happily associated with the project,
23 and we are pleased to hear about that. Go ahead, Joe.
24 MR. ZIEGLER: Good morning. My name is
25 Joseph Ziegler, and these are the basic topics that I

1 am going to cover today. I am going to give you a
2 brief status of our license application and our
3 activities leading to December of '04.
4 I am going to also very briefly go over
5 NRC's risk ranking and KTI agreements, and the NRC had
6 asked us to look at their risk ranking, and give them
7 some feedback.
8 We did that last week in our management
9 meeting with the NRC and I am going to share the same
10 information with you. I will go into a little bit
11 more detail about the status of our key technical
12 issue agreements, and then talk a little bit about our
13 design evolution, and in not very much detail, because
14 you are going to hear most of the details of where we
15 are today with design activities this afternoon from
16 Paul Harrington.
17 Just in a nutshell, we still do plan to
18 submit a license application in December of '04.
19 There are areas where we get a little bit behind
20 schedule, and we have been able to recover that part
21 of the schedule when we have problems from a
22 scheduling perspective.
23 I will go into some of the same slides
24 that Russ did go into in a bit more detail about some
25 of the other issues associated with getting a license

1 application done in three areas in particular where we
2 have had quality assurance issues in the past because
3 of the nature of the program and other reasons, and
4 what we are doing to resolve those.
5 And I will just mention, and this is the
6 only mention, and I will take questions, but I may not
7 be able to answer them, that we do plan to certify our
8 initial certification as a licensing support network
9 in June of '04 as required by Part 63, in Part 2, I
10 think in the NRC regulations that would certify a LSN
11 6 months before you make a license application.
12 The next slide just shows a very brief
13 schedule, and I will concentrate on the upper part of
14 this slide, to the left of the slide, and in the
15 yellow part, it shows activities that we have
16 completed leading up to, and including site
17 recommendation, and site designation by the President
18 and Congress.
19 On the right-hand side of the chart shows
20 the key activities that are a part of what is
21 necessary to be able to submit our license
22 application, as we expect the LA design, the license
23 application design, to be complete in March of '04.
24 The pre-closure safety analysis that will
25 be associated with that design and operation of those

1 facilities also to be completed in about the March of
2 '04 time frame. Our long term safety analysis, and
3 what we call total system performance assessment, it
4 to be completed in the June time frame, and then be
5 able to certify LSN initially in the June time frame.
6 Of course, we will recertify LSN at the
7 time that we make the license application in December
8 of '04 Next slide. In this next slide, I will try to
9 answer some of the questions Ruth raised, and try to
10 answer them later about how we came up with these
11 percentages.
12 The percentages, along with each element
13 or each component as labeled on this chart, are just
14 weighted percentages. Those are subjective in nature,
15 but they are based on the level of effort that we
16 anticipated.
17 This is an overall measure of where we
18 were at the time that the site was designated, up to
19 the time that we would submit the license application.
20 So these are measures for that element of work.
21 The KTI agreement and the TSCA, the KTI
22 agreement almost entirely deals with post-closure
23 performance. So the weight of the agreement is 10
24 percent, but you will notice that we rated total
25 system performance assessment at 30 percent.

1 So overall the weight for the long term
2 performance of the repository is given about a 40
3 percent weight. Now, most of these things are
4 inextricably connected, okay? So they are not really
5 necessarily individual pieces of work. Everything has
6 to fit together.
7 The LA document itself, we have rated this
8 at about 20 percent, because that is a significant
9 effort on our part, and not putting the pieces of the
10 application together to make sure that everything is
11 integrated and consistent across the board.
12 So we have given ourselves quite a bit of
13 time to do that, and mostly that will happen between
14 June and December of '04, but we do have drafts of
15 several license application sections that exist today,
16 and we are continuing on schedule to complete that.
17 The preclosure safety assessment is
18 basically -- it was significantly behind schedule
19 because it was closely tied to the surface facility
20 design efforts. We have been through one round of
21 pre-closure safety assessments since the time of the
22 site recommendation, and we will go through additional
23 rounds.
24 I am going to mention right now one of
25 those red boxes in the performance indicators was

1 surface facility design, and that work was
2 significantly behind where we would have liked it to
3 have been from a schedule perspective.
4 If you will recall over the last 5 or 6
5 years, our budgets have never been what we requested
6 of Congress. This year, it looks like we are going to
7 get a budget close to what we requested.
8 But, for instance, last year, I think our
9 budget was $130 million less than what we requested,
10 and I think we requested 590 or so million dollars.
11 So when we had to defer work, especially in a three
12 site recommendation and site designation, we tended to
13 focus the monies and the resources that were available
14 on the post-closure performance assessment, because
15 that is what made this site suitable or not suitable.
16 Where we deferred work, it tended to be on
17 the surface facility design effort, and on the safety
18 analysis on surface facilities, because those types of
19 activities have all been done and licensed in many
20 other places.
21 So we knew that work was not a first of a
22 kind activities, and we knew that it could be done.
23 It was just a matter of going through the process of
24 doing it. So that effort and the reason that it got
25 behind schedule or behind where we would have liked it

to have been in the schedule is because basically of funding.

But we have made a lot of progress over the last six months in catching up in the pre-closure safety assessment and the on surface facility designs. So, Paul Harrington will go into more detail on the design later on today. Next slide.

I am not going to say a whole lot about this, but these three areas, data qualification, software development and coding, and model development -- and we divided software and models. And software being the physical software itself, and the models being the algorithms that do the estimates of long term performance, and the various components of that.

There have been some longstanding quality issues in each of these areas, and that is one of the reasons that we track this religiously. This is not just fixing the problem of how we do work today. It is also going backwards.

You know, some of the datasets that exist are as much as 20 years old, and making sure that the work that is done in the past is adequately qualified to support the safety analysis that is required for the license application, and for the NRC to make their judgments in the evaluation of our analysis.

1 It has been a difficult process. You
2 talked about the quality assurance program, Russ, and
3 I am going to elaborate on that a little bit; is that
4 10 years ago there was not one quality assurance
5 program for the program.
6 The lab said that their quality assurance
7 program, and GS had theirs, and we had ours, and since
8 then, one, the program has been defined in what we
9 call the QARD or quality assurance requirements
10 document, or requirements description, and that
11 document has been submitted to the NRC.
12 And while there is no legal requirement or
13 regulatory requirement for the NRC to approve or
14 accept that document, over the last 5 years the NRC
15 has accepted our quality assurance premise document.
16 So what we are trying to do is to act as
17 much as a licensee and assume the process as soon as
18 possible. Well, some of that has been painful in the
19 transition over to these multiple programs and into
20 the one program.
21 And I think what you are getting at, Ruth,
22 is that we applied this quality assurance program to
23 all of the work done on the project. So if it a
24 quality affecting activity per the NRC regulations, we
25 apply the one quality assurance program whether or not

1 it is done by the national labs, or the GS, or Bechtel
2 as the IC corporation, or DOE as a Federal entity. We
3 apply the same program.
4 So that is where we are. I think that is
5 enough on that, and so Russ basically covered it, but
6 we are making great progress. We have had what we
7 call significant conditions adverse to quality open in
8 each of these areas for a long time.
9 We are close to closing those significant
10 conditions adverse to quality in the area of models,
11 and again it is not just what we are doing, and what
12 we are doing now going forward. It is also going
13 backwards in time to make sure that everything is
14 adequate as it needs to be.
15 In software development, we are not quite
16 as close, but we are within a couple of months of
17 probably being able to close that deficiency, and I
18 say significant condition adverse to quality, and you
19 talked about CARs, or corrective action reports.
20 In our old terminology up until two months
21 ago, that is what we would have called it, but right
22 now since we went to the single reporting system, we
23 call it a condition report, Level A. That is
24 equivalent to a CAR in our old terminology.
25 And the datasets again, we have plans for

1 all of these. The data is a little bit more
2 problematic, and that it is going to take us -- I
3 think we are scheduled into the spring of next year to
4 get all of those datasets reviewed and verified.
5 And again in each of these elements, we
6 are not just looking forward. We are looking
7 backwards and doing some reverifications because of
8 the multitude of different quality assurance programs
9 that existed when some of this information was
10 developed.
11 To put it in perspective, we have not
12 found problems that we are not able to go and resolve.
13 So we are not losing big chunks of data, or are not
14 able to use big chunks of data because we are not able
15 to quality it.
16 We have not run into a situation where we
17 are not able to use the software that was developed.
18 Sometimes it is more convenient just to redevelop the
19 software instead of going back and qualifying old
20 information.
21 But the same thing in the modeling area.
22 So we have been able to do it, and we have a
23 systematic plan and approach to doing that. Skip that
24 one and go to the next one. Just a brief feedback on
25 the NRC's risk ranking, and I will get into this a

1 little bit later when I show the site on schedule of
2 KTI agreements.
3 It will give you an idea of some of the
4 agreements that follow later in the schedule, and what
5 their risk ranking is, and what they are, and what we
6 are planning to do to address those.
7 The main point that I want to make here,
8 and I made this point to the NRC, and I don't think
9 that they are in disagreement with this, is that the
10 NRC used the terminology of high risk, medium risk,
11 and low risk.
12 Our position is that there is nothing
13 really associated with a repository that is high risk,
14 okay? We are looking at any potential radiation dose
15 to the public is measured in millirems or fractions of
16 a millirem.
17 The post-closure performance for 10,000
18 years, the analysis that we have done today, and I
19 think we have been fairly consistent on this, shows a
20 potential for fractions of a millirem to a
21 hypothetical person of 10,000 years from how.
22 To term that as the high risk in relation
23 to other NRC licensed activities, such as a reactor,
24 when you go back and look at the reactor safety goals,
25 which puts it at something like a 10 to the minus 6

1 probability per year of a large scale core melt
2 accident, is the risk associated with this facility is
3 in all cases is relatively low.
4 That said, we don't have a lot of
5 contention with the NRC on their relative risk
6 ranking, and we are able to say that some things are
7 more significant from a risk perspective based on the
8 way that we model the repository and the repository
9 systems than other things.
10 We are not in probably complete agreement
11 as to what follow upon the high side, and we have
12 agreed to go back and take a closer look at the NRC's
13 high risk areas, but here are some examples.
14 And we agree with the NRC that the
15 corrosion of the waste package and the drip shield is
16 at relatively higher risk than many other components
17 of a repository operation.
18 The probability of volcanic disruption is
19 relatively higher than other elements of the model.
20 An aircraft crash is relatively higher because
21 although I think most of the risk would be to the
22 workers on-site from that type of an event, is
23 relatively higher than some of the others.
24 Other things where the NRC has labeled it
25 as high risk, such as mechanical degradation of the

1 waste package and drip shield, our modeling doesn't
2 show that. We don't think that those components are
3 particularly vulnerable.
4 I think that there are some differences in
5 the way that the NRC is doing it and the modeling.
6 Mark Board may be able to go into that in more detail
7 later. I think he is supposed to speak to you
8 tomorrow.
9 I think that the NRC made some pretty
10 conservative assumptions in their modeling, and I
11 think that they have gone to what we consider to be
12 too conservative in that area. In other areas, and
13 this came up in the NRC meeting last week, such as
14 radionuclide transport in the saturated zone, our
15 models really don't take much credit for that.
16 Our models are probably pretty ultra-
17 conservative in that area. Therefore, if you look at
18 our models, this does not seem to be a very high risk
19 important factor.
20 If you look at the NRC's models, I think
21 they are probably closer to realistic in that
22 particular modeling. So it is a larger component in
23 what is important to the overall risk of the
24 repository on a relative basis.
25 So we have agreed to go back and look at

1 the NRC high risk areas, and I think we will be able
2 to draw conclusions that follow either into we are
3 about the same, or it falls into one of these
4 categories, in the way that we model the systems.
5 Okay. Now I am going to go into key
6 technical issues, and I will try to bring in some
7 elements of the high risk and medium risk from the
8 NRC's staff's perspective.
9 I think we have been over this with other
10 parts of our staff in pretty great detail. We did
11 come up with an approach in the summer to bundle
12 agreements together, groups of agreements that look at
13 certain parts of the systems, or repository systems,
14 and how those things interact and work together.
15 One of the key reasons that we did that
16 was that the NRC was asking for additional information
17 on several of the agreement responses that we sent in,
18 whereas we thought that something was basically
19 obvious the way the overall system is set up.
20 We get questions back from the NRC staff
21 that basically -- and the way that we read the
22 questions, says how does this information fit in to an
23 overall greater perspective of how the repository
24 operates.
25 So to do that, we needed a broader

1 explanation in just responding to each agreement
2 individually, because while we answered the agreement,
3 it didn't really give you that perspective, and the
4 NRC staff wants that perspective in the documentation
5 before they close an agreement.
6 So we came up with this approach of
7 bundling, and coming up with something we called
8 technical basis documents. And I will give you a list
9 in a minute of the ones that we sent in, and the ones
10 that we plan to send within the next few days.
11 But they are in those 14 areas that Russ
12 showed you on that slide earlier, and within those
13 technical basis documents, we can cover about 85 to 90
14 percent of the key technical issue agreements, and put
15 it in the context of how the repository systems
16 operate, and how they will function to isolate
17 radioactive waste.
18 There will be some separate agreements
19 still for some agreements, separate submittals for
20 some agreements. Some of the agreements just don't
21 fit neatly into any of these particular categories.
22 They are kind of -- they are individual questions that
23 don't need to be in that context, and we will continue
24 to respond to those as necessary.
25 But most of the agreements do fit into

1 these categories. We revised our schedule and
2 submitted it to the NRC in June, and that is the
3 schedule that Russ showed you. I am going to show you
4 that again in a minute.
5 We are also working on a further revision
6 to that schedule to accelerate some of our responses
7 to the NRC. One thing that I will mention, too, is
8 that we try to interact with the NRC staff, usually in
9 the form of public meetings, and sometimes they call
10 and ask questions, and we just answer the questions,
11 or the on-site representatives come by and ask
12 questions.
13 But we have interactions to make sure that
14 when we submit something to the NRC that they
15 understand that, and that we can discuss that in a
16 public forum.
17 So we will continue to have those
18 interactions, and I think as we submit these technical
19 basis documents, in order to facilitate the NRC review
20 of them, we will continue to schedule for those
21 interactions, and they will probably increase.
22 We will probably do more and more of these
23 interactions to make sure that everybody is on the
24 same page. That they understand what we are
25 submitting, and if we didn't submit something, that we

1 could follow it up with additional submittals to make
2 sure that information is available.
3 So I think that those interactions are
4 very important, because when you are just working from
5 the written page, you can only put so much information
6 and write it down.
7 Sometimes what we think is obvious, the
8 NRC staff either doesn't, or if they want to see that
9 document. So even the obvious needs to be documented
10 for the staff to be able to close these agreements.
11 I may have already covered this next slide
12 on the organization of work. We develop technical
13 basis documents for each of these bundles, and
14 basically it is not so much the KTI agreements. It is
15 just the way that the repository works.
16 There is another advantage to this
17 bundling and these technical basis documents, and that
18 when we describe the way that the repository works in
19 the license application, this gives us a real
20 headstart in putting that information together.
21 So it also gives the NRC staff a headstart
22 in being able to review the description of the
23 repository and how it will operate in the license
24 application.
25 So these documents, while not absolutely

1 a direct page to the license application, and a lot of
2 the words in these documents will show up again in the
3 application itself.
4 We will address the agreements within that
5 context, and so the agreements aren't the driver. The
6 safe operation of a repository is the driver. The
7 agreements are just issues associated with our
8 analysis of that operation.
9 And one thing that we have done -- and we
10 were significantly behind, and I see that on the
11 scheduled, too, on our submittal of KTI agreements
12 before our reschedule.
13 And again part of that was budget and part
14 of it was other reasons, and we have assigned a
15 dedicated staff. We have a manager, Don Beckman, who
16 is managing the KTI response process, and we have got
17 dedicated staff, that we took them out of their main
18 body of work.
19 They interact with the technical leads in
20 these areas, but that was the key to being able to get
21 these responses to the NRC in a more timely fashion.
22 This is a slide that Russ showed you
23 earlier, and I just want to point out a couple of
24 additional things on it. If you look at the left-hand
25 part of the schedule, you will see that we went for a

1 period -- mostly from October through July and August
2 -- of not submitting very much agreements to the NRC,
3 even though we had quite a few scheduled.
4 We have submitted a reschedule to the NRC
5 in June of this year, and in that reschedule there
6 were a significant number of agreements due in
7 September and October. It was actually a huge bow
8 waves. We had 39 agreements scheduled in September to
9 submit to the NRC, and 23 in October.
10 September looks really bad on this chart
11 since we only submitted seven, but all of the 39, plus
12 some additional ones, were submitted by October 3rd.
13 So we essentially met the schedule in September.
14 We were not so successful in October. We
15 were about 13 agreements behind by the end of October,
16 and we remain about 10 agreements behind. This week,
17 we are hoping to get about 25 more agreements
18 submitted to the NRC, and we are doing a thorough
19 review.
20 I think that this bundling process is
21 working, and I think that it does put things in a
22 better perspective. We got a lot of very positive
23 feedback from the NRC in the public meeting last week
24 about this approach.
25 So I think that the approach is working,

1 and we are not quite as far as ahead of the schedule
2 that I would like to be, but it is working. Okay.
3 Getting into high risk and low risk, we still have a
4 couple of big bow ways coming in the months to come.
5 We are looking at a reschedule, and part
6 of that reschedule, and part of that reason is that we
7 would like to get as many of these agreements
8 addressed completely by the summer of '04 as possible,
9 okay?
10 All of them are not going to be possible,
11 and I will give you a couple of reasons why. In this
12 schedule though, some things that tend to stick out in
13 people's minds when they see it is if you look in
14 April of '05, there is two agreements that show up
15 there, and in August of '05, there is one agreement
16 that shows up there.
17 And the question that we typically get is
18 why is it okay not to address that KTI agreement
19 before the license application, and the answer is that
20 it is not okay not to address it. The two agreements
21 in April of '05 deal with the phase stability of Alloy
22 22, and some particular testing and analysis
23 associated with that.
24 The one agreement in August of '05, the
25 reason that we had it there is because there is some

1 additional test work going on again about corrosion of
2 Alloy 22 and titanium material that the drip shield
3 will be made up of.
4 We have determined basically that we have
5 enough information to do our technical analysis and
6 safety evaluation of the corrosion resistance of Alloy
7 22 and titanium to be basis of a license application.
8 This additional ongoing test and analysis
9 work is really more of a confirmatory nature, and so
10 the schedule for these agreements is going to move up
11 substantially to be right now no later than the fall
12 of '04.
13 Other agreements that show up after
14 September of '04,we are actually trying to accelerate
15 that work as well, and with some success, and before
16 the end of the year we will submit an updated schedule
17 to the NRC, and as I have said, several of these
18 agreements are moving to the left.
19 Two other points that I want to make on
20 this chart, which is September of '05, there is three
21 NRC high risk agreements, and that I am going to point
22 out to you in the last six months or so here where the
23 NRC high risk categories exist.
24 There is 3 out of those 10 in the
25 September '04 time frame were high risk. We are going

1 to be able to accelerate those and move them back into
2 the summer or early fall.
3 There are eight high risk agreements per
4 NRC's categorization in July of '04, and that is the
5 bar that shows 25. Those eight, I believe all of
6 them, or almost all of those eight, are dealing with
7 our final TSPA model, TSPA LA.
8 So those eight agreements are probably not
9 going to come in much earlier than that to the NRC
10 because until we complete our TSPA modeling, the case
11 that we are going to use for the license application,
12 we will not be able to respond fully to those
13 agreements.
14 So it is just a matter of completing the
15 modeling work and the analysis before April to give a
16 complete response to those agreements. I think on the
17 next page, it gives you or tells you which bundles we
18 have submitted to the NRC so far, and the dates that
19 we submitted those bundles.
20 And the bundles so far, biosphere
21 transport, unsaturated zone transport, and colloid
22 transport, and separate into the drifts, water seepage
23 into the drifts.
24 If you go to the next page, volcanic
25 events since October of '03, and we didn't make it,

1 but that was submitted early this month. We have two
2 more packages that contain about 25 more agreements
3 that we plan to submit hopefully this week, but if not
4 this week, soon next week; in-drift chemical
5 environment and waste package and drip shield
6 corrosion.
7 Those are almost ready to go to the NRC
8 and they are in the review process to go out the door.
9 The next slide shows the other bundles and the dates
10 that we plan to submit those other bundles according
11 to our current schedule.
12 Again, we may accelerate some of these.
13 So we are looking to do everything that we can to do
14 that as long as we don't sacrifice the quality of the
15 work.
16 The next slide is just a graph and the NRC
17 staff actually came up with this graph, and everything
18 except the second numerical column says agreement
19 submitted to the NRC.
20 So if you will forget that column, and I
21 think it is in blue. The rest of these columns are
22 all mutually exclusive, and the list down in the first
23 column, it is just the acronym that we use to describe
24 the agreements.
25 For instance, the first one is container

1 license source term. If you move to the right, and I
2 will go down to the bottom, there is 293 total
3 agreements. There is 64 of those agreements that have
4 been submitted to the NRC and we are waiting for a
5 response from them.
6 I am not complaining because they have got
7 a lot very recently as you saw in those previous
8 charts. Partial responses have been submitted on 21
9 of the agreements.
10 The NRC has asked for additional
11 information that we have not provided yet on 27
12 others, and responses are remaining to be submitted on
13 101 agreements, and on 80 the NRC has agreed are
14 complete. So to give you an idea of where we stand.
15 Okay. I am going to shift focus now and
16 talk a little bit about the design. I am not going to
17 go into much detail though, but I want to just point
18 out a couple of features.
19 CHAIRMAN GARRICK: Before you shift there,
20 it is sometimes very difficult to develop a real
21 understanding of what is ahead of you on the basis of
22 just a numerical evaluation of the agreements. Have
23 you made any attempt to look at them in terms of their
24 scope, and weight them in some fashion so that --
25 because there are some agreements that are much more

1 complicated than dozens of other agreements combined.

2 MR. ZIEGLER: Well, actually we have a

3 detailed schedule for every agreement, and we have

4 been looking to accelerate those schedules. Sometimes

5 the original schedules included more work than was

6 necessary, such as some of those corrosion agreements

7 that I showed you that are on our current schedule.

8 As far as an absolute risk ranking, the

9 way that the NRC staff did, no, we have not done that.

10 We did agree to go back and look at the NRC high risk

11 rankings, and if we didn't consider them high risk,

12 and to determine whether we also considered them

13 relatively higher on the risk levels.

14 And if we don't, then to try and come up

15 with an explanation of why we consider it that way

16 differently than the NRC staff does. I guess one of

17 the difficulties is this, and on how many of the

18 actual agreements you have looked at.

19 You know, some of them sound very simple.

20 I mean, most of them sound very simple, provide this

21 additional information. But in many cases there is

22 something behind that other than just provide that

23 additional information.

24 So what we have found through our

25 submittals is that even the ones that sound relatively

1 simple, sometimes they are not.

2 CHAIRMAN GARRICK: Right. Right. Well,

3 some of them certainly require -- some of them are

4 just simply documentation, or a lot of them are

5 documentation, but some of them require some real

6 technical work.

7 MR. ZIEGLER: All of the technical work to

8 resolve all of the agreements is in progress, and it

9 is in our schedule and in our plans. In some of the

10 areas here, some of these agreements are looking at

11 things that typically would not be looked at until we

12 were an applicant.

13 In other words, there are technical issues

14 associated with the way that we do an analysis, and so

15 in some of these our technical staff, the laboratory

16 technical staff typically are the people doing this

17 work, and believe that we have adequate or more than

18 adequate information to address not just the

19 agreement, but the inputs to the safety analysis.

20 You know, the topic of that agreement, and

21 so we go back, and we make sure that our models are

22 validated according to the quality assurance program,

23 and all the requirements and criterions were in

24 Supplement 3 to our Quality Assurance Program, which

25 talked about the validation of models and data, and we

1 have to make some judgments.

2 And sometimes there are some legitimate

3 technical differences of opinion with the NRC

4 technical staff, and we need to work through those.

5 And what we have seen here with the KTI agreements is

6 that process really has been started earlier than is

7 typically done in a licensing proceeding because of

8 various reasons about the law associated with the

9 repository, and the NRC having to make some

10 determinations of sufficiency leading into the site

11 recommendations, and that is legitimate things to do

12 early.

13 And what I would like to do is to get as

14 many of these resolved before the license application

15 as possible, whether they be high risk, or medium

16 risk, or low risk, or whatever risk terminology that

17 we use, because in order for the NRC to be able to do

18 a 3 year review of a license application, which we are

19 hoping we will be able to do, we want to facilitate

20 their knowledge of the way that our safety analysis

21 works. That is a long answer to a short question, but

22 --

23 CHAIRMAN GARRICK: Joe, just for

24 clarification, you are moving into design evolution

25 now?

1 MR. ZIEGLER: Yes.

2 CHAIRMAN GARRICK: Now is that still in

3 the 11:10 to 12:15 category that is on our program, or

4 is that jumping into the repository design status?

5 MR. ZIEGLER: The same category. Paul

6 Harrington will go into much more detail this

7 afternoon.

8 CHAIRMAN GARRICK: Oh, okay. So we are

9 still in the morning session?

10 MR. ZIEGLER: We are still in the morning

11 session.

12 CHAIRMAN GARRICK: Okay.

13 MR. ZIEGLER: And we will go to that

14 surface facility design here. I just wanted to make

15 a few points, and I can answer some questions, and if

16 we get into a lot of detail, I may have to defer to

17 Paul.

18 But I just wanted to kind of present where

19 we have been and where we are going, and what that

20 means as a matter of change, or refinement, or

21 evolution, or whatever terminology that you want to

22 use.

23 At the time of the viability assessment,

24 which was in the late 1998 or early '99 time frame, on

25 the surface facilities, we were looking at one single

1 large building. We were looking at wet handling of
2 the commercial spent fuel, and we were looking at five
3 individual transfer lines through that facility, where
4 we could move different elements of fuel in the
5 packaging in five different transfer lines.
6 At the time of the site recommendation, we
7 were still looking at a single large building, and not
8 quite as large. We were still looking at wet handling
9 of the commercial spent fuel.
10 We had cut it down to three transfer lines
11 because we were able to do a little bit of
12 optimization of the through put even though it was
13 kind of a preconceptual design. And we were looking
14 at 5,000 metric tons of storage capacity, or what we
15 call blending pools, within that facility.
16 And that was made necessary because of the
17 high temperature and low temperature issues associated
18 with the maximum temperature that would be reached in
19 the subsurface repository after it was closed.
20 And in order to do that, we needed to be
21 able to mix and match different fuel elements of
22 different heat outputs so that we could even that up
23 throughout the repository.
24 In the design that we are working on now
25 for the license application, the same functions are

1 basically there, but we have refined things and
2 optimized some things more as far as operational
3 facilities.
4 There are multiple buildings. We are
5 looking at a dry transfer facility, and possibly two
6 dry transfer facilities. Typically, almost identical.
7 We are looking at a canister handling facility, which
8 would be able only to handle canisterized materials.
9 So the DOE material we expect to come to
10 Yucca Mountain will all be in canisters before it gets
11 here. Right now we don't have a definite path forward
12 for multi-purpose canisters, but this facility would
13 be able to handle multi-purpose canisters.
14 We have not ruled that possibility out,
15 okay? So if we are able to load commercial fuel into
16 multi-purpose canisters, and then we run it through
17 this canister handling facility, and the beauty of
18 this facility is that it is a simpler operation.
19 It is clean, and there is no radioactive
20 contamination at all, because we never handle bare
21 spent nuclear fuel. In addition, we wet aside an area
22 for a shielded canister transfer, and we are still
23 considering that. We don't have the design on that
24 done, but it is a relatively simple facility.
25 That if we could shield the canisters, or

1 multi-purpose canisters with shield plugs in them,
2 then we could go through a fairly simple operation to
3 put those canisters in a waste package, and add a weld
4 cell to the shielded canister transfer.
5 The beauty of having a shield plug in
6 multi-purpose canisters is that we could do contact
7 welding, and that simplifies the issues associated
8 with remote welding. It is not that it is not
9 possible or feasible, but it is a slow operation at
10 best.
11 If we could do contact welding and contact
12 examination of those welds, we could actually get a
13 lot more through put through the process. So those
14 are the types of things that we are looking at and the
15 difference.
16 We are also looking at phase construction
17 of these different facilities so that they are not all
18 going to be available on day one. The next slide
19 talks about the subsurface repository evolution, and
20 again where we were at the time of the viability
21 assessment there was very close drift spacing.
22 Drifts got to be 18 foot diameter drifts,
23 and 92 foot spacing center to center between the
24 drifts. The entire repository area would be above the
25 boiling point of water for some period of time at the

1 closure of the repository for a couple of thousand
2 years at least.
3 It was on one single level, and there was
4 minimal ventilation. We really weren't trying to keep
5 the temperatures down at that point in time.
6 The site recommendation looked at a modified approach.
7 There was comments by external review
8 bodies and others and so we modified our approach.
9 And there was 266 foot drift spacing center to center,
10 and the rock between the drifts, the emplacement
11 drifts, would be kept below the boiling point of
12 water.
13 At least half of the rock between the
14 drifts would stay below the boiling point of water.
15 So it sets that. If water were pushed away from the
16 drift, that there was a place where it could drain in
17 between down through the rock.
18 There were two levels, an upper
19 emplacement level on the left, and a lower block on
20 the right. A robust, forced ventilation system was
21 built into the system as long as the repository was
22 open, and we were seriously considering leaving the
23 repository open longer and using natural ventilation,
24 and with not much design effort, we could have natural
25 ventilation circulation through the repository for

1 quite a long time.

2 In our license application design, there

3 has been optimization. The subsurface basically has

4 been divided up into panels, and it facilitates

5 development of part of the subsurface before other

6 parts.

7 We still have the 266 foot drift spacing.

8 We still have the sub-boiling temperatures, at least

9 in a portion of the rock pillars that would provide

10 drainage through that part of the pillar so that the

11 water wouldn't congregate above the drifts and stay

12 there during the period of higher temperatures.

13 It is on one level, and again we have the

14 robust forced ventilation system as long as the

15 repository is open. We are not taking credit in our

16 current modeling for any natural ventilation. So that

17 is not a factor that we are going to build into the

18 license application or that we plan to.

19 Actually, this layout results in a little

20 bit less excavation in the layout in the middle, but

21 still gives us the same area in spacing, and that is

22 just because of some optimization of the accesses.

23 If you go to the next slide, we will talk

24 a little bit about the waste package design evolution.

25 At the time of the viability assessment, we were

1 looking at an outer barrier or an outer layer of the
2 waste package being carbon steel.
3 A corrosion allowance barrier I think was
4 the term that I think that we were using at the time.
5 There was an inner barrier of the very corrosion
6 resistant Alloy-22, and we were looking at a heat
7 output limit, a maximum for each waste package of
8 being about 18 kilowatts.
9 And in the site recommendation, we kind of
10 flip-flopped the barriers, where the corrosion
11 resistant barriers were Alloy 22, and stainless steel
12 as the interstructural part of the waste package, and
13 11.8 kilowatt maximum power output per waste package,
14 and again that was to levelize the heat load so that
15 we could keep maximum temperatures in the subsurface
16 below boiling in at least part of the drifts forever.
17 We extended the outer lid a little bit,
18 and we changed the -- we have a split training collar,
19 and the only reason that I mention that is because it
20 is a change in the design that we have got now.
21 In the license application design, it is
22 really functionally not any different as far as long
23 term performance of the repository. It is still
24 Alloy-22 on the outer barrier, and it is an inner-
25 barrier of stainless steel with 11.8 kilowatt output

1 maximum per waste package.

2 There is a flat outer lid, and we have
3 done some optimization of that outer lid
4 configuration. There is still three lids, but we have
5 simplified the welding configurations because there
6 were some issues about doing some deep penetration
7 remote welding, and this is just a more efficient way
8 to do things.

9 We also sped up throughput through the
10 system, and we got a one-piece twist-on trunnion
11 collar that will twist on the ends of the waste
12 package. To summarize, we are completing the actions
13 to achieve progress and address the longstanding
14 management quality assurance issues that I mentioned,
15 the data quality in models.

16 The NRC is monitoring our performance, and
17 we are not quite where we need to be to be a licensee,
18 but we are headed in the right direction. DOE still
19 plans to submit a complete license application to the
20 NRC in December of '04, and we are well on the way to
21 do that.

22 We have some issues on the way as any
23 large complex project does, and we have so far been
24 able to successfully resolve those issues, and when we
25 get behind schedule to work our way back on schedule.

1

2 An integrated approach is being used to
3 address the KTI agreements, and this bundling
4 approach. We provided responses to 75 agreements
5 since September. There are going to be another 25
6 that hopefully go out this week.
7 The remaining agreements will all be
8 addressed prior to license application submittal. The
9 work, post-submittal of the application, we believe
10 will be more confirmatory in nature, and ongoing test
11 and analysis work will go on for the foreseeable
12 future in the areas of -- and I don't see an end to
13 corrosion testing ever until we close the repository.
14 And design is maturing towards the final
15 basis for the license application. So as we move
16 forward, we get more and more detail. So with that,
17 I will open it up to questions.
18 CHAIRMAN GARRICK: Thank you. Mike.
19 VICE CHAIRMAN RYAN: Not right now. I
20 will wait until the afternoon.
21 CHAIRMAN GARRICK: Okay. Jim, do you have
22 any questions?
23 MR. CLARKE: Your design component, that
24 is now 40 percent complete?
25 MR. ZIEGLER: Yes.

1 MR. CLARKE: That would include both
2 surface and subsurface design?
3 MR. ZIEGLER: Surface, subsurface, and
4 waste package. Now, let me explain.
5 MR. CLARKE: And the waste package?
6 MR. ZIEGLER: Forty percent. Now, 40
7 percent of the design level that is necessary to do an
8 adequate safety analysis, which is the way that we
9 read Part 63, and so it is 40 percent of that level of
10 design.
11 MR. CLARKE: Okay.
12 CHAIRMAN GARRICK: Ruth.
13 DR. WEINER: On your risk granting slide,
14 could you put that up.
15 MR. ZIEGLER: Yes.
16 DR. WEINER: Ont he aircraft crash, are
17 you talking about the risk -- and I assume that this
18 was risk ranking for the repository itself and not the
19 surface facilities?
20 MR. ZIEGLER: No, no, no. Surface. There
21 is no risk in the repository.
22 DR. WEINER: With the repository. Okay.
23 Are you talking about the risk of the crash, the risk
24 of a release, or risk to public health, or all of
25 those, or some of those?

1 MR. ZIEGLER: It is a judgment factor, and
2 if you look at the way that the NRC staff did their
3 risk ranking, it was a combination of this. I would
4 say it is a combination, but so far this is just a
5 judgment factor, and that part of it is that we know
6 that this has been a controversial licensing issue,
7 another licensing proceeding such as at PFS.
8 So the amount of detail and information
9 that is required to do this analysis we think gives us
10 some licensing risk. So we will probably do more than
11 maybe the regulations explicit call for just to make
12 sure that we can get through the licensing process.
13 I think the NRC staff is also going to
14 look at that very deliberately. As far as the risk to
15 individuals, if you put the probability of the crash
16 into the risk, the probability of an aircraft crash
17 hitting the repository surface facilities is very low.
18 DR. WEINER: Well, that was my next
19 question. When you are talking about risk on this
20 chart, you are talking about risk to the licensing?
21 MR. ZIEGLER: It is risk to the licensing,
22 but it is also in this particular instance is the
23 regulations are pretty clear. You know, if something
24 has a 1 in 10,000 chance of occurring over the period
25 of operation of the surface facilities, and we have to

1 consider it.

2 One of the elements of our design, and I

3 didn't mention this, and Paul will go into it in more

4 detail, is an aging area, such that certain parts of

5 the spent fuel will be aged in surface containers.

6 When you look at the square footage of

7 that area, along with the square footage of the other

8 surface facilities, and then we look at the

9 probability of an aircraft crash, it may or may not be

10 -- and we are still trying to tweak the analysis. We

11 are getting some updated information from the Air

12 Force, the Air Force Base right next to us.

13 And it may or may not be above or below 10 to the

14 minus 6 per year.

15 DR. WEINER: So are you actually doing or

16 have you performed a vulnerability analysis for your

17 surface facilities?

18 MR. ZIEGLER: Consequence analysis, or

19 just the probability?

20 DR. WEINER: A risk analysis.

21 MR. ZIEGLER: We have done the probability

22 analysis. I mentioned in September that we completed

23 at least a draft of the probability analysis of a

24 crash into the surface facilities.

25 We are still looking at what the optimum

1 area for the aging facility would be, and when we
2 count the aging area in that probability, it is close
3 to 10 to the minus 6. We have not done a consequence
4 analysis except in the EIS of an actual crash into the
5 surface facilities.
6 We don't think that the aging facility --
7 well, probably where we are going to go is that any
8 aging facilities that we have there, we will probably
9 design them to withstand an aircraft crash.
10 DR. WEINER: And you have submitted your
11 probability analysis to the NRC?
12 MR. ZIEGLER: Yes, we have.
13 DR. WEINER: Okay. The other questions
14 are kind of more general than this. How did your
15 codes, your PA codes, compare to other performance
16 assessment codes, like the performance assessment done
17 for the waste isolation pilot plant, for example? Do
18 you use qualified -- to what extent do you use already
19 qualified codes in your performance assessment?
20 MR. ZIEGLER: To the extent that we can.
21 A lot of the same people worked on that at Sandia and
22 others, you know, with our project, are working on our
23 codes as well.
24 One of the things is that I believe that
25 the NRC regulatory process is more rigorous than

1 anybody else's. So one of the issues has been not
2 whether the code is qualified, but whether it is
3 qualified consistently to our quality assurance
4 program that has been accepted by the NRC.
5 So that while some of those codes may have
6 been qualified at other places, sometimes that still
7 presents a problem in the qualification of that code
8 for our application. So to the extent that that
9 qualification information exists, we are using it.
10 Sometimes we have to supplement that
11 qualification activity quite often, but all of the
12 codes that support the safety analysis will be
13 qualified before we submit a license application.
14 DR. WEINER: And you will then be
15 qualified to satisfy the NRC?
16 MR. ZIEGLER: Yes, to satisfy our quality
17 assurance program and the Nuclear Regulatory
18 Commission, yes.
19 DR. WEINER: Okay. And finally, and this
20 is a short one, do you have public buy-in of the
21 licensing support network?
22 MR. ZIEGLER: Public buy-in of the
23 licensing support network? I am not sure that I
24 understand the question.
25 DR. WEINER: Well, I have been away from

1 that whole area for quite a long time, more than a
2 decade, but as I recall, the purpose, the original
3 purpose of the licensing support network, which was
4 then called the licensing support system, was to
5 provide a record of public input other than DOE and
6 the NRC to the licensing process.
7 And I just wondered if currently the way
8 the licensing support network is configured, if you
9 have had public buy-in, and public acceptance of that
10 configuration.
11 MR. ZIEGLER: Okay. Let me tell you my
12 understanding of LSN, and I am not an attorney,
13 because every time we talk about LSN, I always want my
14 attorneys to do the talking instead of me.
15 As I believe the regulations call for the
16 licensing support network to basically be for
17 discovery during the licensing proceedings. So those
18 bodies that participate in the licensing proceedings
19 have the licensing support network, and it was to
20 facilitate that legal discovery process.
21 My understanding is that the Atomic Safety
22 and Licensing Boards actually are the owners and the
23 definers of what the licensing support network is, and
24 not DOE. DOE, as other parties to the proceedings,
25 must provide input to that system.

1 That said, there is something called the
2 licensing support network advisory review panel that
3 is chaired by Dan Graser, right, or by the NRC staff.
4 And we are a party to that, and the State
5 of Nevada is a party to that, and other interested
6 parties participate on that advisory review panel, and
7 that advisory review panel has quite a bit of standing
8 in defining the make-up and the content of the LSN.
9 So I guess I am begging off and saying
10 that is an NRC responsibility. We participate as
11 other stakeholders do.
12 DR. WEINER: And thank you for the
13 explanation.
14 CHAIRMAN GARRICK: Joe, I wanted to ask
15 you a couple of things. In your decision in your
16 surface facility, they go to dry handling.
17 MR. ZIEGLER: Yes.
18 CHAIRMAN GARRICK: I can certainly
19 appreciate when you have a high inventory of very aged
20 fuel that this is a very rational approach, and that
21 it makes for a lot easier handling activities.
22 On the other hand, if the repositories
23 every catch up with the inventory of spent fuel, and
24 the reactor sites decide that they want to get out of
25 the on-site storage business completely, doesn't this

1 impose a requirement on the generators downstream to
2 be in the storage business more than perhaps they want
3 to be?
4 MR. ZIEGLER: It might, but there are some
5 options out of that, you know. One of the things
6 would be if DOE could develop a reasonable multi-
7 purpose canister to provide to the utilities, then it
8 would facilitate our ability to handle it at the
9 repository, and in our current configuration, we could
10 handle those canisters without ever handling the bare
11 fuel again.
12 Or we could put them in our aging area if
13 there was a heat output issue with them. But it would
14 either require an additional burden on the utilities,
15 or an additional burden on us.
16 CHAIRMAN GARRICK: I guess part of the
17 question is was there an evaluation made? Was there
18 interaction with the generators on making that
19 decision?
20 MR. ZIEGLER: I don't believe that there
21 has been a lot of interaction with the utilities on
22 that. There is some legal issues between us and the
23 utilities.
24 CHAIRMAN GARRICK: Okay. One of the
25 things that we are always looking for in these kinds

1 of presentations on programs and program status is
2 what are the real schedule controllers?
3 If you had to delineate your top 10 list
4 of issues, and I am thinking that some of these issues
5 are not so complicated, but may have a great deal of
6 uncertainty associated with them because of budgeting
7 and other issues.
8 Are we going to get any sense of what your
9 top 4 or 5 of 10 list is as far as being in a position
10 to give the license or give the NRC a good license
11 application at the end of 2004?
12 MR. ZIEGLER: Okay. I'll try. It is off
13 the top of my head, and I sort of tried to do that in
14 what you see in this presentation. I personally think
15 the biggest ones are resolving these quality assurance
16 issues, and which in theory would be the simplest
17 things to do, but in practice, we have had problems
18 getting these issues resolved.
19 And particularly in the area of model
20 development, which I think is coming along nicely now,
21 and is very close to closure. The data qualification,
22 particularly the old data sets, and in the software
23 development.
24 They have been longstanding issues that
25 this project has not yet totally resolved. But I

1 think that there is an end in sight.

2 Technical issues. The KTI agreement and

3 the process itself I think is one that we have to pay

4 particular attention to, to make sure that we have

5 addressed them adequately.

6 Basically, our models and the validation

7 of our models should be adequate to deal with the

8 questions that are the subject of the KTI agreements.

9 And this integration, the technical bases

10 that we are doing, and not just how a repository

11 works, but how these particular agreements fit into

12 that structure, and this consolidation, it is truly an

13 integration effort on our part.

14 I think that was one of our key issues,

15 and I think that one is well in hand now, too. It

16 probably hasn't been probably up until 6 or 8 months

17 ago. Let me think if there are any technical issues.

18 CHAIRMAN GARRICK: Are there any major

19 issues associated, say, in the near field with respect

20 to source term issues that you see as very high on

21 your list?

22 MR. ZIEGLER: I think certainly the end

23 drift chemical environment, although if you have been

24 following the NWTRB meetings or not, I think the issue

25 of the maximum temperature subsurface.

1 Right now our application, we plan to go
2 into our application with a repository for a period of
3 time that will be above the boiling point of water.
4 Okay. Not all the rock between the repository drifts.
5 I think that the NWTRB's recent letter,
6 and you have seen our response to that letter, and we
7 don't fully agree with the NWTRB, but that will be an
8 issue that will probably remain with us that we will
9 have to deal with, not just in that arena, but in the
10 regulatory arena with the NRC and the licensing
11 process.
12 So we are continuing to work on that area
13 to better define the end-drift chemical environment
14 that will exist, and how that might affect waste
15 package corrosion.
16 I think that one of the keys to our
17 analysis though is the probability of any of those
18 extremely harsh environments existing, and enduring in
19 a natural repository environment.
20 And there seems to be a difference of
21 opinion between DOE and the NWTRB on that. That is
22 what comes to mind. There is probably others with
23 design. We were substantially behind where we wanted
24 to be on the design effort, and so the work, just the
25 physical work required to complete the level of design

1 necessary to do an adequate safety analysis.

2 And then integrate the design work with

3 the safety analysis work, and in an ideal situation,

4 we would like to have 2 or 3 rounds of iteration of

5 the design, the safety analysis, and if we tweak the

6 design and do this minor change, will it avoid a

7 potential safety issue.

8 And so we are having to do a lot of work

9 in parallel. So, we are really going to be loaded

10 pretty heavily come the spring and summer of next year

11 trying to make sure that if that iteration happens

12 that it is going to happen a little later in the

13 process than what we wanted it do.

14 CHAIRMAN GARRICK: My final comment has to

15 do with license application schedule uncertainty. We

16 have all experienced in flying around the country what

17 I call the airline schedule syndrome, delay syndrome,

18 where they keep the monitors that is telling you that

19 they are on time until 10 minutes before flight time,

20 and then suddenly there is a several hours delay.

21 Is there an airline schedule delay

22 syndrome associated with this project that we are

23 going to observe? And maybe another way to ask it, I

24 am a great believer in uncertainly analysis.

25 Is there any effort going on to quantify

1 if you wish the uncertainty of the license application
2 schedule?
3 MR. ZIEGLER: No, not to quantify it. We
4 talk about it a lot, and we talk about our problems,
5 and we have critical path meetings every two weeks
6 that go into infinite detail.
7 You know, I think we are going to make it.
8 I think that the work required, and I think I laid out
9 the issues here to you today that are most of the
10 things that could prevent that from happening that are
11 in our control.
12 There are some things, of course, that are
13 not in our control. If you look at the site
14 recommendation schedule, which I think that was
15 relatively optimistic, I don't think we made it, but
16 I think we came within 6 or 8 months of that schedule.
17 And there were some external driving
18 forces that kept us from meeting that schedule. So as
19 far as the physical work activities, and the design
20 activities, the safety analysis activities, I believe
21 we are on track to make it.
22 One thing, and I will just point this out,
23 is the way that we have built our schedules is that we
24 have scheduled the safety analysis work to be done in
25 the summer of next year.

1 If some of that work gets delayed, and if
2 it gets delayed in a matter of months, a couple of
3 months, there still is time to get the license
4 application put together. I mean, the license
5 application could be put together with holes in it,
6 and that is not the way that we want to do it
7 internally.
8 That is not the way that we want to do it
9 and trying to fill those holes at the end, but there
10 is a possibility, and there is some area there that if
11 there are pieces, small pieces, that don't get
12 complete in June of '04, that we could still recover
13 if it gets done in July or August of '04, and still
14 make the 12/04 license application date.
15 So while we don't show any contingency in
16 our schedule right now, we were showing negative flow
17 for a while in our monthly meetings that we do, and in
18 our critical path.
19 That float in our schedule today is zero.
20 That is not a good place to be. There is on
21 contingency. But the way that we built our schedules
22 for all the technical work to be done earlier, and to
23 give us 6 months to actually the application itself
24 nailed down in its final form.
25 So I believe that there is some time to

1 get there. I am fairly confident that unless some
2 unknown factor comes in beyond our control, that the
3 physical work to get this license in by 12/04 will be
4 completed.
5 CHAIRMAN GARRICK: Very good. Are there
6 any questions? Yes. Ruth.
7 DR. WEINER: Yes, one more quick one. I
8 noticed on your KTI schedule that you have two
9 agreement scheduled for January of 2005, and two for
10 April of 2005, and one in August, and I understood you
11 to say that those have to d with corrosion testing.
12 Could you expand on that a little bit?
13 Are those confirmatory tests to confirm other
14 corrosion tests so that when the corrosion KTIs are
15 resolved that you are fairly confident that you can
16 meet the licensing requirements?
17 So are those confirmatory or those just
18 further tests, or what?
19 MR. ZIEGLER: Yes, they are absolutely
20 confirmatory, and I think that I mentioned that we
21 were going to move the schedule on those agreements
22 up.
23 The testing will continue, but the testing
24 really of a confirmatory nature, and the testing and
25 analysis associated with those test results are more

1 confirmatory.

2 We believe that we have an adequate basis

3 based on the existing data and analyses to validate

4 our models and to assure that the safety analysis

5 meets all of the requirements.

6 So it is confirmatory, and those

7 agreements we believe that we are going to move into

8 the late summer or early call time frame as far as our

9 submittal.

10 The agreements themselves didn't or aren't

11 so specific that this particular testing has to be

12 done. It is when we originally scheduled this work,

13 or when we originally came up with the work that we

14 were going to do to resolve the agreement, we believe

15 now we went beyond what it requires to resolve those

16 agreements. So it is entirely confirmatory in nature.

17 DR. WEINER: Thank you.

18 CHAIRMAN GARRICK: I think we have a

19 question down there. Sher Bahadur.

20 MR. BAHADUR: Joe, I had a question on

21 your Slide 20, when you talk about the evolution of

22 the subsurface repository.

23 MR. ZIEGLER: Yes.

24 MR. BAHADUR: You mentioned that the DOE

25 during the viability assessment considered single

1 level, that turned to two levels in the recommendation
2 phase, but then again came back to one level. Do you
3 know that factors that led you to go from 1 to 2, and
4 then back to 11 again?
5 MR. ZIEGLER: Well, I am going to look out
6 and see if any of my zoologist friends are here. I
7 know that Mark Board is going to be here tomorrow, and
8 he may be able to address that better than I could.
9 But, no, I personally do not.
10 MR. BAHADUR: Okay.
11 MR. ZIEGLER: Is there anybody out in the
12 audience that can help? Paul Harrington said that he
13 can address that this afternoon.
14 MR. BAHADUR: Okay.
15 CHAIRMAN GARRICK: Neil Coleman.
16 MR. COLEMAN: Neil Coleman, ACNW staff.
17 Mr. Ziegler, there was an event in the last 36 hours
18 that relates to your slide 9 under aircraft crashes.
19 I noticed that the local morning news reported that an
20 A-10 Warthog had crashed in the Nellis Range. The
21 pilot fortunately survived.
22 MR. ZIEGLER: Yes.
23 MR. COLEMAN: They also had a report about
24 this kind of aircraft type that -- and I don't know
25 how accurate this is, but they said that nine had

1 crashed in Southern Nevada.

2 But specifically about this one that just

3 happened, could this require an update of your

4 probablistic risk assessment for aircraft crashes?

5 MR. ZIEGLER: Well, I don't know if that

6 particular event would, but we were in the process of

7 doing that update anyway, and we are working with the

8 Air Force on their future plans for flight activities.

9 Paul may be talking about this this

10 afternoon, too. I know that the Air Force, and I know

11 that we have been working on the no-fly zone around

12 the repository, and actually the Air Force volunteered

13 that.

14 So we will update the probability analysis

15 of aircraft crashes before the license application,

16 and we will use the latest available information int

17 hat analysis.

18 CHAIRMAN GARRICK: Okay. I wanted while

19 there was still some senior management of DOE here to

20 at least express our appreciation to DOE for how they

21 not only supported our meetings but especially our

22 working group sessions.

23 As you know the working group sessions

24 become a very valuable resource for nurturing our

25 knowledge about some of the most important issues, and

1 DOE has been very cooperative in making resources
2 available for those, as well as for the meetings, and
3 we want to thank you for that.
4 MR. ZIEGLER: Thank you.
5 CHAIRMAN GARRICK: Are there any other
6 questions at this point, which means that we are very,
7 very much on schedule. And we will look forward to
8 resuming our meeting at 1:30. And until then, we are
9 adjourned.
10 (Whereupon, at 12:12 p.m., a luncheon
11 recess was taken.)
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1 A F T E R N O O N S E S S I O N

2 (1:30 p.m.)

3 CHAIRMAN GARRICK: The meeting will come
4 to order. We are now going to hear about repository
5 design status, and the committee member that is going
6 to take the lead in the discussion will be Mike Ryan.
7 VICE CHAIRMAN RYAN: Thank you, Mr.
8 Chairman. We are going to hear some presentations
9 this afternoon on various aspects of the design update
10 in a little bit more detail than we heard this
11 morning, I think, and to start us off, Paul Harrington
12 will give an overview presentation, and perhaps
13 introduce the topics and other speakers for the
14 afternoon session.
15 We are going to have an initial discussion
16 I think, and then a short break will interject between
17 the first and the second presentations; and then we
18 will go on from there after a short break. So, Paul,
19 without further ado, let me ask you to lead us through
20 this afternoon's session.
21 MR. HARRINGTON: Okay. I am Paul
22 Harrington, and I am the DOE Systems Engineering Lead.
23 And what we wanted to talk through with you today was
24 the current status of the design, but also weave
25 throughout it the results of the recent preclosure

1 safety analysis that we have done.

2 That has been the first time that we have

3 actually run the PSA process, and we had done an

4 earlier assessment, but this one was the first time

5 that we have actually run through the PSA as a

6 quantitative result.

7 So that is woven throughout the

8 discussion. I had actually planned on doing the

9 presentation, all of it, myself. But obviously it is

10 a very broad range of topics, and because of that I

11 have four gentlemen here to help support and answer

12 questions.

13 Dennis Richardson is the Bechtel FCIC

14 preclosure safety analysis manager. Preston McDaniels

15 is the BSE Surface Engineering Lead. Mark Board is

16 the BSE subsurface engineering lead. And Mike

17 Anderson is the BSE waste package lead.

18 And the bulk of the presentation is on the

19 surface and that is where we have done the most work

20 recently. It is really most subject to update, and

21 then we will take a short break after that, and then

22 do the waste package and subsurface after that.

23 Okay. We have gone ahead and done the

24 preliminary PSA, and as I said, it is important to

25 publish --

1 VICE CHAIRMAN RYAN: If you could just
2 pull that microphone up a little bit so that everybody
3 can be sure to hear you. Thank you.
4 MR. HARRINGTON: Okay. It is important to
5 note though that that is certainly not the completed
6 set of design that will be needed to support the
7 license application. So the work that we are doing in
8 the design side of the house from now until early next
9 year is to add that additional detail to support the
10 license application.
11 That means that we will need to rerun the
12 preclosure safety analysis on that design update. The
13 surface facilities, the most significant changes there
14 are as a result of implementing some Cogema input that
15 we have gotten, and also breaking it into a number of
16 separate facilities.
17 I think the last briefing you had showed
18 a series of buildings on the surface, but we have
19 somewhat changed what goes on inside those buildings,
20 and we will talk through that.
21 On the subsurface, the layout has changed
22 somewhat, and we have made some changes in the ground
23 control, ground support primarily. The waste package
24 is really relatively unchanged. There is some
25 detailed changes primarily in the closure head that we

1 will go ahead and talk through.

2 The preclosure safety analysis approach to
3 recap, we look at the internal and external events to
4 identify what hazards may be that the facility has to
5 withstand, and we will go ahead and do categorization
6 analyses to look at the potential frequency of those
7 event sequences.

8 And then we will do the consequence
9 analyses to estimate the dose to both the public and
10 the workers as a result of those event sequences, and
11 then we have to do classification analyses that will
12 identify which of those system structures and
13 components, SSCs, are important to safety.

14 And then finally we are preparing
15 something called a nuclear safety design basis
16 document, and that captures the design requirements.
17 There has been some confusion in the past as to what
18 that document represents, and whether or not that is
19 PSA directing the design organization to specific
20 designs.

21 It's real intent is that it has captured
22 the design basis that the design organization had used
23 in their original design, and that was used by the
24 preclosure safety analysis group so that that design
25 basis won't be inadvertently changed. That is the

1 point of that document.

2 The preliminary PSA was done based on

3 April '03 design, and the results of that are going to

4 be taken into consideration as we continue the design

5 evolution to support the LA.

6 Primarily that identified certain

7 components that are important to safety, and so the

8 design organization will include the necessary

9 redundancies and other features in the components

10 during the detailed design of those components, and we

11 will talk through a little later what those types of

12 SSEs were that are ITS, and important to waste

13 isolation also.

14 Again, we will need to redo the PSA prior

15 to submitting the license application based on the

16 conclusion of the LA design. We don't expect there to

17 be significant differences though as a result of

18 completing the design for LA and rerunning the PSA.

19 The kind of functions that the PSA looked

20 at based in the April '03 design are really very

21 similar and are going to be the same in the additional

22 set of facilities.

23 I will talk a little later about what the

24 PSA will need to pick up. This first version, for

25 example, there was no canister handling facility,

1 which will be something that will be added.

2 It also was on a smaller aging pad, and so

3 the results of a larger aging pad will have to be

4 incorporated into it. Looking at the surface

5 facilities themselves, again, it picks up the design

6 input from Cogema.

7 They have a lot of experience from

8 operating the La Hague facility. Some portions of

9 that are wet, and some portions of that are dry, in

10 terms of fuel transfer.

11 We have adapted those design solutions for

12 the Yucca Mountain facilities, and some of the recent

13 changes in the surface facilities are the addition of

14 a transportation cask for receipt facility with a

15 buffer area.

16 That really comes out of -- and

17 particularly the buffer area, comes out of the Cogema

18 experience. They had a fairly standardized national

19 transportation system.

20 So they were able to take transportation

21 casks and their supporting appertances off of the

22 national transportation conveyance, and put it on to

23 a site conveyance, and use that effectively as staging

24 prior to going into the waste transfer facilities

25 themselves. We are adopting that concept also.

1 A canister handling facility. As Joe
2 mentioned briefly, that is a facility that would allow
3 transfer of sealed canisters from a transportation
4 cask to a waste package, or to an on-site storage cask
5 if we needed to send something out to the aging pad.
6 That could be built we think quicker than
7 an entire dry handling facility, dry transfer
8 facility, because it is simpler. It is a little bit
9 smaller. We have also integrated the remediation
10 capability that previously had been in a separate
11 building, and into the dry transfer facility one, DTF-
12 1.
13 There is a second dry transfer facility
14 that would be built following DTF-1. Earlier that had
15 been a larger building than DTF-1. It had a larger
16 through put capacity, given the through put analyses
17 that we have been doing, plus the addition of the
18 canister handling facility.
19 It does not look like that there is a
20 reason or a need to have the second DTF have a
21 different through put capacity, having it be
22 effectively a mirror of the first one simplifies
23 design and construction also.
24 The processing is primarily dry now.
25 There is a small pool for remediation of fuel

1 assemblies or other items that might need that. Dr.
2 Garrick, you had a question for Joe about the
3 potential impacts of dry handling on utilities.
4 The standard contract that we have with
5 the utilities defines several criteria. One of them
6 is that standard fuel will be at least 5 years old.
7 So we are designing our facility around 5 year old
8 fuel.
9 We have also implemented some other
10 parameters that we think are quite bounding for the
11 types of fuel that the utilities would be generating
12 in the future, and we will be using that as the basis
13 for our facility design.
14 So we don't see that the change from a wet
15 to a dry transfer capability inside of our facility
16 would really have an impact on that standard fuel
17 definition, or the ability of utilities to ship to the
18 repository.
19 Also, we have gone back to a rail-based
20 transportation for emplacement. The handling on the
21 surface between the several buildings will be rail-
22 based. Earlier, we were moving to a multiple-wheeled
23 transporter that would take the waste packages below
24 ground.
25 We have stepped away from that and gone

1 back to a rail-based system. We had moved away from
2 the rail-based initially because of concerns of tight
3 radius turnouts in the underground.
4 We have increased the radius of that, and
5 that supported moving back to a rail-based system, and
6 we are doing that.
7 On the site plan, the things to take away.
8 This is the overall, and there is the subsurface area.
9 This is the north construction ramp. That does not
10 exist now. Right now the existing as you saw
11 yesterday is the north ramp, down through the main and
12 out the south ramp, with the ECRB across it.
13 These are the north portal facilities, and
14 all the emplacement facilities would be located there.
15 This also shows though a 19,000 MTHM worth of aging
16 pads. That is in addition to the 1,000 that is local
17 to the north portal.
18 Zooming in to the surface facilities, this
19 is the fuel depot, visitors center, some of the admin
20 type buildings. The transfer facilities are
21 concentrated up here, and this is some of the support
22 administration, warehousing and those sorts of things.
23 Going in a little bit closer to the North
24 Portal plant is the rail line that comes in, and that
25 is a storage yard for casks on rail cars, either in-

1 bound or out-bound, and there are a series of
2 buildings through here.
3 The upper-most is for receipt of the empty
4 waste packages. The one smaller one below it right
5 here is the receipt of transportation casks. The one
6 below that is not a building, per se. It is the
7 buffer area.
8 That would be transportation casks that
9 would have been removed from the national conveyance,
10 and put on to the site conveyance, and the SRTC, site
11 rail transfer cart. That would be an area to put
12 those.
13 VICE CHAIRMAN RYAN: Paul, just a quick
14 question to help frame this a little bit. Do you have
15 a controlled area fence here or something that we
16 could think about?
17 MR. HARRINGTON: Yes, that is the fence
18 that goes around here, and is effectively the
19 radiological controlled area.
20 VICE CHAIRMAN RYAN: Thanks.
21 MR. HARRINGTON: Working down the next
22 side, this is the canister handling facility, and that
23 is where canisters could be transferred from a
24 transportation cask to a waste package, and the waste
25 package is welded up and then sent underground

1 directly from there.

2 The next building down is DTF-1, and on

3 the bottom side of that is the integral remediation

4 building. Below that is DTF-2, and below that is

5 space set aside for future transfer facilities should

6 through put needs warrant it at some time in the

7 future.

8 Moving to the transportation cask receipt

9 facility, we will walk through the individual

10 buildings, the floor plans. This is a fairly

11 straightforward building. Incoming waste packages

12 come in on the top and side of the building.

13 Several of the bays have rail access, and

14 so you can run a rail car in there. Several of the

15 bays do not have that, and you would run trucks in

16 there. And all of the bays have a rail coming out of

17 the bottom that accesses this site rail transfer cart

18 system.

19 So you would simply move the national

20 conveyance into the upper end of that building, using

21 an on-site locomotive. There would be an empty SRTC,

22 a transfer cart, set in one of the other bays, and an

23 overhead crane would pick the transportation cask off

24 of the national conveyance, and put it on to the SRTC.

25 That may require that impact limiters be

1 removed. If you physically could not lift it with the
2 impact limiters on, they would have to be removed, and
3 the transfer done, and then reinstall the impact
4 limiters for the continuation of the move of that
5 transportation cask over to the actual waste transfer
6 buildings.
7 The next sketch is of the canister
8 handling facility, and if there were a transportation
9 cask that had disposal canisters in it, then it could
10 come to this facility. That set of disposable
11 canisters now includes the Navy canister.
12 Those are relatively large, on the order
13 of 6 feet in diameter, by about 15 feet long. The
14 Navy long is the heaviest canister that we would have.
15 There are also several DOE canisters for high level
16 waste, and spent nuclear fuel.
17 We will come later to that in our
18 discussion to what those are. They are really
19 unchanged from previous briefings that we have given.
20 Okay. In here the SRTC would come in the entrance
21 there, and there are a series of three welds here.
22 The waste package would be upended and
23 taken off of the SRTC here, and then lowered into one
24 of the transfer welds. The two welds that are
25 adjacent to it to the left can accommodate either a

1 waste package or a site storage canister.

2 And the waste then, this is a shielded

3 transfer area, and the transportation casks would be

4 opened, vented, purged, cooled, and the tops removed,

5 and the transfer would be done by an overhead crane.

6 It would grapple on to the canister, pull

7 it out of the transportation cask, translate over

8 above whichever receptacle it was going into, and then

9 be lowered into it.

10 After that was lowered in there, then the

11 -- assuming there was a waste package, would be picked

12 up out of its transfer weld and moved over and put

13 into the closure cell there. In the closure cell is

14 where the three lids would be installed, welded up,

15 and a non-destructive examination would be done.

16 In the waste package discussion, we will

17 go into more detail about what that actual closure

18 detail looks like now. It is a little different and

19 simpler than what we have had in the past. So after

20 the welding, the inspections, the testing, are

21 completed in there, then it would be taken out and

22 moved over, and down-ended on a table here.

23 There is a transfer table at that point.

24 Joe mentioned briefly that we had changed the

25 mechanisms for lifting waste packages. Rather than

1 having a split ring collar around them, and there will
2 be more graphics later in the waste package, it is
3 basically like a camera lens bayonet.
4 You can install it. It has several large
5 threads if you will on it. You turn it about 60
6 degrees and it engages. It is a simpler mechanism, we
7 think, than having to clamp and remotely bolt and
8 remove individual bolts from the old style.
9 So those lifting collars would be removed
10 and then the waste package would be sitting on the
11 emplacement pallet at that point. The pallet would be
12 picked with the waste package on it, and put on to the
13 subsurface emplacement transporter, and moved into the
14 shielding part of that transporter, and then be ready
15 to be taken underground.
16 So functionally that is a fairly
17 straightforward building. The transportation cask
18 comes in, and put into a weld, and opened, and the
19 canisters are transferred into either a waste package
20 or a site storage cask, and then the waste package or
21 storage casks are closed, sealed, and taken out the
22 left-hand side of the building.
23 The direct transfer one facility and
24 remediation combination is more complicated. The main
25 through put, and I will give you a very quick

1 overview, and then go back in more detail, waste
2 packages come in either of two lines here.
3 And this area constitutes a transfer cell.
4 Transportation casks and site storage casks come in
5 this line, and they are fed to ports here or here. So
6 the basic transfer mechanism happens right in that
7 cell.
8 The waste packages, after they have been
9 loaded at either that port or that port, are moved out
10 into this gallery, and there are three closure cells
11 here. That is the same as in the canister handling
12 facility. That is where the lids are completed being
13 installed, welding, testing, et cetera.
14 And then the waste packages are moved out
15 into this area, and that is where they are down-ended,
16 and the lifting collars are removed, and put into the
17 subsurface emplacement transporter and taken out to
18 the subsurface.
19 In a little more detail the incoming here,
20 there is room there to remove the impact limiters, the
21 personnel barriers, those sorts of things that are on
22 the transportation cask during national
23 transportation.
24 The two plugs there are for the transfer
25 of waste into the waste package proper. There is also

1 a small cell as part of that overall cell that has
2 some capacity for lagged storage.
3 It is on the order of 48 PWR assemblies,
4 72 or so BWR assemblies, and 10 of the DOE SNF or HOW
5 canisters. There is no storage capacity in there for
6 the large Navy-type canisters, because there is no
7 reason to store that. You would not bring it into the
8 building to do a transfer unless you had a waste
9 package there and available to do it.
10 But given that the capacities of the
11 transportation casks, and the waste packages, are
12 somewhat different, we may need to do some mixing and
13 matching. So there is some capacity there in that
14 small lag storage area to be able to either load fuel
15 into that if you are unloading a transportation cask.
16 It is larger than the waste package, or
17 pull from that as you are loading out a waste package.
18 There was a very small capability for mixing and
19 matching hotter and cooler fuels, but it is not near
20 the inventory capacity that earlier designs of the
21 facility had.
22 CHAIRMAN GARRICK: Okay. Is that going to
23 handicap you in terms of having options for
24 controlling the temperature of the fuel that is in
25 place?

1 MR. HARRINGTON: It will make it somewhat
2 more difficult to do that, simply because I won't have
3 the wide variety of fuels to pull from. Practically
4 speaking, it would be reasonable to expect though that
5 many of the utilities would want to clear out much of
6 their fresher hotter fuel first.
7 So to have planned the facility around an
8 expectation that you were going to get a mix, and all
9 it took was a little bit of inventory to really blend
10 it well, was probably optimistic.
11 That is why we are now looking more at the
12 aging pad. If we get a campaign of relatively fresh
13 fuel, and 5 year old is the minimum for the standard
14 contract, then conceivably we can put it out on the
15 aging pad to continue to cool.
16 CHAIRMAN GARRICK: Is the 5 year
17 requirement something that could change?
18 MR. HARRINGTON: At this point, I would
19 not anticipate changing it.
20 CHAIRMAN GARRICK: I see. It seems kind
21 of strange that generators would go along with it,
22 because their idea is to get back to the old days when
23 reprocessing was available, and they could get rid of
24 the fuel in 90 days or something close to that.
25 MR. HARRINGTON: If we used up the

1 inventory that the utilities would have that was older
2 than 5 years, we might revisit it. But there is a lot
3 of inventory there that is older than 5 years.
4 CHAIRMAN GARRICK: Okay. Well, I know
5 that there is, but sooner or later you should catch
6 up, and that was the only question.
7 MR. HARRINGTON: If we ultimately get to
8 that point, certainly we can revisit some of that.
9 But not now. Okay. A little bit of lag storage right
10 there. The loading takes place in those loading
11 ports. These are the two transportation cask ports
12 that would be used to do the transfer.
13 That is one fuel handling machine and
14 crane assembly in there; the fuel handling machine for
15 the individual fuel assemblies, and the cranes for the
16 canisters.
17 Over here this gallery has room to stage
18 several completed waste packages. At the point of
19 transfer, we would put the inner stainless steel lid
20 on to the waste package at that point. We would not
21 have engaged the shear ring that will retain that lid
22 in place, but at least the lid itself will be in
23 there.
24 The movement from that cell over the
25 closure cells, it will come out on a cart, and the

1 crane would pick it up and move it over, and put it on
2 to a different cart, and be rolled into the closure
3 cells.
4 In the closure cell the shear ring, and
5 spread ring, would be installed. There has actually
6 been a mock-up of that fabricated up in Idaho. They
7 have run it and they did it on the smallest diameter
8 waste package sample that we are looking at and it
9 worked.
10 It seemed to work well, and we saw the
11 videos of that. Then the welding of the shear ring
12 would take place. That is something that I will defer
13 to the waste package discussion, because in there we
14 have a good graphic of that.
15 After the closure and non-destructive
16 examination of those welds, the testing for the
17 guidance, then it is brought out on the trolley cart,
18 and picked up by the crane, moved down, and put into
19 this area.
20 And that is very similar to the back end
21 of the canister handling building. The same types of
22 equipment would do the down-ending, and do the lifting
23 collar removal, and pick the waste package on its
24 pallet, putting it into the shielded subsurface
25 transporter, and it would be ready to go.

1 Now, this lower part of the building is
2 the remediation section. There is a small pool
3 available in the lower right-hand corner.
4 The intent is not to have any sort of
5 storage there, but rather if there were actions that
6 had to be done on a canister, on a fuel assembly, that
7 you could better do with more direct access to it
8 while it was under water, rather than having to do it
9 remotely through manipulators, through video cameras,
10 and that sort of thing. That could be done in that
11 pool area.
12 Also, opening of non-disposable canisters
13 happens down in that general area. There is certainly
14 canisters out there now that are being used at the
15 utilities that are not qualified, and have not been
16 designed for disposal. So we would not be able to
17 dispose of them as is.
18 So this design allows us to open those,
19 and remove the fuel assemblies, put them into waste
20 packages, and dispose of the fuel that way.
21 Site aging. In the EIS, we addressed that
22 we could have as much as 40,000 metric tons of heavy
23 metal capacity for aging. A year or so ago, we were
24 looking primarily into 1,000 MTHM, and some of the
25 through put analyses, the thermal analyses that we are

1 doing, indicated that some additional amount beyond
2 that 1,000 would be necessary.
3 So we are looking here at up to 20,000.
4 It is a series of relatively identical modules, and as
5 we conclude those thermal studies and through put
6 studies, the final amount of aging that we believe
7 necessary may change from this.
8 So the individual aging facilities are
9 really all the same. This block has about a thousand
10 metric tons capacity, and 20 percent there on the left
11 is devoted to the new homes type canisters. They are
12 in existence now, and a number of facilities have
13 them.
14 We would need a facility that would be
15 able to receive and continue aging them as need be
16 prior to putting into waste packages for disposal.
17 There are also a number of facilities that have the
18 independent vertical, cylindrical, type of waste
19 storage casks.
20 So, 80 percent of the capacity of an
21 individual module is devoted to that stand alone
22 canister type concept. We have not chosen a
23 particular vendor for this. That is sometime down the
24 road.
25 This is a concept for that, and we will

1 have to work out what the design parameters for those
2 need to be. Joe mentioned earlier this morning that
3 one of those design parameters may need to include
4 aircraft crash resistance.
5 Phased implementation at the surface
6 facility. That would give us the ability to have a
7 higher chance of meeting a 20-10 initial operation.
8 If you start small rather than building out the very
9 large facilities that we have had in the past, we
10 think that will improve the confidence of being able
11 to do that and make that milestone.
12 The inclusion of the remediation integral
13 with the processing and handling within the same
14 facility we think is more efficient, rather than
15 having it be a separate facility, and having potential
16 problems with transfer of a fuel assembly, or possibly
17 a cask or waste package and having an assembly stuck
18 in it, and trying to get it from one building to
19 another did not make much sense.
20 So inclusion of that capability into the
21 one large structure we think makes a lot of sense.
22 The adoption of lessons learned for DTF-2. If we find
23 either from our own experience in DTF-1, or other
24 international experience, that fundamentally there
25 should be some changes made, we would have the ability

1 to react to that, and accommodate that, in the design,
2 and in the finalization of DTF-2.
3 I will restate though that the LA will
4 address DTF-2. It is part of the facility design, and
5 so we realize that we need to come in with a case that
6 does include DTF-2 and its design. Let's see.
7 You see the construction sequence for
8 surface facilities. In Phase I, that would include
9 the transportation cask receipt facility, and also the
10 canister handling facility, the dry transfer facility,
11 and 6,000 MTHM worth of aging. That is the 1,000
12 local to the north portal, and one of the 5,000 MTHM
13 modules slightly away from the north portal.
14 And some of the DOE facilities admin, and
15 warehousing certainly will be necessary. Some of the
16 ES&H support structures will be necessary. Phase II
17 would come in after that, and include the second dry
18 transfer facility, the balance of the aging, and the
19 balance of the plan.
20 Let's shift over for a moment to the PSA
21 results. There were no Category I or II external
22 event sequences identified for the surface facilities.
23 We looked at all the different external events that
24 might happen, and none of them ended up falling into
25 Category I or II event sequences.

1 We did identify two Category I internal
2 event sequences, and those both dealt with drop and
3 collision of commercial spent fuel assemblies in the
4 DTF.
5 The reason for that is simply the sheer
6 number of individual fuel assemblies that we are
7 expecting to have to handle. The individual drop rate
8 is very, very low, but the number of assemblies is
9 high enough that it put it into that category one
10 area.
11 There are 31 Category II internal event
12 sequences for the cask, canister, and assembly
13 handling, and again there are drops or collisions in
14 the surface facilities, and not just the DTF. But
15 because of the Category II picking up 10 to the minus
16 4 event sequences, there are some of those in the
17 other waste handling facilities on the surface also.
18 For the 1,000 MTHM aging facility, there
19 were no Category I or II event sequences. As that
20 increases, we have to go back and revisit that with
21 the greater number of handling events that go on
22 there, plus the footprint that it takes up.
23 Likewise, the canister handling facility
24 and that greater aging capacity was not part of the
25 design in April, and so therefore it was not part of

1 the PSA, the preliminary PSA results, but will
2 certainly have to be rolled into the final LA PSA.
3 Dose consequences. The sum of the off-
4 site doses from normal ops and the frequency weighted
5 Category I event sequence doses are below the
6 regulatory limits. The frequency weighted Category I
7 events, we looked at the annual probability of the
8 Category I event sequences, and added that to the off-
9 site doses, and looked at the regulatory limits.
10 So of the worker doses from normal ops and
11 the Category I event sequences are likewise below
12 regulatory limits; and the Category II off-site doses
13 also are.
14 Certainly as we redo the PSA based on the
15 final LA, we have to revisit that, but that was the
16 conclusion of the analysis on the April '03 design.
17 Classification analyses themselves. Those
18 systems, structures, and components, that are credited
19 for prevention or mitigation of Category I or Category
20 II event sequences are important to safety. That is
21 basically paraphrasing the NRC's definition.
22 In our parlance, we are classifying them
23 as safety category, rather than our trying to draw a
24 distinction between an important to safety, versus
25 important to waste isolation. We just came up with

1 the term safety category to include both of those.

2 Natural or engineered barriers that are

3 important to meeting Part 63.113 performance

4 objectives are important to waste isolation, and are

5 also classified as a safety category.

6 SSCs that are not important to safety or

7 to waste isolation we are classifying as a non-safety

8 category. That is somewhat of a change from a power

9 plant parlance, where we talk in terms of Q or non-Q,

10 given that we have ITS and ITWI. SC is basically Q

11 for us.

12 What are those SSCs that were classified

13 as important to safety? Structures, the actual

14 structures themselves, in which we handle the spent

15 fuel assemblies, canisters, or casks, casks without

16 their impact limiters, are important to safety. That

17 is their consignment function that they play.

18 The important to safety subsystems and the

19 cask receipt and return system conclude that a receipt

20 of the cask itself, the preparation of it, and the

21 cask buffer subsystems, the ITF systems in the dry

22 transfer facilities, have the cask preparation, the

23 waste package itself, the canister, this SNF and high-

24 level waste transfer systems, again barriers and drops

25 primarily.

1 And the other ITS systems include the
2 transportation casks, the waste packages themselves,
3 remediation system, and placement and retrieval
4 system, and the aging system. Again, barriers and
5 drops.
6 But those things that are barriers and
7 that are important to avoid dropping or impacting the
8 barriers, are those that graded out as important to
9 safety. Let's shift over to the aircraft hazard
10 evaluation.
11 VICE CHAIRMAN RYAN: Just a quick question
12 before you leave that, and it is out of my own
13 ignorance, and I apologize. But when you say system,
14 you mean instrumentation and all the kinds of things
15 that would provide information to operators and all of
16 that as part of the system, or are you just referring
17 to the mechanical handling systems?
18 MR. HARRINGTON: No, no, the systems
19 include all the --
20 VICE CHAIRMAN RYAN: Okay. I just wanted
21 to be sure that I understood that. Thanks.
22 MR. HARRINGTON: Now, we have done a
23 couple of aircraft hazard evaluations over the last 2
24 years, and we looked at the hazards that were on the
25 Nevada Test and Training Range, and also the Nevada

1 Test Site, and the commercial, general aviation, and
2 military flights that are out in the Beatty corridor.
3 That is the name that we have given to the
4 commercial aircraft flight path that is to the
5 southwest of the corner of the test site. That is
6 generally 8 miles or more away from the north portal
7 area.
8 Our approach was to see if we could screen
9 out impacts of aircraft based on probability, and we
10 used a methodology that was similar to the NUREG-
11 0800,a nd we made some minor modifications to that to
12 deal with the north portal being in the middle of the
13 test site, and in the middle of some of the military
14 flights, rather than off of a flight path.
15 There were military flights that were not
16 restricted to a flight path, and so we made an
17 adjustment there to account for that. We got flight
18 counts from the FAA in Las Angeles for the commercial
19 traffic that was through there.
20 One of the comments that the NRC had in
21 our technical exchange a month-and-a-half or so ago on
22 the aircraft crash evaluations was that they wanted to
23 see more, and that we needed to provide more
24 information, and we are certainly taking that to
25 heart.

1 We are getting more information, both from
2 FAA and from the Air Force. We got flight counts from
3 NTTR, and we have been looking at the crash rates by
4 the type of aircraft. Some aircraft are more
5 susceptible to crashing than other types are.
6 The initial study screened out that hazard
7 for a 100 year operational period, and only 1,000 MTHM
8 worth of aging pad. There was certainly a lot of
9 discussion as to some of the bases for the conclusions
10 that we had drawn in that.
11 We are working with the Air Force to get
12 a better set of information to better support that
13 sort of information. As we looked at increasing the
14 aging pad, the ability to screen that out became very
15 marginal, if even at all possible. But that was also
16 based upon a 100 year duration.
17 If the aging pad would be emptied within
18 50 years, we thought it supportable, justifiable, to
19 use a 50 year period for that though. Both of those
20 are somewhat moot though because in the continuing
21 interchanger that we have had with the Air Force, we
22 found that they are significantly changing their
23 access to the Nevada Test Site for their operations.
24 Previously, the test site, because of its
25 testing operations, had been an area that the Air

1 Force could overfly, but they didn't actually conduct
2 training missions over test site area.
3 There was only one permanent no-fly area
4 on the test site, and that is over the device assembly
5 facility, DAF. There were none on other parts of the
6 test site. We had been looking at the Air Force
7 flight historical data with the assumption based on
8 the discussions with them that that would continue to
9 be the case.
10 We are putting into place a more formal
11 agreement with them for them to share upcoming
12 changes, and we knew of some potential changes that
13 might come from the introduction of the FA-22.
14 But in the discussions that we had with
15 them, because of the change in the test site's
16 mission, the Air Force is going to become more active
17 over test site land. That will certainly have an
18 effect on the probabilities that we had rolled into
19 the analyses that we had to date.
20 So we need to go back and just reassess
21 that whole process. As Joe said, and as I think I
22 said once before, one of the results of that might be
23 to impose crash resistance, at least upon the aging
24 facility casks. We will just have to do that analysis
25 and see what the results of them are.

1 Surface Facility ALAR, and worker safety
2 issues. We are using a 500 millirem per year design
3 goal for worker protection. The design guide items
4 are the normal ALAR, time, distance, and shielding, to
5 minimize the operations that might have to be done
6 manually in radiation areas.
7 To improve the reliability of process
8 equipment, and minimize the possibility that someone
9 might have to actually access a radiation area to do
10 equipment maintenance or repairs, and those sorts of
11 things. Increase the distance, et cetera.
12 The sorts of things that we are doing are
13 really to look at remote handlings for those high RAD
14 areas. You will see operating galleries on those
15 sketches that we walked through, and there is a lot of
16 remote manipulator control available, and closed-
17 circuit t.v. cameras, and operating windows, and local
18 manipulators, and that sort of thing, to provide
19 worker protection.
20 In that the Cogema experience at La Hague
21 and elsewhere has really been very valuable. They
22 have a lot of history operating a very large facility,
23 and not just doing the sorts of things that we are
24 doing, but also dual processing there.
25 So we are able to pick up a lot of that

1 sort of information. Okay. That is the end of the
2 prepared remarks on the surface facility. We could
3 take questions on that now, and then if you wanted to
4 take a little break before we go on to the second part
5 that would be fine.
6 VICE CHAIRMAN RYAN: Any general
7 questions?
8 CHAIRMAN GARRICK: One of the lessons that
9 we keep learning in some of nuclear operations,
10 including the nuclear power field, is the issue of
11 inadequate laydowns for repair, and inspection, and
12 what have you. How much is maintenance inspection,
13 and other activities associated with interruptions
14 that could occur?
15 How much has that entered into your
16 layout? It is very hard to see on these drawings?
17 MR. HARRINGTON: We have maintenance
18 people just to make sure that their needs are
19 adequately captured. We also have been doing some
20 modeling using a couple of different programs --
21 Goldsim (phonetic) is one, and I don't remember what
22 the other one is. Witness, right -- to model the
23 through put through there to make sure that the
24 activities that have to be done on the bolting of
25 lids, and laydown functions, and pulling equipment

1 off, is adequately modeled, and therefore captured in
2 the design.
3 Preston, you have got the mike there if
4 you want to elaborate on that, and if so, please do.
5 CHAIRMAN GARRICK: Please give you name.
6 MR. MCDANIELS: My name is Preston
7 McDaniels, and I am with DOE. Other areas that we
8 have been considering and we got included in the
9 design are pulling a crane into a parked area, and
10 shield it, and do maintenance.
11 We also have provisions in the design if
12 a shield door fails, and we can do maintenance on it
13 in a shielded environment. There are other activities
14 that we are looking at potentially, remote change out
15 of components where necessary in a cell where we do
16 not normally have access.
17 So this is being considered and we are
18 continuing to look at other constructibility and
19 operability features that we need to build into the
20 design to address the concern of what happens if, and
21 our models also include the potential for varying
22 ability of equipment to see how that affects through
23 put.
24 Again, that may change the design
25 requirements based on what availability the different

1 equipment has.

2 CHAIRMAN GARRICK: Yes, I was going to ask

3 if at the preclosure safety analysis, which you are

4 calling PSA, which I wish you wouldn't. We have

5 talked the NRC into changing it to PCSA to not be

6 confused the international acronym of PSA, which tends

7 to mean probablistic safety analysis.

8 But in the course of generating scenarios

9 for the preclosure safety analysis, I would think you

10 would look pretty close of incidents and accidents

11 that you can get into, and what kind of recovery

12 requirements are associated with those scenarios.

13 This has been a very valuable way to think

14 out maintenance and repair requirements of other

15 facilities, and I am curious if the PCSA people are

16 working with the design people to make sure that you

17 have the capability to respond to those kinds of

18 events.

19 MR. RICHARDSON: Yes, that is a good

20 question, John. This is Dennis Richardson --

21 CHAIRMAN GARRICK: How are you, Dennis?

22 It has been a long time.

23 MR. RICHARDSON: Yes, and I am with the

24 preclosure safety analysis, PSC, in Nevada. Yes,

25 first of all, on industry experience. We certainly

1 try to follow what is going on in industry. We follow
2 -- I was just at a MOX meeting last week in Charlotte
3 trying to get a feeling from them on what was going on
4 there, and what they had to do.
5 We especially are utilizing our Cogema
6 friends here in the contract to get their experience
7 in France and at La Hague for the type of incidents
8 and things that they have gone through.
9 And of course we bring the experience from
10 the commercial nuclear industry in with this, too,
11 with a number of people in our organization. One
12 thing we tried to do was work obviously very closely
13 with design day in and day out.
14 We try to walk through the hazards that we
15 have analyzed to see if they think it is the same
16 hazards, or if we have missed the boat somewhere, and
17 have missed one, and in fact we are in the midst of
18 doing that now.
19 We would document all that work to support
20 our revised calculation in that, and probably the most
21 important part of our work is that our going in
22 strategy is to try to prevent as much stuff from
23 happening as possible.
24 And so much of our design basis are for
25 prevention, and the real key there is that we ask them

1 to design something that is either impossible from
2 their viewpoint, or very difficult to do, and there is
3 where a lot of our dialogue and interactions take
4 place obviously.
5 We try to make our job as easy as possible
6 by preventing everything and not having anything to
7 analyze. Of course, it can make their job very
8 difficult.
9 CHAIRMAN GARRICK: Yes. Well, I was very
10 curious about your ability to handle any kind of
11 recovery operation, and the issue there is what kind
12 of recovery operations are we talking about. I mean,
13 that is something that you should be able to get out
14 of your PCSA.
15 MR. RICHARDSON: Yes. We will be using
16 obviously the credible event sequences that we are
17 looking at, and also critical events that can happen
18 in determining emergency operating procedures, and
19 recovery operations that happen after the event to see
20 what kind of equipment operator actions might be
21 relied on to recover from whatever the abnormal event
22 is.
23 CHAIRMAN GARRICK: Yes, okay. When did
24 the north ramp come into being, and tell us again why?
25 MR. HARRINGTON: The new north ramp?

1 CHAIRMAN GARRICK: Yes.

2 MR. HARRINGTON: Oh, 2 years or so ago.
3 Mark Board can answer that as far as when. The reason
4 is constructibility of that additional set of
5 emplacement drifts to the north of the existing -- of
6 the north end of the north ramp.

7 CHAIRMAN GARRICK: Because it was not in
8 the earlier designs as I recall.

9 MR. HARRINGTON: Right. It was as we
10 started looking at the emplacement areas that our now
11 marked as 3 and 4.

12 CHAIRMAN GARRICK: Are you saying that it
13 is constructed motivated, and it is not operations
14 motivated?

15 MR. HARRINGTON: Yes. In fact, we will go
16 into more detail on that area in the next set.

17 CHAIRMAN GARRICK: Okay. All right.

18 VICE CHAIRMAN RYAN: I had must a couple
19 of quick questions that follow directly to John's
20 questions. And one goes back to the first thing that
21 I asked, which is what is the radiological controlled
22 area?

23 It is interesting that the whole fenced
24 area is radiologically controlled, and that is counter
25 to what a lot of facilities do. They tend to make

1 radiological areas as small as possible.

2 Certainly security and so forth needs to

3 be all fenced, and I understand that, but you raised

4 the bar of health physics and monitoring, and all of

5 that if you put it all in a radiologically controlled

6 area.

7 So I appreciate any comment that you might

8 share with me on that, and then the second is this

9 question of automation, and you mentioned a little bit

10 about it.

11 I am sure that there is a lot of detail

12 that I don't have and have not seen, but when you

13 raised automation, you raised the maintenance, and you

14 raised the bar for repair and so forth.

15 So I think about both of those issues in

16 terms of their radiological controls question. I

17 would be happy to have any additional comments that

18 you might have in those areas.

19 MR. HARRINGTON: Okay. Let's go to Slide

20 9.

21 VICE CHAIRMAN RYAN: Nine it is. We have

22 a big one here, too.

23 MR. HARRINGTON: These are all buildings

24 that will be involved in some manner in radiological

25 waste handling, and the rail yard out here on the

1 side. So what we are really looking at defining as a
2 radiologically controlled area would encompass the
3 rail yard and that set of buildings, and the aging
4 pad.
5 It would exclude this set of buildings,
6 and the other things, but because each of these
7 buildings all have radiological material in them of
8 some sort, either a canister transfer, or an
9 individual fuel transfer, or the transfer of the
10 transportation cask on to the site CAR, we are looking
11 at just designing that entire area as the RCA.
12 VICE CHAIRMAN RYAN: I understood that is
13 what you were doing, but it kind of implies, and again
14 maybe you are not planning to do this, but if I am in
15 building one, and I have an activity and I need to go
16 to building two, do I change out and go to building
17 two, and change back in?
18 Do I monitor and then go to building two?
19 It makes that whole outdoor area part of the facility
20 that needs a higher level of radiological monitoring
21 than you might otherwise have.
22 MR. HARRINGTON: I just don't know your
23 work flows well enough to know if I think that is
24 reasonable or not.
25 VICE CHAIRMAN RYAN: Okay.

1 MR. HARRINGTON: Well, certainly if you
2 want from one radiologically controlled area, a work
3 area, to another, you would be exiting that one area,
4 and having to sign out a RWP there, a radiation work
5 permit, to go over to the other one and sign in on the
6 new one.
7 But in terms of defining what is the
8 overall radiologically controlled area, that is the
9 broader area. We are not saying that whole
10 area constitutes one RWP area.
11 VICE CHAIRMAN RYAN: No, I am not talking
12 about RWPs. I am talking about exactly what you are
13 saying, which is controlled area. The tendency in a
14 lot of places that I am familiar with is to make them
15 as small as possible so that the bar for monitoring is
16 not as high, except where the work is going on. It is
17 just something to think about.
18 MR. MCDANIELS: This is one of the areas
19 that we have not fine-tuned yet. We are still looking
20 at it right now, and obviously we have radiation and
21 contamination zones in each one of the buildings that
22 we are controlling access into. But your point is
23 well taken, and that is an area we are looking into.
24 VICE CHAIRMAN RYAN: Just another example
25 that comes from a slightly different perspective, but

1 the rail yard, and especially the arrival yard. They
2 arrive and it is a radiologically controlled area.
3 But they are at a siting somewhere in the
4 middle of the country, or something, and it is not.
5 There is a perception problem with that.
6 MR. MCDANIELS: Okay.
7 VICE CHAIRMAN RYAN: So how you define
8 those areas I think needs very careful thought.
9 MR. HARRINGTON: And the second question
10 had to do with the automation and the potential for
11 increasing maintenance difficulties, and if you had a
12 highly automated system.
13 MR. MCDANIELS: Again, in the cranes, for
14 example, we are going to have a crane park area so
15 that we can pull it out of the radiation zone and get
16 it into area where we can do maintenance.
17 But obviously there are going to be areas
18 that we are going to have to bring a component out,
19 bag it out, sot hat we can get access to it, and
20 change out.
21 So we are looking at remote change out of
22 components where required, but it is an area again
23 that we are looking into a lot more detail. We don't
24 have a lot of the fine operating procedures and
25 maintenance activities identified yet, but that is

1 going to be one of the ongoing activities as you get
2 further into the design.
3 VICE CHAIRMAN RYAN: One of us would be
4 remiss if we didn't ask this question somewhere in
5 this panel, and that is how much waste are you going
6 to generate in all of the operational activities? And
7 what will it be, Class A, B, C, or something else?
8 MR. MCDANIELS: We are hoping it will all
9 be low level waste, classified as low level waste,
10 suitable for disposal at a low level waste disposal
11 facility.
12 The quantity, we have made some very rough
13 estimates, and I don't have those numbers. We are
14 obviously in a waste minimalization mode, and we are
15 trying to minimize the quantity of low level waste we
16 generate.
17 VICE CHAIRMAN RYAN: And don't get me
18 wrong. I really appreciate the trade-off and waste
19 generation maintenance, automation versus hands-on,
20 worker dose. It is a complex algorithm. So I
21 appreciate the task. But it is interesting to hear
22 your views at this point. Thank you.
23 VICE CHAIRMAN RYAN: Ruth.
24 DR. WEINER: You mentioned that you did a
25 surface facilities consequence analysis. How about a

1 risk analysis?

2 MR. HARRINGTON: Dennis, I will let you

3 answer that.

4 MR. RICHARDSON: Excuse me, but I didn't

5 hear the very last part of your question.

6 DR. WEINER: You have done a consequence

7 analysis for the surface facilities, the dose

8 consequences.

9 MR. RICHARDSON: Yes.

10 DR. WEINER: How about a risk analysis?

11 Have you contemplated that, or are you planning one?

12 MR. RICHARDSON: Well, in Part 63, we

13 don't have per se a safety goal. So we in a sense are

14 doing a probablistic risk assessment up to the point

15 of where you might say combine all the Category II

16 event sequences on the dose and everything.

17 That is not part of the regulation, and

18 obviously that is something that you would do in a,

19 let's say, Level II PRA. But in terms of the other

20 elements of the instance of the PRA, we do each of

21 those things.

22 We develop initiating events, and the

23 event sequences from that. We do the frequency

24 determination event sequences, and those that are

25 within the Category I or Category II, we calculate the

1 dose.

2 Now, on Category I event sequences, we do

3 in a sense add those together per the regulation. But

4 on the Category II, we look at the individual event

5 sequences for compliance against the dose.

6 We don't have again a safety goal, per se,

7 like a core melt limit, or early large release

8 fraction, or anything like that. We look at the

9 individual event sequences on that.

10 DR. WEINER: So basically you don't also

11 report the risk as well as reporting the consequence?

12 MR. RICHARDSON: Not per se. But in terms

13 of the strict or what we have to show for compliance

14 with Part 63, that is not part of that.

15 DR. WEINER: The second question is that

16 you have done a hazard assessment for aircraft

17 crashes. How about a vulnerability assessment for

18 your facilities?

19 MR. RICHARDSON: Well, are you getting

20 into --

21 MR. HARRINGTON: Dennis, when we do speak,

22 please announce yourself. As far as vulnerability

23 assessment for the facility itself, and this is Paul

24 Harrington again, no, we have not done a formal

25 vulnerability assessment, if by that you mean a

1 probability of penetration of the facility, for
2 example?
3 DR. WEINER: And the consequences. I
4 mean, how vulnerable are your facilities?
5 MR. HARRINGTON: Our first approach was to
6 see if we could screen them out. As I said, initially
7 we thought that we probably could address aircraft
8 crash by a low probability, beyond Category II. With
9 the change in Air Force flight patterns, we may well
10 not be able to do that, and we will possibly have to
11 get into consequence evaluations.
12 DR. WEINER: So you would be planning or
13 possibly planning to do a vulnerability assessment of
14 your surface facility?
15 MR. HARRINGTON: Yes.
16 DR. WEINER: In your staging areas where
17 do rail cars sit if there is no immediate space for
18 them to be off-loaded? Do you have a place where you
19 can pile them up so to speak?
20 MR. HARRINGTON: Back on that Slide 9, the
21 north portal plant, there was an area that is a rail
22 car staging right here on the right side of this
23 sketch.
24 DR. WEINER: And you think you can
25 accommodate enough cars there?

1 MR. HARRINGTON: Yes.

2 DR. WEINER: So that you won't get backed

3 up to the point where you can't get any through put?

4 MR. HARRINGTON: Right. Well, we also are

5 responsible for transportation. The DOE is also

6 responsible for transportation.

7 DR. WEINER: So you would stage that I

8 would assume?

9 MR. HARRINGTON: Right.

10 DR. WEINER: How are you planning to

11 handle the high level waste canisters?

12 MR. HARRINGTON: In the same manner as we

13 talk about there. There are also sealed canisters,

14 and they are 24 inches in diameter generally; and 10

15 and 15 feet long. The same overhead crane grapples on

16 to them, and pick them out of the transportation cask,

17 and put them either directly into the waste package,

18 or into that little bit of lag storage area.

19 DR. WEINER: So they will be handled just

20 like canister fuel?

21 MR. HARRINGTON: Right. Functionally,

22 there is really no difference between any of the

23 canisters.

24 DR. WEINER: Okay. Thanks.

25 CHAIRMAN GARRICK: Back to the question

1 for just a minute of recovery and maintenance, and
2 what have you. In these scenarios that you considered
3 were there any scenarios that would be greatly
4 facilitated from a recovery sense by having hot cell
5 capability, and how much hot cell capability if any do
6 you intend to have?
7 MR. HARRINGTON: Well, define hot cell
8 capability for me if you would. Do you mean
9 additional capacity, or the ability to work via
10 manipulators and windows?
11 CHAIRMAN GARRICK: Yes, by hot cell
12 facility, I do mean where you have manipulators, and
13 you can make repairs, and handle highly radioactive
14 material safely.
15 MR. HARRINGTON: The remediation facility
16 has that capability. It has the ability to do
17 remediation both dry and wet.
18 CHAIRMAN GARRICK: Well, I was wondering
19 whether this is where you were planning to do it, but
20 you don't call out a hot cell specifically?
21 MR. HARRINGTON: No, not by that term.
22 Let's see. Let's go to Slide 12, please. Preston,
23 this area right here is the right area. That is a dry
24 area. It is titled, DCP cutting and waste package
25 remediation.

1 If we needed to do dry remediation, dry
2 hot cell work if you will, that is the area that would
3 happen, right in there. You have view points and
4 manipulators from this work area here and that can be
5 done there. That is a parallel capability if you will
6 to the wet remediation capability there.
7 CHAIRMAN GARRICK: It is a little
8 different than a real hot cell. Are these permanent
9 manipulators that you are going to have in those
10 locations, or are these equipment that you bring in on
11 an as needed basis?
12 MR. HARRINGTON: Oh, there will be some
13 permanent in there.
14 CHAIRMAN GARRICK: It will be permanent
15 remote manipulators?
16 MR. HARRINGTON: Yes.
17 CHAIRMAN GARRICK: And what kind of
18 shielding is -- what are you capable of handling
19 there? What is the shielding of that particular room?
20 MR. HARRINGTON: Preston, you can talk to
21 the shielding as far as what we are capable of
22 handling.
23 CHAIRMAN GARRICK: Well, when I think of
24 a hot cell, I think of high density windows, and high
25 density concrete, and a real capability to handle

1 essentially anything, and total remote manipulation
2 capability, and I don't think that is what these are.
3 But go ahead and tell me what they are.
4 MR. MCDANIELS: This is Preston McDaniels
5 again. This would be a fully loaded waste package,
6 which is our worst case shielding design basis. So
7 there would be approximately 4 foot walls, and with
8 viewing windows, shielded viewing windows, and remote
9 manipulators.
10 And of course as we get into a specific
11 remediation case, we may need to build special tools
12 so that we would have the capability to bring in a
13 special team in for remediation.
14 CHAIRMAN GARRICK: Primarily these are for
15 production are they not? I mean, these rooms are
16 going to be used routinely.
17 MR. MCDANIELS: For remediation only, and
18 as well as the dry or dual purpose canister cutting
19 and opening. But for remediation, it is on an as
20 needed basis.
21 CHAIRMAN GARRICK: I see. Okay. All
22 right.
23 VICE CHAIRMAN RYAN: Jim.
24 MR. CLARKE: Just a general question on
25 the sequence. If I understand your intent, it is to

1 build what you need to get started and then at a later
2 date to expand at least two of the facilities.
3 The subsurface construction is going to be phased as
4 well?
5 MR. HARRINGTON: Yes, it is.
6 MR. CLARKE: And obviously those will
7 dovetail to some extent?
8 MR. HARRINGTON: Yes.
9 MR. CLARKE: And do you expect the through
10 put to increase with time as you --
11 MR. HARRINGTON: Yes, the through put
12 requirements out of the Level I DOE requirements
13 document are 400 metric tons of heavy metal the first
14 year, and I think 600 the second, and 1,200, and
15 2,000, and 3,000. So it is a 5 year wrap-up to 3,000.
16 MR. CLARKE: Okay. So when do you expect
17 Phase II; how many years after Phase I?
18 MR. HARRINGTON: I don't know that we have
19 a schedule for that yet. I mean, there probably is,
20 but I just am not the one who has it. Just simply
21 some time to follow Phase I.
22 MR. CLARKE: Okay. I really just wanted
23 to clarify my understanding of the sequence.
24 MR. HARRINGTON: Okay.
25 VICE CHAIRMAN RYAN: Any other questions?

1 Paul, perhaps this is a good time to take a break. I
2 have 20 minutes of. Why don't we break until 5
3 minutes of 3:00, and reconvene with the other two
4 presentations.
5 MR. HARRINGTON: Okay.
6 VICE CHAIRMAN RYAN: Thank you very much.
7 (Whereupon, at 2:40 p.m., the meeting was
8 recessed and resumed at 2:55 p.m.)
9 VICE CHAIRMAN RYAN: Okay. Paul, we are
10 in your capable hands once again. Please proceed.
11 MR. HARRINGTON: Okay. I was looking for
12 my BSE support person.
13 VICE CHAIRMAN RYAN: Let me ask you to
14 yank that microphone a little closer to you so that we
15 can hear you better.
16 MR. HARRINGTON: Okay. For the subsurface
17 facility, I will do the same thing that I did for the
18 surface, and walk through what the facility is trying
19 to accomplish and what it looks like now, and the
20 changes recently, and then roll in the preclosure
21 safety analysis results.
22 It is to accomplish several thermal goals,
23 and one is the cladding temperature limitation of 360
24 C, and that is really a post-closure issue, with a
25 preclosure ventilation. That should not be

1 approached.

2 The preclosure drift wall temperature will

3 be limited to 96 C, and postclosure drift wall

4 temperature limit to 200 C. We do still want to allow

5 for drainage of liquid phase water in the pillar

6 between the adjacent emplacement drifts.

7 The ventilation system is still sized for

8 15 cubic meters per second per emplacement drift, and

9 that would run for 50 years after the last

10 emplacement.

11 That 15 cubic meters per second is on the

12 order of 2 miles per hour, and just to give a sense as

13 to what sort of a breeze might be down there. The

14 waste packages are also emplaced a 10th of a meter end

15 to end.

16 The changes recently to the subsurface

17 design, we revised the panel layouts a little bit, and

18 moved them to the north somewhat. Because of the

19 waste package spacing being fixed at a 10th of a cubic

20 meter, or a 10th of a meter end to end, we did not

21 need as much emplacement drift spacing as the SR

22 figure that Joe Ziegler had put up.

23 So that is why on the current designs that

24 you are not seeing that fifth panel at the different

25 elevation. Fixing the 10th of meter end to end says

1 that you just don't need that much extra space.

2 It is there and it is available should we

3 for whatever reason need to ultimately use that. It

4 is not excluded for any reason, but it just is not

5 necessary for the number of waste packages at that

6 10th of a meter end to end. So that is why it came

7 off there.

8 The ground support, the ground control

9 materials have changed. There is a graphic there

10 later, but basically it is going from wire mesh and

11 steel sets with some rock bolts, to a liner type in

12 the emplacement drifts.

13 We went back to the rail systems as was

14 mentioned earlier to move the waste package

15 transporters from the surface to the subsurface

16 emplacement drift openings.

17 The actual emplacement of the waste

18 package inside the drift had not changed. That had

19 had a rail system, an emplacement gantry transversed

20 that rail system. None of that has changed.

21 We increased the radius of the turnouts at

22 the emplacement drift openings to accommodate the

23 longer wheel-based transporters. And the ventilation

24 control doors. Our old graphics showed those doors

25 basically at the end of the straight section of the

1 emplacement drift.

2 They have been moved out to be adjacent to

3 the perimeter main. So after you pass through those

4 doors, and go through the turnout, there is no extra

5 set of doors at the emplacement drift proper. They

6 are at the loading dock.

7 Panel numbers show the proposed sequence.

8 The first set, panel one, is right there. This again

9 is the ESF tunnel down, and then back out the south.

10 So there are eight emplacement drifts that would be

11 taken off the main at that point, and we would need at

12 least three of those to begin emplacement activities

13 in 2010.

14 The second phase of that first panel would

15 be the remainder of the eight drifts then, and then

16 panel two has 17 drifts that excludes the contingency

17 area down below there. Then panel three, east and

18 west, and panel four, off on the west side.

19 The total emplacement length available is

20 about 41 miles, or 65 kilometers. That contingency

21 area there at the bottom represents about a 12 percent

22 case for the 70,000 MTHM, and that is a little over

23 11,000 waste packages, with the tenth of a meter end-

24 to-end spacing.

25 The first panel itself is again the eight

1 drifts. It is about 4,100 meters worth of useable
2 emplacement drift. It is about half int he lower
3 lithophysal, and half in the middle non-lithophysal.
4 It gets ventilated with a supply coming
5 down the north ramp, and there is an exhaust raised
6 that would be taken off the back end of it; and a
7 portion of it would be used for performance
8 confirmation, with some very heavily instrumented
9 tests for performance confirmation, and come off and
10 go underneath adjacent to one of the emplacement
11 drifts, with a PC axis drift, and then be able to
12 instrument up into that one emplacement drift and
13 adjacent rock areas.
14 The isometric of the emplacement drift
15 itself, it shows the fabricated structural steel
16 invert on the bottom,a nd it shows the emplacement
17 gantry rails running alongside. It shows a series of
18 different sized waste packages, each sitting on their
19 emplacement pallets.
20 Generally the 21 BWRs and 44 BWRs are on
21 the order of a meter-and-a-half in diameter. The
22 widest ones are the co-disposal packages that have the
23 one DOE SNF canister inside a ring of five; and DOE
24 HLW, and that is a little over 2 meters.
25 And the Navy canisters are also about two

1 meters in diameter. The drift shield that fits over
2 the waste packages is a constant dimension. It simply
3 is large enough to straddle all of the waste packages.
4 And so there will be varying clearance
5 between the ID of the drip shield and the OD of the
6 differing waste packages, rather than trying to make
7 a drip shield that is varied in size. This is a
8 simpler, and more straightforward design.
9 The entrance to the emplacement drift --
10 actually, let me go back to that for a moment. Back
11 up one, please. This also reflects the shift from the
12 rock bolts and steel sets, and wire mesh, to the
13 perforated liner that runs down the length of the
14 emplacement drifts.
15 So within the emplacement drifts
16 themselves, it is a stainless steel perforated mesh
17 liner, and stainless steel rock bolts holding it in
18 place. The next slide, please.
19 Okay. This is the entrance of the
20 emplacement drift, with the emplacement gantry running
21 on its set of rails. These are the rails that come
22 down from the surface facilities that are now rail
23 based waste package transporter moves on.
24 This is the loading dock if you will. The
25 gantry has the ability to come out on what is now a

1 structural steel support set of members, and straddle
2 the waste package, and pallet. It engages the sides
3 of the pallet, and picks it up and moves it down the
4 length of the emplacement drift.
5 That part of the operation is
6 fundamentally unchanged from the last several years.
7 It is still an electric-based locomotive for moving
8 the emplacement transporter to and from the surface.
9 The invert, which is the fabricated steel
10 invert segments, with an emplacement gantry crane rail
11 on top, and this open area in the middle is where the
12 pallets for the waste packages would sit.
13 There is a granular backfill installed
14 there, crushed tuff compacted to provide a bearing
15 surface for the pallets. They don't have to sit right
16 on the cross-numbers of the invert material, but they
17 can sit on that, or they can sit on the ballasted
18 material.
19 And the invert itself is a steel
20 structure, ballasted material, and it is carbon steel
21 for the invert, and it supports the rail system, and
22 the waste packages, and the drip shields.
23 The drip shields are actually not
24 installed until the end of the preclosure period. So
25 we have not changed that. The intent has been and

1 continues to be that the waste packages sitting on the
2 pallets are in the emplacement drifts through the
3 preclosure period.
4 Then at the point at which we would do
5 closure is when we would expect to bring in the drip
6 shields, ballast material, crushed tuff, and an
7 engineered barrier for diffusive potential. And also
8 supports waste packages and drip shields.
9 Ground support. These are friction type
10 rock bolts, 3 meters long, and the 3 millimeter thick
11 perforated stainless steel plate, covering a 240
12 degree arc of that drift along the entire emplacement
13 drift.
14 Bolts and sheeting made out of stainless
15 for longevity, and we want to minimize the potential
16 needing to access emplacement drifts to do any kind of
17 maintenance, rock bolt maintenance, ground control
18 maintenance, or anything else. We have moved to
19 stainless steel components in there just to ensure
20 their longevity.
21 CHAIRMAN GARRICK: Paul, you may have
22 answered this, but is the ground support throughout
23 always the same in the drifts?
24 MR. HARRINGTON: In the emplacement
25 drifts, it is the same. But in the --

1 CHAIRMAN GARRICK: Whether you need it or
2 not?
3 MR. HARRINGTON: -- other drifts, it is
4 different, and we will get to that in the next slide.
5 CHAIRMAN GARRICK: I see. Okay.
6 MR. HARRINGTON: Throughout all the
7 emplacement drifts, this is what it would be. The
8 next one is the non-emplacement openings would use
9 fully grouted rock bolts typically spaced within a
10 meter-and-a-quarter.
11 Holding up welded wire fabric from spring
12 line to spring line, or below if necessary to control
13 reveling, and that is carbon steel material. Again,
14 in the non-emplacement openings, we have accessibility
15 for maintenance activities.
16 Turnouts and intersections, again fully
17 grouted rock bolts and wire mesh, but inclusion of
18 shotcrete, about a hundred millimeters thick, and
19 lattice girders if necessary for those spans. The
20 shafts for ventilation would have rock bolts and
21 shotcrete or concrete.
22 The ventilation system is forced, and we
23 have changed the ventilation design a little bit from
24 VA to A. The intent now is that each of the
25 emplacement drifts have access from one end, and the

1 incoming air comes in that end also, and the perimeter
2 drift on the other end of the emplacement drift is the
3 exhaust main.
4 It used to be that we had much longer
5 emplacement drifts, and we could do emplacement from
6 either end with a central exhaust main. This is a
7 little different. The emplacement would come from one
8 end of the drift and exhaust is at the other end.
9 That is the case in all of these.
10 So there are a series of supply shafts
11 that feed the emplacement access mains, and there are
12 a series of exhaust shafts that pull off the perimeter
13 drift on the back end, which is the exhaust main now
14 for each of the panels.
15 For the intakes, there are three shafts
16 and three ramps. We use the ramps also -- north ramp,
17 south ramp, and new north ramp -- for intake air
18 supply.
19 The total intake airflow is about 1,700
20 cubic meters per second. That provides that 15 cubic
21 meters per second per, with some leakage, and exhaust
22 shafts, there are six of those shafts or raises, and
23 note that is 17 cubic meters per second per drift.
24 Those are not standard CFMs, but they are
25 actual so that the air is hotter, and it is expanded,

1 but it is effectively the same mass flow rate.

2 Okay. The waste package transporter.

3 This is very similar to what we have carried for the

4 last several years, with the exception that we went

5 back to the rail based system. A year ago, we had a

6 series of wheels under there, and we were looking at

7 running that on just a solid surface. It could be

8 concrete and it could be steel.

9 But we have gone back to the rail based

10 system. This has a platform that extends out from the

11 shielded part of the transporter to provide access for

12 the crane and the surface facilities, to lower the

13 pallet and waste package on to that bed, and then gets

14 retracted into the shielded part, and the shield doors

15 close.

16 And the two locomotives, one on either

17 end, move it underground. Then when it gets to the

18 emplacement drift, one locomotive cuts off, and the

19 other one backs it into the -- backs the transporter

20 into the turnout, and the shield doors open, and the

21 tongue extends, and the emplacement gantry comes, and

22 straddles it, and picks the pick points on the pallet,

23 and lifts, and moves down the length of the

24 emplacement drift.

25 This item, this device, is about 350 tons

1 with a waste package in it, and up to 65 unloaded.
2 That is because of the shielding that is on it. It
3 runs at 5 miles an hour maximum operating speed.
4 The manual and remote controls are through
5 the transport locomotives. The emplacement gantry
6 itself is really very similar to what it has been the
7 last few years. It has four lifting hooks on it that
8 engage the offset and the pallet so that we are not
9 picking the waste package proper.
10 We are only handling the pallet that the
11 waste package sits on. We have a series of wheels to
12 move down and back through the emplacement drift, and
13 operates at a smaller speed, 1.7 miles an hour
14 maximum, and that is remote controlled.
15 And it has a bus bar for power pickup, and
16 there will be some control mechanisms for that. Now,
17 preclosure safety analysis results of that. There are
18 no Category I or II event sequences in the subsurface
19 facility.
20 The system structures and components that
21 prevent Category I and II event sequences are
22 important to safety though. What that means is that
23 we are crediting performance of those components there
24 at the bottom -- the waste package, and waste package
25 transporter, and the emplacement gantry -- with

1 providing the function that we are assigning to them.
2 Therefore, we are considering those
3 because of the function that is assigned to them as
4 being important to safety. But the event sequence,
5 there are no event sequences that would involve
6 failure of those, plus a drop and breach of the waste
7 package, for example.
8 That is a beyond Category II sequence, but
9 we are relying on those components to make that a
10 beyond Category II event sequence, and that is why
11 those components are classified as important to
12 safety.
13 The next page is waste isolation. These
14 items are important to meeting the 63.113 performance
15 objectives. Now, on the Q list that we have prepared
16 as a result of concluding this preliminary PSA, to be
17 inclusive, we have included the important waste
18 isolation components, barriers, features, as well as
19 important to safety SSCs.
20 That way we would get an entire sense of
21 those things that are important to the facility. The
22 preclosure safety analysis though is not the vehicle
23 that defines these as being important to waste
24 isolation.
25 These came out of the total system

1 performance analysis, and the preclosure safety
2 analysis folks picked that out of the TSPA analyses,
3 and captured it in the Q list. So that we have the
4 complete set of ITS and ITWI components listed in
5 there.
6 But those include the subsurface facility
7 itself, the drift inverts, the drip shields, the
8 saturated zone between the repository and the
9 accessible environment; and the unsaturated zone, the
10 waste packages, the cladding for commercial and Naval
11 fuel, and not for the DOE fuel.
12 The reason for that is we know that some
13 of the DOE fuel is degraded, and cladding is not
14 intact. We are not going to try and take credit for
15 that.
16 Instead, the DOE fuel will be coming in
17 robust canisters, and we will be crediting those
18 canisters. And the waste form. The LARA and worker
19 safety. The waste packages are not shielded. They
20 are certainly robust, and they withstand the design
21 bases events that we have assigned to them.
22 We have considered several times over the
23 years whether or not we ought to provide shielding in
24 the waste package proper, and have each time
25 determined that that was not an appropriate trade-off.

1 Either of the result, and heavier waste
2 packages, possibly more difficult to handle or recover
3 from, or there would be more waste packages.
4 Given that these are large heavy components, they have
5 to be handled with robust mechanical systems anyway.
6 So we felt that we could do that
7 reasonably remotely, as well as allowing contact
8 access to the waste packages. So the waste packages
9 are still unshielded, but as you have seen on the
10 surface facilities, they is shielding, and there are
11 remote controls for them.
12 And in the subsurface, they are
13 transported in that shielded transporter, and that is
14 providing a shielding mechanism, and also protection
15 against rock falls and those sorts of things.
16 The drift turnouts reduce the dose and the
17 access main, and they are not only a mechanism to get
18 from one track to the emplacement drift, but the
19 curvature of them and increasing that radius has
20 provided additional rock mass there.
21 So that is providing shielding for workers
22 and the access mains to the waste packages that are in
23 the emplacement drifts. The ventilation control doors
24 that are now out adjacent to the access mains are
25 providing personnel access control.

1 There is also that we continue to maintain
2 a differential ventilation pressure between the
3 emplacement and the development side. We want to have
4 the emplacement side at a lower pressure relative to
5 the development side.
6 So that if there is any leakage of air
7 from one area to another, it is going from where the
8 development workers are to the emplacement side.
9 Okay. That is the prepared remarks on the subsurface
10 set, and before we go into waste package, I would want
11 to take questions.
12 VICE CHAIRMAN RYAN: Sure. We can take
13 questions that folks might have here. Ruth, do you
14 want to start, please.
15 DR. WEINER: Sure. Could you go back to
16 Slide 29, and I guess it is the replacement drift.
17 What does that emplacement configuration do to the
18 prospect of retrievability? I mean, how would you
19 retrieve if you had to given that the drip shields
20 won't be there.
21 I am assuming that the drip shields won't
22 be there, but suppose that something happens to one of
23 your containers. How would you retrieve one?
24 MR. HARRINGTON: In years past, we had
25 considered having the capability of going in and

1 picking an individual waste package from the middle of
2 a string, and decided that was not a very good idea,
3 because if you had component failure, it would be hard
4 to recover from that.
5 So for the last several years the
6 expectation has been to fill starting at the back of
7 the emplacement drift, and then fill out to the access
8 mouth of the drift.
9 That means that if you had to go retrieve
10 a package, or all the packages, you would start
11 retrieval from the mouth and work your way back to
12 whichever package you were trying to get.
13 Isn't that making a lot of difficulty for
14 yourself? I mean, wouldn't it have been -- I mean, I
15 don't know because I am not an engineer, and I don't
16 pretend to any engineering knowledge.
17 But wouldn't it have made retrievability
18 more convenient, easier, if the emplacement were
19 transversed to the rail direction rather than along
20 it?
21 MR. HARRINGTON: There have been many
22 different concepts of emplacement methodologies, and
23 how you might orient it. Some of them are bore holes,
24 or larger areas. This one we think gives us the best
25 mix of construction costs.

1 This is a fairly straightforward tunnel
2 boring machine access. It is a fairly straightforward
3 set of mechanical features in there; the invert, the
4 drift, and going to devices kind of like you were
5 talking about, some of those were considered to be an
6 individual bore hole off of the main gallery.
7 That is more complicated in many respects,
8 and having to simply go in, and turn, and transverse,
9 extract. If you had shielded packages, that may not
10 be a problem. If you didn't, it would be a problem.
11 This also is fairly conducive to ventilation.
12 The packages are sitting in a larger
13 opening, and so you have that much greater surface
14 area for heat to radiate to from the packages. If you
15 went to the smaller holes, it is a lesser surface
16 area, and you can see higher temperatures.
17 This really has been something that we
18 have studied for a long time, and we kept coming back
19 to this sort of --
20 DR. WEINER: I have a question, and I
21 don't think you came on this sort of suddenly, or
22 without a lot of thought. I am just concerned that as
23 you pointed out, that if you have to retrieve a
24 package, you have to pull out all the packages that
25 are in front of it.

1 MR. HARRINGTON: Well, we think that is a
2 lesser issue than some of the others that would have
3 been introduced by other configurations.
4 DR. WEINER: Okay. The second question I
5 have is that you are assuming I take it that the waste
6 transporter and the emplacement gantry will never be
7 involved in any kind of accidental fall?
8 MR. HARRINGTON: No, we are not assuming
9 that.
10 DR. WEINER: Have you done a risk
11 assessment for these?
12 MR. HARRINGTON: We have done probablistic
13 analyses of the potential for drops, and the drop
14 frequency of those. That's why those ended up being
15 classified as ITS because we don't want them to drop.
16 We also are designing those devices so
17 that they don't exceed the drop height that was
18 defined as one of the design bases of the waste
19 package.
20 DR. WEINER: So you are assuming that if
21 they do drop, they are so designed so that they will
22 not breach?
23 MR. HARRINGTON: We are having to look at
24 the event sequence of a potential drop, which would
25 involve having a failure of the emplacement gantry,

1 for example, and also a breach of the waste package.
2 We would have to look at the
3 probabilities of both of those, plus whatever else
4 might enter into that particular event sequence, and
5 the overall categorization of that, and that's why the
6 potential for a drop and breach is less than 1 in 10
7 to the minus 4 based on the analyses that we did, and
8 that is why it is not a Category II event.
9 But we are crediting the gantry for its
10 ability not to drop, and we are crediting the waste
11 package for its ability not to breach, and that's why
12 those components end up being classified as important
13 to safety, though they are not participants in an
14 actual event sequence. We are relying on them to
15 prevent the event sequence.
16 DR. WEINER: Okay. I guess that is all
17 for now until I think of something else.
18 VICE CHAIRMAN RYAN: John.
19 CHAIRMAN GARRICK: Would you summarize
20 once again the propulsion systems between the access
21 drifts and the emplacement drifts?
22 MR. HARRINGTON: The which systems?
23 CHAIRMAN GARRICK: The power systems from
24 moving this stuff around.
25 MR. HARRINGTON: Oh, in the access mains,

1 the power to the locomotives is by overhead gantry,
2 and that is current expectation. As far as the
3 control system there, I would probably defer to Mark
4 for that.
5 In the emplacement drifts there is a bus
6 bar, I believe, running along there that the machine
7 that the emplacement gantry would take its power from,
8 and as far as the controls for that, there are several
9 different technologies that we have looked at,
10 including microwaves, leaky feeders, and I forget what
11 the other one was.
12 And I don't know that we have actually
13 made a decision on that. If I can have Mark Board
14 talk to that a little more, please.
15 MR. BOARD: The decision on the control
16 system for the gantry I don't believe has been
17 finalized yet. As far as the transport of the waste
18 package down the tunnel to the access main, there are
19 two engines on it, one in the front and one behind,
20 and the idea is to have those two prevent sort of a
21 potential runaway of the waste package.
22 The one that could be decoupled on the
23 front and in the switch thrown in the engine remotely
24 back into the turnout, and there is a control system
25 that will control when it docks into that docking bay

1 that you saw right there and stop.

2 And then the bed plate that the waste

3 package and pallet right on is remotely controlled

4 after the shield doors are open to push the bed plate

5 out on to the dock where the gantry will pick it up

6 from that point on.

7 And from that point on the gantry is

8 powered from a bus bar that runs down the invert of

9 the drift.

10 CHAIRMAN GARRICK: Is there a reason that

11 you went to an overhead system for the access drifts

12 and a ground system for the emplacement drifts?

13 MR. BOARD: I am not sure of all of the

14 reasoning behind that. I think the primary thing is

15 that it is just simply a simpler system. It is well

16 proven and it is out of the way from a construction

17 standpoint. I guess the overall safety is the primary

18 concern.

19 We have lots of room in the access mains,

20 and it is something that is often used in underground

21 in mining systems. I think that is the primary

22 reason.

23 CHAIRMAN GARRICK: What is the life

24 expectancy of the ground support system?

25 MR. BOARD: The total life expectancy I

1 can't exactly say. We were looking at -- the
2 preclosure period that we are looking at right now is
3 about a hundred year preclosure period, and we
4 designed the system to be robust from an operational
5 standpoint to easily last through that period of time.
6 I don't exactly know that we have
7 determined ultimately how far we think that system
8 would last, because once the system or repository
9 closes, we are not counting on that ground support for
10 anything.
11 CHAIRMAN GARRICK: Right.
12 MR. BOARD: We made it very robust also
13 from the standpoint of requiring what we think is
14 going to be minimal and no maintenance, and so it is
15 kind of unconventional, the system that we are using,
16 only from the standpoint that it is made out of
17 stainless steel.
18 Every component that we have specified in
19 there is in common use in the mining industry. It is
20 just that we have sort of beefed the components up to
21 hopefully make certain that we don't have to have
22 worries about it.
23 CHAIRMAN GARRICK: Stainless steel, that
24 sounds kind of extravagant.
25 MR. BOARD: Well, a hundred years is an

1 unusual requirement.

2 CHAIRMAN GARRICK: Right.

3 MR. BOARD: And stainless steel rock bolts

4 are in standard use, and so lots of mines have high

5 sulfite contents, which create acidic environments,

6 and for example, both of these swellicks (phonetic)

7 and split set type bolts, the same ones that you saw

8 yesterday out there, are available in stainless steel

9 off the shelf.

10 CHAIRMAN GARRICK: All right.

11 MR. BOARD: So they are a bit more

12 expensive, but it is not outrageously more expensive.

13 CHAIRMAN GARRICK: Thank you.

14 VICE CHAIRMAN RYAN: Jim, do you have any

15 questions?

16 MR. CLARKE: Just a couple of questions,

17 Paul, and these are really more about operations than

18 design, but they are inspired by design I guess. So

19 the first one is a follow-up to the question that I

20 asked just before the break.

21 And that is that as I understand it, you

22 will be beginning a second phase of construction after

23 the facility has opened, and at a time when the

24 through put has been steadily increasing.

25 And I guess the point that I wanted to

1 make was that just adds another potential source of
2 things that can go wrong, and you now have
3 construction activities while you are receiving waste.
4 And I wondered do your scenarios incorporate that?
5 MR. BOARD: The Coldsim (phonetic) and
6 Witness modeling scenarios, or just the basic
7 construction?
8 MR. CLARKE: Well, just the possibility of
9 construction accidents and encounters with other
10 vehicles.
11 MR. BOARD: In laying out the layout, and
12 let's go back to Slide 27, please. The reason that
13 this evolved over the last year or so was really to
14 address construction and operations interfaces.
15 MR. CLARKE: And I am really thinking more
16 about what is going on at the surface.
17 MR. BOARD: Okay.
18 MR. CLARKE: As you are building new or
19 expanding existing surface facilities.
20 MR. HARRINGTON: Well, you will notice
21 that the DTF-2 was offset from DTF-1, and there was a
22 shielded corridor if you will between them. That sort
23 of discussion is directly a result of -- or that sort
24 of solution is a direct result of some of the
25 operations concerns.

1 Some of the earlier facility layouts were
2 focused on how can you optimally approach the north
3 portal. But then when you looked at access to
4 subsequent building construction, you found that you
5 were constrained. So a lot of things have shifted
6 around as a result of that.
7 That corridor is one thing where we see a
8 recognition to provide an isolation between the
9 operating DTF-1 facility and the DTF-2 facility to
10 support the latter's construction as the former is
11 operating.
12 So that is a mechanism to do it. It would
13 also provide protected transfer of materials from DTF-
14 2 to the remediation part of DTF-1, and that is why it
15 is there.
16 But as we are doing the facility layouts,
17 that is really one of the major considerations, is
18 that given that not everything gets built and
19 finished, and is operational on the same day, now do
20 you then make sure that you are able to continue
21 construction on the subsequent facilities.
22 The subsurface is really more
23 straightforward than the surface, and it is repetition
24 of emplacement drifts, and they lump them into panels.
25 MR. CLARKE: You're right. I was really

1 more concerned about the surface, and no additional
2 activities going on, and other kinds of vehicles
3 running around construction activities in the middle
4 of an ongoing waste receiving operation.
5 MR. HARRINGTON: Right. I said earlier
6 that the construction and -- well, I think I said
7 operations and maintenance folks are involved with the
8 design, so are the construction people, just for those
9 sorts of constructibility issues.
10 MR. CLARKE: And my second question is
11 related to Ruth's line of questioning, but a little
12 more basic, and I may have missed something, but on
13 Slide 36, the waste package transporter will have two
14 locomotives associated with it.
15 MR. HARRINGTON: Yes.
16 MR. CLARKE: Manual and remote control
17 operations; will there be people in those locomotives?
18 MR. HARRINGTON: Yes, there are.
19 MR. CLARKE: Okay.
20 MR. HARRINGTON: That is a shielded
21 transporter, and so the operators in the locomotive
22 cabs are protected.
23 MR. CLARKE: So you have two locomotives
24 in case one of them has a problem; is that a factor as
25 well?

1 MR. HARRINGTON: Yes.

2 MR. CLARKE: I guess I was wondering how
3 you would retrieve the waste package transporter if
4 you got halfway to your destination and something
5 failed.

6 MR. HARRINGTON: You can access that. The
7 waste package transporter, because it is shielded, you
8 can have local personnel access. If it jumped the
9 track or something, you could easily access it and
10 jack it up, and get it back on track.

11 If you had a mechanical failure, you could
12 have people access it hands-on to repair whatever it
13 is.

14 MR. CLARKE: Okay. Thank you.

15 VICE CHAIRMAN RYAN: Sher.

16 MR. BAHADUR: Paul, on your Slide 29, when
17 I look at this isometric diagram, I get the idea that
18 the waste packages are stacked end to end on the
19 transport rail system, and that they have been placed
20 in a rock supported drift,a nd they also have a drip
21 shield, which to me seems more like a genetic
22 schematic.

23 Is there something that I am missing which
24 is making it specific for Yucca Mountain or just a
25 generic design?

1 MR. HARRINGTON: Well, that design is
2 specific to Yucca Mountain, and it certainly takes
3 into credit or into account the rock properties there.
4 That is part of why we are looking at the ground
5 control devices that we have assigned there.
6 As far as could you bore a hole and put
7 materials somewhere else, yes. Mark, do you have
8 something to add to that?
9 MR. BAHADUR: Well, what I heard was that
10 these openings are going to have the rock support,
11 whether we need it or not. So if that is true, then
12 that does not make it specific to Yucca Mountain, and
13 if we assume that the water is going to find its way,
14 then you are going to use the drip shield.
15 So I am just trying to see as to what
16 gives me the idea that after considering all of the
17 factors of Yucca Mountain that this design has been
18 finalized?
19 MR. HARRINGTON: Okay. I will answer from
20 one perspective, and that is a maintenance issue. We
21 want to have a very robust ground control mechanism
22 that will minimize to the extent possible the need to
23 potentially send people back into emplacement drifts
24 having to do the unloading of packages if that were
25 the case, or having to use remote tooling or

1 something.

2 We want a very robust ground control

3 mechanism. Mark, if you can talk to that.

4 MR. BOARD: Well, yes, I think it is --

5 well, I think the problem is that anytime that you

6 look at any picture that it is difficult to see all

7 the details that went into the design of that.

8 In our case, first of all, the ground

9 support is very much specific to this project. We

10 have done extensive calculations over the past year-

11 and-a-half that were all aimed at examining what kind

12 of ground support is specific and best for Yucca

13 Mountain.

14 And, for example, the type of sheeting

15 that we are using around the exterior is slotted to

16 allow air circulation for drying the rock. The design

17 of the slotting itself that we have is such that we

18 can prevent even small rocks from falling off on the

19 track.

20 The type of bolting that we are using and

21 the spacing is specific to this rock type in this

22 project. We are using the same ground support in both

23 rock types that were in really more from a

24 standardization point of view.

25 If you go to virtually any mine, I think

1 you will find that in most places the same ground
2 support is used on a regular basis to allow the mining
3 crews to get good at installing something and using
4 the same thing.
5 So we don't think that it is a good
6 practice to change things based specifically on rock
7 type. The invert design there has been done
8 specifically for this project based on the waste
9 package dimension and things.
10 The ballast that is placed in there, which
11 we really have not talked much about, has been the
12 compaction and the design of it has been such for
13 utilizing the crushing of the tuff that we take from
14 the tunnel boring machine, and take back underground.
15 The drip shield itself is very specific to
16 this project and the design there, which I guess we
17 will touch on a little bit later, has been very
18 specific to this project. So I think that would be
19 how I would answer that question.
20 VICE CHAIRMAN RYAN: Let me follow up just
21 a bit on the design completeness and so forth, and I
22 appreciate the fact that with graphical presentations
23 like these drawings that it is difficult to understand
24 some of the details, but I think about design as
25 conceptual, preliminary, detailed, and final. Where

1 are we, and particularly on these underground systems?

2 CHAIRMAN GARRICK: Or in the vanacular of

3 the engineer-constructor world, conceptual Title I and

4 Title II.

5 VICE CHAIRMAN RYAN: The percent complete,

6 and I am trying to get a gauge as to where we are,

7 because we have covered a lot of the conceptual

8 details, but the rubber meets the road on the details.

9 MR. HARRINGTON: If I had to use one of

10 those terms, I would use preliminary, but we agreed

11 with the NRC that we would not use that, because that

12 was in effect DOE terminology, especially the Title I

13 and Title II terminology.

14 Instead, we will simply refer to this as

15 the LA design, a design necessary to satisfy the

16 requirements for the license application for

17 construction authorization.

18 So we really have tried to stay away from

19 referring to it as preliminary, versus conceptual,

20 versus final.

21 VICE CHAIRMAN RYAN: That still leaves me

22 confused. You know, I appreciate the schematic nature

23 of these, but it is difficult to -- you know, I have

24 spent a lot of time, for example, and again I am not

25 a 10 year veteran of Yucca Mountain. So it is hard to

1 probably educate me.

2 But we go from an overhead power trolley

3 system to a bus bar system, and I am thinking, well,

4 how does that transfer take place, and I don't see

5 some of that detail.

6 And I just think about from my perspective

7 safety and radiological control, and opportunity for

8 mishaps, and if things were not to work exactly right,

9 and then I think about, well, what stage is the design

10 of these two transporters, and my mind turns to design

11 construction and testing, and all of that, and I am

12 just trying to think about where along the road of the

13 process that these designs are.

14 MR. HARRINGTON: The focus that we are

15 trying to hold is somewhat more detailed than the

16 power plant preliminary safety analysIS report design.

17 That was a two-step process, and this is a two-step

18 process.

19 VICE CHAIRMAN RYAN: Okay.

20 MR. HARRINGTON: So in our mind that is

21 the way we are interpreting Part 63 and the LARP when

22 it says that you have to have a design. We will do

23 that design. We have taken a number of different

24 approaches in the past few years to try and clarify

25 that to make sure that we don't provide less than what

1 is expected.

2 We have talked in terms of percentages of

3 design. I personally don't care for that because what

4 is 40 percent. Is it a hundred percent of 40 percent

5 of the stuff, or is it 40 percent of everything? Is

6 it the rate of 40 percent?

7 That use of percentage is not real

8 helpful. We have talked about PSARs versus FSARs, but

9 each of us has a little different experience with what

10 we saw in preliminary safety analysis reports versus

11 the finals.

12 We bring a little bit of that to the

13 table. So we have defined some matrices of specific

14 products in the design organization that we expect to

15 have done to support the license application. That is

16 not to say that each of those things

17 -- its drawings, its calcs, its analyses -- that they

18 would be in the LA proper, but they would be completed

19 to an extent necessary to support the license

20 application.

21 A companion document with that was a text

22 discussion of what degree of completion are those

23 products to be. A piping and instrumentation diagram

24 is not going to have vents and drains on it until you

25 have done the physical layout to know where the high

1 points and low points are.

2 But you certainly, and we believe that the

3 NRC staff, will need to know what the components are,

4 what the major pipes are, what the flow rates are, how

5 this system operates. That is the kind of

6 information, at least on the mechanical side, that we

7 are expecting to provide.

8 Yes, that actually probably comes out of

9 a 3-D model, but it looks like it might be a fairly

10 simple discussion, with not much behind it. There is

11 a lot of analytical information though that has been

12 done that supports that.

13 They have done calculations on the rock

14 mass properties, and on the strength of the rock, and

15 on the types of ground control, and the thermal

16 analyses that support it.

17 And the surface facilities, I showed you

18 a series of sketches there, and they have done a fair

19 amount of actual structural analysis of the concrete

20 structures primarily.

21 They have done a lot of through put

22 analysis, and they have Cogema, and Cogema has been on

23 board for the better part of 9 months or so. They

24 have all of their input in. We have redone the system

25 description documents about a month ago, about the end

1 of September.

2 And 33 or so of those came in, and

3 revisiting and reclarifying the system requirements.

4 So there is a lot of information that has been created

5 to support these sorts of sketches, and we are trying

6 to make sure that neither the NRC staff nor us are

7 surprised when we go to deliver the license

8 application with that set of material.

9 VICE CHAIRMAN RYAN: Thanks. That is a

10 summary of what you have worked on with regard to

11 these units and that is helpful. And I am again

12 reminded of John's question about the airplane

13 schedule.

14 So I am just trying to anticipate how much

15 is left, and it is always a question that comes up

16 when you hear what has been done. Thanks.

17 MR. HARRINGTON: Okay.

18 VICE CHAIRMAN RYAN: Any other questions

19 or comments? All right. Let's go on to the waste

20 package discussion then.

21 MR. HARRINGTON: Now, for the waste

22 package, the design for the preclosure period, and

23 analyzed for the post-closure period. So in that

24 preclosure design, we are designing that such for each

25 is beyond the category to prevent sequencing, that

1 supports the preclosure safety analysis.

2 We will look at a series of event

3 sequences. An object falls onto the waste package,

4 and waste package drops, dynamic events, swingdowns,

5 tipovers, vibratory ground motion, parametric fires.

6 There is a series of fires that are

7 identified and will vary the parameters of those fires

8 and make sure that the waste package doesn't breach.

9 The preclosure design basis for rock fall. So that is

10 the set of design bases for the waste package for the

11 preclosure period.

12 For the post-closure, we will analyze its

13 performance during the post-closure period. We have

14 to look at a series of postulated events during that

15 post-closure period that has the drip seal installed

16 at that time.

17 Those support the model abstractions for

18 TSPA, and look at damage from rock fall, and damage

19 from seismic events, and distribution of weld flaws to

20 provide potential and preferential pathways for early

21 waste package failures, and stresses in the waste

22 package, and base metal and weld areas.

23 We have done some mock-ups recently for

24 the waste package, and in FY 2000 we fabricated a

25 quarter-length test mock-up to validate the

1 fabricability of that design, and performed stress
2 measurements before and after welding of that mock-up,
3 and demonstrated that we could actually use remote
4 machine welding to do that.
5 There has been a lot of concern as to
6 whether or not that might be a problem area in the
7 surface through put issues, and the results of that
8 mock-up was used in several of the developmental
9 stages.
10 I mentioned earlier that we have now done
11 a mock-up of the spread ring. This is for the revised
12 stainless steel lid closure, rather than what earlier
13 was a 4 inch open fresh weld to be made, and any
14 projectable indications reworked remotely that did not
15 seem like a high likelihood of success.
16 We have gone to effectively the same type
17 of arrangement that the Navy has, where they main
18 canister lid is retained by a shear ring, and call it
19 a spread ring, and in 4 hours it is a single ring that
20 you can see on the right there in that overlapped area
21 right there.
22 And this machine basically closes the
23 shear ring enough to allow insertion of it into the
24 waste package end, and then that machine will force
25 this end of that shear ring out, and engaging inside

1 the groove in the waste package body, and that worked
2 well.
3 And the developmental studies for the
4 waste package gives us information, and rationale for
5 the design, and any issues that might come up with
6 fabrication, and that support analyses and model
7 reports which are supportive of TSPA.
8 We have completed a series of studies
9 already on weld flaw distribution, induction
10 annealing, laser peening, et cetera, and there are
11 several other studies that are planned for or are
12 continuing this fiscal year now, this one that we just
13 started.
14 Weld material and base metal variability
15 studies, that was one of the items out of a KTI
16 agreement; and laser peening and controlled plasticity
17 burnishing corrosion study, and a fracture toughness
18 study, and a welding interpass temperature study.
19 The prototyping of the waste package
20 themselves, we want to demonstrate the fabrication
21 process early enough in the design cycle that if there
22 are changes that would be appropriate to make as a
23 result of that, we can still do that.
24 So we are looking at prototyping so that
25 we can make sure that they are fabricatable, and

1 inspectable, and testable. We have to do NDE on them.
2 Do the stress mitigation.
3 So they will be done to verify the closure
4 processing systems, and also to support the handling;
5 lifting, trunnion, collar, engagement exercise, and
6 provide for operator training.
7 So we have planned for 15 waste package
8 prototypes and that does not mean necessarily that
9 there are 15 full-length ones. One of the things that
10 we need to focus on is the making and inspecting of
11 welds.
12 So of the waste package types are very
13 similar. The Navy short is identical to Navy long,
14 except for length. Those prototypes are looking at
15 getting a contract cut by the end of this calendar
16 year.
17 They would be produced over the next 6
18 years, and we expect to have bids in by July of '03.
19 I'm sorry, to issue an RFP for them by July of '03.
20 The 10 configurations there on the left are the same
21 as have had for quite a few years now.
22 The change is both in the closure
23 mechanism form, which is a slide or two later, and
24 this lifting trunnion. This is the lifting trunnion.
25 It has a pair of trunnions on the side there, and

1 lifting collars is the right name for it.

2 There are three short threads if you will,

3 like a bayonet lens on a camera is probably the best

4 analogy that I can use. So you would insert that on

5 to the end of the waste package, and give it about a

6 60 degree turn, and that would then be engaged on to

7 the end of the waste package to support or to allow

8 using that collar and trunnions then to pick the

9 package into a vertical condition, vertical

10 orientation, and handle it.

11 Recent changes to the waste package. The

12 extended outer lid was replaced with a flat one. The

13 induction annealing stress mitigation technique would

14 be replaced by either laser peening or low-plasticity

15 burnishing.

16 The middle lid was changed from a full

17 penetration weld to a fillet weld, and that then

18 allowed us to delete the stress mitigation step for

19 that.

20 The inner lid became thinner, and the

21 closure mechanism also changed from a full penetration

22 weld to a spread ring. The split trunnion collar

23 changed from the one piece like we talked about, and

24 the gap between the inner stainless vessel and the

25 outer Alloy-22 vessel was changed to better

1 accommodate our expectations for a differential
2 thermal expansion.
3 The closure details. The older design had
4 a fabricated extended lid, and this was a full
5 penetration weld out there. This is the support
6 collar for the trunnion collar to be engaged on.
7 The middle lid had been full penetration,
8 and the inner lid had been full penetration. So we
9 have changed to a thinner inner-stainless steel with
10 the shear ring.
11 So that was the tool that I showed you a
12 moment ago that would engage that shear ring, and
13 compress it enough to allow getting it down adjacent
14 to the groove, and then allow the shearing to be
15 extended back into that groove, and filler welds, and
16 seal welds, would be made on the upper and lower
17 interfaces of the shear ring to the body of the waste
18 package, and to the inner lid.
19 And that middle lid, as a filler weld
20 there, instead of the full pin, and the outer lid,
21 goes to a much simpler design with a smaller, but
22 still full penetration weld.
23 The drip shield design again analyzes for
24 post-closure. The postulated events that can happen
25 to it would include rock fall and vibratory ground

1 motion, a seismic event.

2 There is a section of the drip shield, and

3 the drip shields do not align directly with waste

4 packages. They are a fixed length long and some of

5 the waste packages are of varying length.

6 So the joint of a waste package doesn't

7 necessarily line up with the joint of the drip shield

8 segment. It is not important that they do so.

9 Now, these are changes that we are

10 considering making to the drip shield. We have not

11 yet adopted them, but one is to increase the distance

12 from the bottom of the drip shield upper cover, the

13 insider of the drip shield top if you will, to the top

14 of the waste package.

15 That will allow additional deflection of

16 the drip shield without contacting the waste package.

17 Also, to increase the stiffness of the drip shield for

18 bending loads, and to add some longitudinal stiffener

19 beams along the axis between the bulkheads.

20 The materials of that are unchanged. They

21 are still titanium grade. The preclosure safety

22 analysis results. The waste package design considers

23 both of the Category I and Category II event sequences

24 as part of its design bases.

25 Because of that, inclusion of that as a

1 design basis, the robustness of the waste package, the
2 breach of the waste package then we believe becomes
3 beyond Category II.
4 That was part of the discussion that we
5 have had with the NRC staff, both on the waste package
6 and also on canisters, is might you have undetected
7 flaws that would permit a breach that had not been
8 accommodated in your design basis.
9 So we are looking at and have looked at
10 what sorts of flaws might be undetectable, and what
11 would the flaw distribution be, and so we think we
12 will have an answer for that.
13 Classification. The waste package itself
14 is important to safety, and the waste package and the
15 drip shield are important to waste isolation because
16 of the role that they both play in postclosure.
17 Again, because the drip shield isn't
18 installed until the end of the preclosure period, it
19 is not credited with any preclosure ITS performance.
20 In summary, we did the preliminary
21 preclosure safety analysis and that was actually
22 completed at the end of September based on the April
23 '03 design status.
24 That indicated that we would be able to
25 meet the regulatory performance objectives. We have

1 identified SSCs that are in that design that would be
2 important to safety, and engineered features which
3 would be important to waste isolation.
4 We are working now to complete the design
5 to support the license application. The PSA will need
6 to be updated based upon that completed LA design, and
7 we don't anticipate new event sequences.
8 So we believe that the LA would continue
9 to be able to meet our regulatory performance
10 objectives. Are there questions based on that?
11 VICE CHAIRMAN RYAN: John.
12 CHAIRMAN GARRICK: Given that the lid
13 welds were considered one of the more likely pathways
14 for moisture gaining access to the fuel, have these
15 changes, development activities, and the consequence
16 of the detail design, are they having an impact on
17 what the license application performance assessment
18 will look like?
19 MR. HARRINGTON: I would defer to Mike
20 Anderson of BSE, the waste package design lead for BSE
21 to answer that.
22 CHAIRMAN GARRICK: I am talking about the
23 performance assessment more than the --
24 MR. HARRINGTON: Right.
25 CHAIRMAN GARRICK: Yeah, right.

1 MR. HARRINGTON: I don't do the
2 performance assessments, and so I can't really --
3 CHAIRMAN GARRICK: Well, only because the
4 lids were the most likely pathway for --
5 MR. HARRINGTON: You are talking
6 postclosure TSPA, right?
7 CHAIRMAN GARRICK: Yes.
8 MR. HARRINGTON: Mike.
9 MR. ANDERSON: This is Mike Anderson,
10 Waste Package Design for BSE. I, too, do not do the
11 postclosure TSPA, but these changes are the result of
12 a value engineering study that was conducted last
13 fall, in which TSPA was a part of, and so they closely
14 examined the bases for the --
15 CHAIRMAN GARRICK: I am having a little
16 trouble picking you up.
17 MR. ANDERSON: Is that better?
18 CHAIRMAN GARRICK: Yes.
19 MR. ANDERSON: Let me start over again.
20 Last fall, there was a value engineering study that
21 was conducted on the waste package and particularly
22 focused on the final closure and the feasibility of
23 the induction annealing process.
24 And in conjunction with the folks from
25 TSPA, they looked at what the real requirements were

1 in terms of compressive layers, and weld
2 microstructure, and how much time they had before it
3 would become an issue and adversely affect TSPA
4 predictions.
5 And as a result of that value engineering
6 study, this recommendation came out. So in that
7 recommendation, both low plasticity burnishing and
8 laser peening were found to give adequate compressive
9 depth to meet their long term performance goals.
10 CHAIRMAN GARRICK: Okay.
11 VICE CHAIRMAN RYAN: Ruth.
12 DR. WEINER: There is a question that I
13 always wanted to ask. What is to prevent water from
14 condensing on the inside of the drip shield, thereby
15 sort of obviating the effect of the drip shield?
16 I mean, you are going to reach a certain
17 humidity in the post-closure period, and given
18 temperature differences, and so on, if water simply
19 condenses from the air, it can condense as easily on
20 the inside of the drip shield as it can on the
21 outside. Am I missing something? What am I missing?
22 MR. ANDERSON: This is Mike Anderson
23 again. The primary purpose of the drip shield to
24 prevent direct adjective flow on to the waste package,
25 and so it certainly has been postulated that what you

1 say would occur.

2 But what you have then is water that comes

3 in through the crack or the fracture network, and ends

4 up in the invert, and finds it way underneath the drip

5 shield and evaporates.

6 Now you have water that basically is

7 distilled water that would condense on the inner

8 surface of the drip shield and drip on to the waste

9 package surface.

10 Now, there has been a lot of discussion

11 about what salts and things like that, and dust is on

12 the drip shield, and the interaction with that high

13 purity water that would come from condensation.

14 But insofar as the purpose of the drip

15 shield, it is the intersection of that adaptive flow

16 and also interception of rocks that might fall from

17 the roof of the drift.

18 DR. WEINER: So you are assuming that,

19 first of all, that is a whole lot less likely to

20 happen; and, secondly, if it does happen, that the

21 water is of such purity that you don't have salt and

22 other things enhancing corrosion. Am I correct in

23 thinking that?

24 MR. ANDERSON: Well, it would be certainly

25 be more pure than water directly coming from the roof

1 of the drift directly on to the waste package. We are
2 speedily getting out of my depth of knowledge on these
3 things, and so I think I will just leave it at that.
4 VICE CHAIRMAN RYAN: Okay. Is there
5 anybody else here who would want to talk to that?
6 Okay.
7 DR. WEINER: Okay. The studies that you
8 discussed on Slides 45 and 46, and you don't have to
9 turn to them. But I was just wondering.
10 Are these modeling studies, or are you
11 planning to do actual tests, and how are you dividing
12 that up? Is everything going to be physically tested
13 experimentally, or are some things simply going to be
14 modeled? What is the division between the two?
15 MR. HARRINGTON: Both are them are in
16 there, and --
17 DR. WEINER: Well, could you give me a
18 little more detail on that?
19 MR. ANDERSON: Okay. You are talking
20 about the ones that are on the bottom there, the 1, 2,
21 3, 4, 5, and 6 --
22 DR. WEINER: The whole group, yes.
23 MR. ANDERSON: Okay. That whole group,
24 those are all actual tests that remain on hardware.
25 DR. WEINER: Okay.

1 MR. ANDERSON: The weld flaw distribution
2 study is complete and documented, as is the induction
3 annealing tests that were done. Laser peening, I
4 think that there has been some work done there, and
5 there is going to be additional work done as with
6 controlled plasticity burnishing.
7 The residual stress measurement, those
8 things have been done, and will continue to be done.
9 And it says analyses there, and clearly you do some
10 measurements, and you also do some predictions with
11 numerical tools, and understand throughout the whole
12 volume of the metal what is going on, and not just
13 where you did the testing.
14 And then the neutron infarction analysis
15 is a way to non-invasively understand what is going
16 on, but those are all actual tests of hardware.
17 DR. WEINER: Okay. Thank you.
18 MR. CLARKE: Just one question, and again
19 a follow-up to Ruth. Slide 51, if you could pull that
20 up. Has this system been tested in the temperature
21 range that you expected to see in the repository?
22 MR. HARRINGTON: You mean has it been
23 physically tested already?
24 MR. CLARKE: Yes.
25 MR. HARRINGTON: I don't believe that we

1 have made a mock-up of the new. We had made a mock-up
2 of the old, but the prototyping that I talked to you
3 about --
4 MR. CLARKE: You had materials expanding,
5 and contracting, and things of that nature.
6 MR. HARRINGTON: Well, that was one of the
7 changes that I mentioned. I mentioned also was the
8 change in the annular gap between the inner cylinder
9 and the outer was to address that thermal expansion
10 issue. So we have made physical mock-ups of the older
11 design.
12 We have done testing and other things that
13 Mike was talking about in that. We are shifting to
14 this newer one and that is what we would expect to use
15 as the basis for the prototyping that we hope to get
16 started here fairly soon.
17 MR. CLARKE: And you would test that over
18 the temperature sequence that you expect to realize in
19 the repository?
20 MR. HARRINGTON: Oh, I don't know your
21 temperature range before that, but I would assume so,
22 sure.
23 MR. ANDERSON: This is Mike Anderson. I
24 guess I would have to ask you -- you know, we have
25 thermal expansion allowances in there and those are

1 well known material properties. I guess one
2 particular aspect of the thermal part of it --
3 MR. CLARKE: Well, I was just thinking of
4 the waste package as a system with all the components
5 in place, and then testing that over the anticipated
6 temperature ranges in the sequence that you would
7 expect to see the temperature changes.
8 Just how does it perform? Does it keep
9 its integrity? I mean, whatever is the best measure
10 of that.
11 MR. ANDERSON: I think if you think about
12 it a little bit, the thermal and other challenges to
13 the waste package in the drift are probably somewhat
14 more benign than the actual manufacturing process and
15 the final closure, because you have got large
16 temperature differences, particularly in the final
17 welding and things like that.
18 So in the prototype development process,
19 we would hope to pick up any flaws in the design, in
20 terms of mismatches, or differential expansion, and
21 things like that.
22 MR. CLARKE: Just to make sure that you
23 don't have something like an O-ring in your system.
24 In other words, how is this whole system performing
25 over that range.

1 MR. HARRINGTON: Well, there are no O-
2 rings in there.
3 MR. CLARKE: I know that, and that was
4 perhaps a bad analogy, but again just suggesting that
5 the system be tested as a system over those
6 temperatures.
7 MR. HARRINGTON: Okay. I understand.
8 VICE CHAIRMAN RYAN: Any other questions?
9 Sher.
10 MR. BAHADUR: I would like to follow up
11 the question on the drip shield that Dr. Weiner asked.
12 The way that I understand it, the drip shield is to
13 isolate your waste package from rock fall, and also
14 from any water that may have strayed into the
15 repository.
16 If in the postclosure time the rock fall
17 makes a dent in the drip shield, and comes in contact
18 with moisture, and with all that stress on it would it
19 corrode, or is the presumption is that the drip shield
20 material would not corrode?
21 MR. HARRINGTON: Well, I believe that
22 there is a corrosion allowance in there for the drip
23 shield. Mike.
24 MR. ANDERSON: This is Mike Anderson
25 again. Certainly there is general corrosion that

1 occurs in the drip shield, but when you have these
2 localized stresses the TSPA abstraction will predict
3 stress corrosion and cracking at those locations or
4 some kind of accelerated corrosion and cracking.
5 My understanding is that they assume that
6 because of the minerals in the water that those very
7 fine cracks will plug up and prevent additional
8 evective transport through the drip shield.
9 MR. BAHADUR: So if that is true then,
10 would you consider a drip shield with an arch around
11 the waste package, where your grabbing is actually in
12 touch with the waste package? Because then perhaps
13 you would be able to mobilize the strength a lot more
14 than just making an arch around the waste package?
15 MR. ANDERSON: Well, one of the advantages
16 of the drip shield is that it is decoupled from the
17 waste package. So when it gets hit by a rock, there
18 is no transmittal of any energy to the waste package
19 And one important thing about the waste
20 package Alloy 22 corrosion is that we have worked very
21 hard to get a compressive stress in the outer
22 millimeters of that, which will mitigate accelerated
23 corrosion, whether it is stress corrosion cracking or
24 some other form of corrosion.
25 So the longer that we can keep that

1 surface, those first few millimeters of the Alloy-22
2 in the as manufactured state, the greater resistance
3 we have to to accelerated modes of corrosion.
4 VICE CHAIRMAN RYAN: Mike Lee, you had a
5 question?
6 MR. LEE: Yes. I have two questions,
7 Paul. First, in the last year, either at the last
8 committee meeting here in Las Vegas, or in a
9 subsequent meeting with the NRC staff and the DOE
10 staff, there was talk of some development if you will
11 of a kind of prototype facility, possibly off-site and
12 outside of NTS, to work on the development of some of
13 these waste handling systems?
14 What is the status of that, or is that
15 still just kind of a concept?
16 MR. HARRINGTON: That is very conceptual
17 at this point. It is not off the table, but it has
18 not been determined whether or not to go ahead and
19 pursue that.
20 MR. LEE: Okay. Thank you. And my second
21 question is that once DOE submits the license
22 application does the DOE have a position on the amount
23 of site prep it needs to begin to undertake in advance
24 of the receipt of the license application?
25 Has there been any thought about that, or

1 is there just road running so to speak, or are you
2 waiting until the license application is approved, and
3 are you going to wait until that point to do prep
4 work, or could you elaborate a little bit about that,
5 please.
6 MR. HARRINGTON: There has been some
7 discussion about what would be an appropriate set of
8 work to ask permission to start prior to receipt of
9 construction authorization.
10 But the last that I heard is that we are
11 not yet to the point where we think it appropriate to
12 come and propose any set of work.
13 MR. LEE: Okay. Thank you.
14 MR. HARRINGTON: Okay.
15 VICE CHAIRMAN RYAN: Anyone else have any
16 questions or comments? I think we are just a little
17 bit ahead of schedule, and so I would suggest that we
18 take a short break. I have now about 4:15, and so why
19 don't we make it about 4:25 and we will reassemble and
20 start with our last formal presentation of the day,
21 and then move into stakeholder interaction and
22 comments. Thanks very much, Paul. Thanks for a great
23 afternoon.
24 (Whereupon, at 4:15 p.m., the meeting was
25 recessed and resumed at 4:30 p.m.)

1 CHAIRMAN GARRICK: Can we take our seats,
2 please. At the last ACNW meeting the Committee heard
3 a presentation from the NRC Staff and the Center for
4 Nuclear Waste Regulatory Analysis on Drift
5 degradation. This is a subject of considerable
6 interest to the committee.
7 Unfortunately, our earth scientist was
8 unable to attend this particular meeting, but we will
9 do our best to represent some of the questions that he
10 might have asked. At this time, we are going to hear
11 from the DOE, and we wanted to wait until we heard
12 that presentation before we wrote a report to the
13 Commission.
14 And at the time of our discussion and our
15 questions, Dr. Notaroja of the NRC staff will make a
16 few comment, somewhat in the manner that you made,
17 Mark, at our last meeting. So with that, let's
18 proceed. And I guess that Mark Board is going to give
19 the presentation; is that correct?
20 MR. BOARD: Yes.
21 CHAIRMAN GARRICK: Okay.
22 MR. BOARD: Just so Raj and I don't have
23 a boxing match at the end. I think he outweighs me.
24 Okay. I am going talk about the work that we have
25 been doing on drift degradation and the rock mechanics

1 aspects of drift degradation.

2 And just for those of you who were not

3 here yesterday, we went underground and we discussed

4 a lot of this stuff yesterday, and so unfortunately

5 you are probably going to have to have a repeat of

6 some of it.

7 But at any rate, we went underground and

8 looked at the rock, and had a lot of discussion in

9 this regard. What I would like to do today is give

10 you sort of a broad overview presentation.

11 I don't have a lot of highly detailed

12 technical slides and things in here because it was

13 meant to be an overview presentation, but I can try to

14 answer any of your questions.

15 First of all, I wanted to summarize for

16 you what we think the general sources and mechanisms

17 of mechanical degradation of the tunnels are; how we

18 think it will degrade, and what the stress mechanisms

19 are that cause that degradation.

20 I would like to review the geology and the

21 layout of the repository and how it relates to the

22 geology, because it has a direct impact on the

23 significance of this mode of drift degradation.

24 I would like to review briefly the

25 methodology that we have been using for simulation and

1 prediction of drift degradation processes, and then
2 finally I would like to give you a presentation of
3 some of the results that we have, and drift
4 degradation in particular to in situ stresses, thermal
5 stresses, and seismic loading, and also time
6 dependence changes in the rock mass.
7 As we go through it, in some cases I will
8 do some contrasting between our approach -- that the
9 NRC staff has been using, and the center staff has
10 been using in analyzing these processes.
11 The first thing that I wanted to talk
12 about was just about what the sources of mechanical
13 degradation of the rock are. Mechanical degradation,
14 I gave a little definition there. There is damage or
15 yield in the rock mass that is induced around these or
16 in any tunnel that is mined underground as a result of
17 applied stresses or time dependent changes in the
18 mechanical behavior of that material.
19 Damage here refers to in general
20 propagation of fractures or new creation of new
21 fracture surface due to yielding or failure of the
22 rock mass. Now, underground, you can go into
23 virtually any mine and you will find yielding or
24 failure of rock masses that occurs around all tunnels.
25 It doesn't mean that the tunnels are

1 unstable. It simply means that they can locally yield
2 and shift the stresses out to an area that the rock is
3 confined, and it comes to equilibrium. So it is a
4 natural process that occurs around most underground
5 excavations and tunnels where the tunnel is deep
6 enough, and the stresses are high enough to cause
7 yield to the rock.
8 In our case, there are three primary
9 sources for stress change that we are concerned with.
10 The first is the in situ stress in the material
11 itself, which I show here.
12 At Yucca Mountain the maximum stress in
13 the rock itself which is due to gravitational load
14 from the overburden is in the vertical direction, and
15 the minimum principal stresses are in the horizontal
16 direction.
17 And the vertical stress in general is
18 about -- if you think in terms of metric units, it is
19 about 7 megapascals, which is just simply due to the
20 weight of the overlying rock.
21 And the minimum stress is about --
22 anywhere from about 3-1/2 megapascals, which is a
23 ratio of about 2 to 1, to about 5 megapascals or so.
24 So the minimum or the maximum stress ratio which
25 controls the shearing stresses that develop in the

1 rock is about 2 to 1.

2 Naturally when you have a maximum vertical
3 stress component, the peak stress concentrations occur
4 in the walls at the spring line or the center line at
5 the top.

6 So in our case, when you walk underground
7 at Yucca Mountain right now, the maximum stresses that
8 occur are actually right at the spring lines of the
9 tunnels.

10 In general, at Yucca Mountain right now,
11 the rock stresses that occur here are not sufficient
12 to cause yield of the material, and it is in an
13 elastic state in general.

14 There are a couple of localized areas that
15 we have observed some small yielding in the spring
16 lines of the tunnels, and yesterday we went down
17 through the ECRB, and when you pass through the
18 immediate intersection, or rather the transition from
19 the middle lithophysal unit to a lower lithophysal
20 unit, there is a transition zone in there where the
21 lithophysal are large, and the rock is somewhat
22 fractured or more fractured in there.

23 That is one spot locally where if you
24 drill holes in the side wall here, you can see some
25 minor yielding in the side wall that goes to the depth

1 of perhaps a quarter of a meter or something, and you
2 can actually see fractures that are forming parallel
3 to the free surface, which is a typical type of
4 yielding that you have.
5 That is about the only areas that we see,
6 and I will describe the testing that we had done
7 later. We drilled approximately 60 or 65 one-foot
8 diameter diamond drill holes for collecting samples.
9 And they are large enough that you can
10 actually stick your head in there and look at things,
11 and we got a very, very good look, and we did those at
12 various locations in the middle nonlithophysal and the
13 lower lithophysal unit.
14 So we got a very good look at just what
15 the conditions of yielding were in the side walls,
16 because we drilled most of the holes directly into the
17 spring lines. We also drilled some at different
18 angles.
19 One thing that I will point out is the
20 minimum stress, and when I say the maximum stress
21 concentration occurs here, the minimum stress
22 concentration occurs in the crown of the tunnel then,
23 due to the fact that the minimum part of the stress is
24 horizontal.
25 The second form of loading that we have to

1 be concerned about is the thermal loading, and I just
2 showed you a drawing on the side here, which is a
3 prediction for a few different cases, three different
4 cases of different thermal properties, just to
5 illustrates what kind of temperature conditions that
6 we are calculating at the walls of the tunnel.
7 This time period here is the preclosure
8 time period, and when the rock mass is ventilated, a
9 larger amount of the heat from the waste package is
10 removed by the ventilation air, and so the
11 temperatures are kept quite low. They are somewhere
12 in the order of 45 to 65 degrees, depending on the
13 conditions that you assume.
14 At closure when the ventilation is turned
15 off, the temperature rises very rapidly, and within 20
16 years, it reaches its peak temperature at the drift
17 wall, which is anywhere from 145 to 165 degrees
18 centigrade.
19 Once it hits that peak temperature, the
20 temperature slows drops off over time, returning back
21 to pre-emplacement conditions after a long period of
22 time.
23 I believe -- and I can't read from there,
24 but I believe that the temperature remains at the
25 drift wall remains above boiling for about a thousand

1 years in the current scheme, is 1.45 kilowatts per
2 meter thermal loading.
3 Thermal stresses are dependent upon the
4 temperature change, as well as the Youngs (phonetic)
5 modulist and thermal expansion coefficient of
6 material. So the thermal stresses that we calculate
7 follow directly this thermal profile that occurs here.
8 So the peak thermal stresses are actually
9 occurring very early on in the system, and they then
10 decay over as a function of time afterwards. The
11 final types of loads that we are concerned with are
12 seismic loads, and I show an example of one of the
13 ground motions that have been supplied to us by the
14 seismologist.
15 And this happens to be for 10 to the minus
16 4th annual exceedence frequency ground motion. We
17 talked some about this yesterday, but as the seismic
18 wave passes through the rock mass, it induces stress
19 change in the rock mass.
20 Typically in most underground situations
21 seismic stability of underground excavations is not an
22 issue, because typically that is where it is most
23 stable.
24 The peak accelerations, and peak particle
25 velocities, are typically at the ground surface, and

1 so that is where the area of greatest concern is. It
2 is the same of course here, you know, that the
3 accelerations and particle velocities are lower at
4 depth than at the ground surface.
5 I will get into our seismic calculations
6 a bit later. How do we use the rock fall that we
7 calculate, or the drift degradation? All these
8 thermal in situ and seismic stresses that I -- stress
9 changes that I show up above here from those sources
10 we are using to calculate stability of the tunnels on
11 both emplacement and access drift tunnels.
12 But most of our effort has been in the
13 post-closure area, and so we are mostly concerned
14 about emplacement drifts, which are the 5-1/2 meter
15 diameter tunnels.
16 We have been using these primarily to
17 calculate rock fall, and change in shape and size of
18 the tunnels as a function of time, and as a function
19 of the load.
20 The types of things that we are
21 calculating here, and let me get my glasses on here as
22 I can't see the thing, but you can see it. The types
23 of things that are calculating here are the particle
24 size distribution of the rock that has actually failed
25 and is falling from the roof.

1 And the total volume of that rock that
2 actually falls off, and also we are concerned about
3 the acceleration and velocity of those particles. So
4 therefore we are calculating the energy content of
5 that particle as it is ejected or falls from the rock,
6 and in context the drip shield or the waste package,
7 depending on whether it is a preclosure or a
8 postclosure simulation.
9 The other thing that we are examining from
10 a rock fall standpoint is time dependent change in
11 rock mass strength, and how that affects the amount of
12 material that fails and actually falls from the rock
13 and bulks into the tunnel itself.
14 Now what we do with that, we are primarily
15 feeding three different functions. The first thing we
16 are doing is examining the mechanical effects of this
17 rock that falls on the drip shield itself.
18 We are feeding to the drip shield folks
19 the structural engineers repeating impact forces, and
20 their velocities from accelerated particles, and where
21 they impact the drip shield as a function of time or
22 a function of a shaking event.
23 And we are also calculating what I have
24 termed quasi-static load. In other words, it is the
25 static load of the weight of the material that has

1 fallen off and is resting on the drip shield itself.
2 Quasi-static from the standpoint that it
3 changes as a function of time. Other areas -- and
4 that is the primary area where we have been doing our
5 calculations and feeds from our calcs, but we are also
6 doing or looking at mechanical effects on the in-drift
7 environment.
8 And in particular as the rock falls from
9 the tunnel surface, and forms around the drip shield,
10 we are concerned about the thermal effects of that
11 insulating blanket on the waste package itself, and
12 the temperature change that it and the drip shield
13 undergoes.
14 And we are also feeding off the changes in
15 drip shape and the size, as well as the fact that
16 there is rock in the tunnel to seepage calculation
17 folks to look at the impact that that has on seepage
18 estimates into the tunnels as a function of time.
19 We went underground yesterday, and we
20 showed you this picture, and we will just briefly go
21 over it again. This is an east-west section through
22 Yucca Mountain, looking to the north. This is west,
23 and this is east, and this is the Solitario Canyon
24 fault and this is the front scarp face there of Yucca
25 Mountain that you can look out toward Crater Flat

1 from.

2 The tunnels that currently lead in the
3 north ramp comes from the east, and enters at a slight
4 downward grade to intersect the repository units,
5 which is the Topopah Spring formation, which is shown
6 in green here on this picture.

7 And as we talked about yesterday, the
8 Topopah Spring formation consists of four different
9 distinct stratigraphic units within the flow that are
10 based primarily on the degree of porosity of those
11 units.

12 And when we have an upper and a lower
13 lithophysal unit, and between them is the middle non-
14 lithophysal unit, and below the lower lithophysal
15 unit, which you didn't see yesterday, is the lower
16 non-lithophysal unit.

17 The middle non and the lower non are very
18 similar to one another. It is very difficult visually
19 to see the difference between the two, at least for
20 me, mineralogically and their fracture geometries.

21 The upper lith and the upper lith are
22 different. The upper lith as you saw yesterday has
23 lithophysal cavities that are relatively uniform in
24 size and distribution, and that are on the order of
25 maximum of about a decimeter in size.

The lower lithophysal unit has much more irregular lithophysal content, with larger lithophysals that can be irregular in shape. But the average size again there is slightly greater on average. It is somewhere around a decimeter on average, but we have sizes that are maximum and excess of one meter.

The area where the largest lithophysy and the poorest ground conditions I found is in a layer that is at the contact as I mentioned earlier between the middle non and lower lithophysal unit.

And the thickness of that contact layer is relatively thin. It is hard to judge it very specifically, but in thickness wise, it is probably about 10 meters in thickness, or something like that.

This slide I just wanted to show you the difference in behavior of these two materials. We treat them separately in our calculations because their behavior we feel is distinctly different, and it is primarily because of the structure that occurs in the rock.

The non-lithophysal rocks, which are shown in these top two frames here, their behavior is controlled primarily by the fractures that are in them. The intact rock itself between the fractures is

1 quite strong and elastic as I mentioned yesterday.

2 The small core strength of the middle non-

3 lithophysal unit, for example, for 1 inch samples, is

4 over 200 megapascals, and one of the interesting

5 features about this rock is that it is quite uniform

6 in its constituent grain makeup so that the rock is

7 very elastic.

8 We can raise the load on these rocks up to

9 in excess of about 95 percent of their peak strength,

10 and unload them, and there is very little histolysis

11 or permanent deformation in them.

12 They fail in a brittle fashion on failure

13 and uniaxial compression. The stress state that we

14 have in the mountain, even from the thermal loading,

15 is far below the strength of the intact material here,

16 and so we are not quite so concerned about that.

17 It is more the stability effects of the

18 jointing and fracturing in here. The fracturing is

19 interesting in here. It is unlike what you might

20 think of as a typical blocky rock mass, and that the

21 fractures themselves are of a relatively short length,

22 and they are in fact shorter than the diameter of the

23 tunnel.

24 So as you look along a typical section,

25 and I don't believe that I pointed this out to you

1 yesterday, but you can typically trace fractures that
2 start and end before they cross out of the tunnel
3 itself.
4 Also the fractures often dead-end against
5 another joint -- or in other words, we don't have a
6 typical set of fractures that have very long trace
7 lengths in them, and they are based on a regular
8 interval, and is quite irregular in its cooling
9 history.
10 There is four sets of joints in general;
11 three sets, plus a random set, and two of them are
12 subvertical sets, one northwest and southeast, and the
13 other southwest and northeast. And there is one
14 subhorizontal set that are called vapor face partings.
15 When you do have yielding in this type of
16 material, it is typical that you see this sort of
17 thing, and this is a photograph from the ECRB where we
18 were yesterday.
19 Periodically if the joint orientations are
20 correct, you form a wedge shaped thing, and they are
21 relatively small wedges. They are typically less than
22 a half-a-ton in size, and this is a tracing of one of
23 those wedges.
24 In the ECRB itself, in the whole
25 construction of it, all the wedges that were formed

1 were either removed directly behind the tunnel boring
2 machine, and most of them are removed by physically
3 prying or barring the wedge out, because it was
4 recognized by the mining people that it was
5 potentially an unsafe condition for workers.
6 In fact, this is one of them because they
7 put a plate over the top of it after it was barred
8 out. In the lithophysal rock, behavior is controlled
9 by porosity. I think one thing that we have come very
10 strongly to the conclusion on is that the properties
11 of the lithophysal rocks are porosity driven.
12 This is one of the panels that you perhaps
13 saw at the site that we were standing at yesterday,
14 and Dave Bush talked about this, but essentially these
15 are lithophysal cavities that can be either roughly
16 circular shaped or they can be much more complex
17 shapes, like these star typed shapes that were
18 influenced by the fractures, and gas flow, and
19 expansion along the fractures in the rock when the
20 lithophysy were formed.
21 Down here it shows one of our cores that
22 we drilled out, the one foot diameter core, and this
23 far away, it is hard to see. The core is wet, and you
24 can see the fracture distribution in the core, and you
25 can also see the lithophysy in the core.

1 If you look at what happens when you
2 either mine this rock or drill it out, it is very
3 clear to see that when this rock fails and rocks
4 detach and fall away, they fail in small particle
5 sizes.
6 I have never seen a particle size come out
7 of the lower lithophysal unit that has been much
8 bigger than about this sort of size, about fist size,
9 or head size. That is about the maximum size that we
10 think is possible to produce from this.
11 The repository rock units. I know that
12 you guys have a lot of questions about this, and I am
13 sure that you are going to ask more today about why we
14 are locating the repository in the lower lith, as
15 opposed to the middle non-lith, because it appears
16 that it is more difficult to characterize that rock.
17 And I will wait on those questions and
18 answer them when they come up, but just to show you
19 that this is an overlay of the rock units on top of
20 the subsurface layout that shows that about 80 percent
21 of the emplacement drifts are within the lower
22 lithophysal unit.
23 Yesterday when we went to Panel Number 1
24 was right here, and we were standing right there where
25 the ECRB crosses, and we were in the middle

1 lithophysal unit, which is green in this picture. It
2 just so happens that the layout as we put it now,
3 virtually all of the turnout to the large area
4 excavations that we have are actually all in the
5 middle lithophysal unit.
6 Very few are in the lower lithophysal
7 unit. Mostly the emplacement drifts. There is a
8 little bit of the upper lithophysal unit that occurs
9 here on the eastern side of Panel Number 3.
10 Observations in existing tunnels. We
11 talked about these yesterday, but we have two tunnel
12 sizes, the ESF is 25 feet in diameter, which is the
13 same size as the proposed access mains in the
14 repository. and the ECRB drift that we are in is 5-1/2
15 meters in diameter or 16 feet, and that is slightly
16 smaller, about a half-a-meter in diameter smaller than
17 the proposed emplacement drift size.
18 But the two of those make a pretty good --
19 give you a pretty good feel for what the size of those
20 excavations are going to be. They are 5 to 7 years
21 old, and as we pointed out yesterday, there is only
22 light ground support consisting of friction bolts and
23 wire mesh in the roof.
24 Typically there is no support placed in
25 the walls, particularly in the lower lithophysal unit.

1 As we saw yesterday, there is generally four bolts put
2 across the roof, and in most cases there is very light
3 wire mesh, which is just a typical sort of
4 construction grade wire mesh.
5 You also noticed I'm sure that there was
6 a lot of steel sets when we first entered, and I
7 mentioned to a couple of you yesterday that we sort of
8 I think got bit on the construction contract there.
9 It was very good for the contractor to put
10 in steel sets from an economic standpoint, and I don't
11 think we had very good control over how many steel
12 sets he put in, and in fact we have measured load in
13 a number of those, and we have not seen many cases
14 where there is any load in anything down there.
15 In fact, those were pressed in place, and
16 it is a very unusual way to put steel sets in there,
17 and jacked in place, and you can see visually that
18 there is no load on those sets at all.
19 So in many cases, or in my view at any
20 rate, they are kind of a window dressing, and I
21 wouldn't get too carried away with the fact that there
22 are steel sets in there, because they are not
23 indicative of what the rock quality is at those
24 locations.
25 Right now -- and I have talked to

1 everybody out there, all the miners and everyone.
2 Well, first of all, we have got deformation
3 measurements that are made with x-insometers
4 (phonetic) and closure pins that are done on a regular
5 basis.
6 And in particular their measurements are
7 made after every earthquake that occurs in the area,
8 and all the excavations show that they have reached a
9 stable equilibrium. In other words the deformations
10 have dequilibrated right after mining, and they
11 dequilibrate as a function of time.
12 As far as I can tell talking to everyone,
13 no one is knowledgeable of any observed rock fall that
14 has occurred in those tunnels since they were
15 excavated, and some of the people working there have
16 worked there the entire time.
17 The one minor spaulding that I showed you
18 yesterday from the drift scale test, which was done
19 specifically because of a thermal overdrive test that
20 was done, is one of the few things that we have
21 actually observed in any kind of spaulding or rock
22 fall that has occurred.
23 To my knowledge there has never been the
24 necessity to go back and maintain any drift support or
25 reapply new ground support. I could be wrong on that,

1 but I have not heard that.

2 CHAIRMAN GARRICK: Mark, what would you

3 expect to happen in a thousand years?

4 MR. BOARD: I will get there. We are

5 going to show that. But first what I wanted to do was

6 to tell you how we have approached the problem,

7 because this as you all know calculates or attempts to

8 estimate how rock is going to behave around tunnels

9 for thousands of years. It is not standard practice

10 in the industry.

11 We have excavations that are subway

12 tunnels, and other tunnels that are being used

13 currently that have been used for hundreds of years.

14 But for thousands of years, or tens of thousands of

15 years, it obviously is not standard practice to worry

16 about that kind of thing.

17 So we are in new territory in making these

18 estimates, particularly in hard rocks. In soft rocks,

19 like salt, and I know that most of you have been

20 involved probably back in the salt program and things,

21 but it is a bit different situation there because

22 people can generate creek curves and calculate with at

23 least -- well, I would say at least with a domale salt

24 anyway. I don't know about bedded salt, because it is

25 a bit different animal.

1 But in domale salt, there is some
2 expectation that you can make extrapolations of what
3 those creek curves will do over time. In hard rocks,
4 however, it is a new territory. Not many people have
5 been too concerned about this.
6 There is not a great wealth of
7 information. Because of that, we felt that it was
8 necessary to try and understand how this rock behaves
9 from a basic mechanics level.
10 And this chart, I hope that you can read
11 it in your document. I will just go through the top
12 bar up here, but this is sort of the strategy that we
13 set up initially to try and gain confidence in our
14 understanding of how both lithophysal and non-
15 lithophysal rock behaves.
16 And as we pointed out a few weeks ago in
17 Washington, and I am sure that Raj will talk about
18 here later, our approach is different than what you
19 saw, and that we are not relying on empirical
20 estimates from mining practice or from tunneling
21 practice to try and make estimates of things that are
22 occurring for thousands of years.
23 We felt that the only approach that was
24 going to produce reasonable results that we could back
25 up would be if we could start from a very basic level

1 and work our way forward.

2 What this plot shows is actually something

3 that we have done over the last few years, where we

4 started with detailed field characterization of the

5 rock mass.

6 We felt that we absolutely had to start

7 with a very good understanding of the basic geology

8 and the structure that existed in the rock mass,

9 because that is what controls the properties.

10 And so we have spent a lot of time going

11 over the detailed structural analysis of the

12 fracturing and the jointing in both rock units, and in

13 particular in the lithophysal units doing detailed

14 mapping of the lithophysy, and how it is shaped, and

15 its size, and its porosity, its distribution through

16 the mass, trying to understand its variability within

17 the tunnels that we have access to.

18 The lower lithophysal unit is in the upper

19 lith, and can be observed in both ECRB and in the ESF.

20 We didn't see the ESF yesterday because it is way down

21 in the south end there, but it is observable in both

22 of those.

23 We have taken a lot of time to map those

24 and statistically try to describe that work, and I

25 won't go over that again because Dave Bush talked

1 about that yesterday.

2 What we have done then is that realizing

3 that the lithophysal rock, that the two important

4 features for the porosity in the lithophysal rock, and

5 the fracturing in the non-lithophysal rock, we tried

6 to set up a program to try and understand those two

7 structural features and how they affect rock mass

8 properties.

9 And we did two things in the lithophysal

10 rock. We sampled large cores in which we had at least

11 5 lithophysy across a diameter. We felt that was

12 reasonable enough to begin to start seeing the impact

13 of lithophysal porosity on strength.

14 We sampled those through quite a extensive

15 drilling program that was done. I would say that we

16 drilled about 65 holes, and we did laboratory testing

17 on those at Sandia Labs.

18 At the same time, we knew full well, and

19 as I discussed yesterday, that we could not do a

20 typical statistical testing program as you would on

21 metals, or perhaps hard rocks, with no structuring

22 them.

23 And to fully understand the impact of

24 lithophysal variation, we felt that we had to

25 calibrate a numerical model or some sort of simulation

1 tool that was capable of physically representing those
2 holes in the material and how they affected its
3 strength properties and the variability.
4 So at the same time that we started the
5 lab testing, we started a calibration program using
6 two different numerical approaches, one in terms of a
7 micromechanical model, which is the PSC code it is
8 called, and I will show you some examples in a minute.
9 And the other one is a program called a
10 UDEC, which is a discontinuum program, and they both
11 sort of predict the same thing, but we wanted two
12 methods to be able to use to examine the problem.
13 So we originally calibrated and tested
14 that code against the laboratory results. Then we
15 went to the next physical scale up, which was the
16 field scale, and we did in situ compression tests on
17 that material which were partially successful.
18 A couple of the tests that we did were
19 successful, one not quite so successful, and then we
20 examined the results of those tests with the model
21 that we calibrated as a validation exercise.
22 We then used that model, which we felt we
23 had some confidence in, and actually quite a bit of
24 confidence in its predictability, and asked the
25 question how much do these properties vary, the

1 physical and mechanical response, when I start to
2 extrapolate with that program over all the conditions
3 that I can't test.
4 In other words, we are using it almost
5 like a laboratory tool, a laboratory simulation tool,
6 where we took the actual panel maps that Dave showed
7 you yesterday that were created here, and used those
8 as input to the numerical model, and examined just how
9 much variability we had in response for realistic
10 conditions of lithophysal characteristics.
11 And we used that to try and establish what
12 range of variability we needed to use for design
13 purposes. Once we had that, then we went ahead and we
14 did a whole series of parametric examinations of how
15 this rock behaves when you apply stresses to it, and
16 those are in situ, thermal, and seismic stresses.
17 And those were done as a series of
18 parametric analyses, where we used bounding ranges of
19 properties that we determined from the laboratory
20 testing and the extrapolations that we did.
21 First of all, the non-lithophysal rock
22 mass. I had mentioned to you that we did a lot of
23 examination of fracture mapping. In the ESF, every
24 fracture -- and we did not discuss this yesterday, but
25 in the ESF and the ECRB, every fracture with a trace

1 length greater than one meter, it was actually
2 recorded.
3 It's dip direction, and its surface
4 variability, in standard terms that are used in the
5 geotechnical description area. Every one of those
6 fractures was described, and we have an enormous
7 database.
8 I think the entire database is about
9 35,000 observations, but we have been using a subset
10 of that, which is I believe about 10,000 observations.
11 And we have used that to develop a statistical or
12 stochastic model of the fracturing. It is hard to see
13 what it going on here because there are so many
14 fractures in there.
15 But we have used a program called FracMan,
16 which is a common program used, particularly in the
17 oil industry, where they actually generate synthetic
18 fracture geometries, or rock mass geometries, to try
19 and estimate fluid flow and uptake oil, oil pumping
20 rates from fractured rock masses.
21 We used that as a tool to generate a
22 synthetic rock mass that is a cube, a hundred meters
23 on a side. So we said let's take the data that we
24 have, and statistically generate our own rock mass
25 that we can tunnel inside and run simulations from.

1 The other part of this picture is the
2 property surface properties of the joints. We did a
3 lot of testing at Sandia years ago using a technique
4 called rotary shear testing. There is a little bit of
5 a question about the validity of that, although we get
6 pretty much the same results as we did here.
7 And we actually sampled in those large
8 bore holes that you saw yesterday, we sampled all the
9 major joint types that we have, and we did large scale
10 direct shear tests at the U.S. Bureau of Reclamation
11 on these joints.
12 And these are very large. It is the
13 largest direct shear testing machine that I am aware
14 of, and we determined their shear behavior there to
15 get properties.
16 For the lithophysal rock, this shows one
17 of our one foot by two foot diameter samples at Sandia
18 Labs in a large testing frame. We did compressing
19 testing on these cores, and we found basically that
20 the testing that we were doing here confirms the
21 results of testing that was done in 1985 from cores
22 also from the lithophysal rock from Busted Butte,
23 which is next door here.
24 In '85, before there was any tunnel there,
25 the same rock units outcropped at Busted Butte, and

1 they went up into a quarry, and took samples from it,
2 and we found that we were getting the same
3 correlations with porosity and rock strength.
4 Here it just simply shows a uniaxial
5 compressive strength versus the lithophysal porosity.
6 At zero percent porosity, the rock strength is about
7 70 megapascals for these large samples.
8 So we see this logorhythamic decrease in
9 strength as a function of lithophysal porosity. The
10 only thing that I wanted to point out there is that
11 from Dave Bush's results that he showed you yesterday,
12 where he mapped the porosity and the intervals going
13 up the ECRB, most of the cases that we have in the
14 ECRB are from situations where the lithophysal
15 porosity varies between 10 and 20 percent.
16 And 90 percent of the intervals that we
17 have mapped in that tunnel haver porosities of 20
18 percent or less. So in other words, what I am trying
19 to say is that the majority, the large majority of
20 porosity that we see in the ECRB is less than 20
21 percent, and it averages somewhere close to 15 percent
22 by volume.
23 This is important later, because what we
24 did is we did a bounding analysis, where we calculated
25 estimated properties that went anywhere from zero

1 percent lithophysal porosity, all the way up to 30
2 percent.
3 And we ran calculations across that entire
4 range, but I want to point out to you that the mean
5 condition that you looked at yesterday, the stability
6 that you were viewing yesterday, was typically based
7 on a porosity level of somewhere around 10 to 15
8 percent, in that range.
9 Let me just go back one second. I'm
10 sorry, but I just wanted to point out again that for
11 design purposes, what we did is we took the mechanical
12 properties, and we subdivided these ranges, these
13 properties up into a series of ranges that covered the
14 entire range of observations underground, and we
15 divided this into five different categories of
16 strength.
17 And we can then relate that to the
18 categories that we actually see underground of the
19 percentage. So that is how we make a correlation
20 between this and what you actually observed
21 underground, okay?
22 I wanted to briefly show you what we did
23 then to generate rock properties to try and understand
24 the range of variability to lithophysal rocks. We
25 used this numerical approach that I had mentioned, a

1 discontinuum of numerical models.

2 This particular one is called the particle
3 flow code, and it was developed by a Peter Condel, and
4 it essentially models the rock as a series of bonded
5 particles, and it is in quite common use in the rock
6 mechanics area now.

7 We felt that it was an ideal tool for us
8 to try and understand how a lithophysal rock behaved.
9 What we did is that we started off first by
10 calibrating this model against non-lithophysal rock,
11 which I show here.

12 And I thought that the easiest thing would
13 be to understand this is to show you a little movie of
14 what one of these tests looks like. You are seeing a
15 numerically generated test. This is a stress strain
16 curve, and this is a rock sample composed of about
17 10,000 bonded particles.

18 Remember how I told you how elastic it
19 was. You got right up to the peak stress before any
20 failure starts. What you are seeing here is that
21 these fractures are actually 10 cell bond breakages
22 between particles that coalesced to form overall
23 shearing fractures, bifurcating shearing fractures in
24 the material, which is exactly what we see when we
25 test these rocks.

1 We get a highly elastic response to a peak
2 strength, which then falls off in a brittle reaction,
3 post-peak reaction. You can go ahead and run it
4 again. It goes very quick.
5 What we did is that we calibrated this
6 first against the medullas of the material, and the
7 peak strength, and we observed the failure mechanisms
8 that occurred, and compared it to the actual samples.
9 And we found that we could reproduce the
10 failure mode quite nicely in the material. Then what
11 we did is that once we had calibrated the bond
12 properties of the material, we then applied it to
13 lithophysal rock here, and this is a case where I am
14 showing you 26 percent lithophysal porosity in round
15 holes.
16 Now, these two plots that I just showed
17 you are to the same scale, the last one and this one.
18 The stress strain behavior that you see, this is
19 stress versus strain, and it is being compressed in
20 uniaxial compression from the ends.
21 You see a much different behavior. First
22 of all, the peak load drops by almost an order of
23 magnitude with these samples, and you get an elastic
24 plastic response, in which the material behaves in a
25 non-brittle fashion after failure.

1 The mechanism of failure that we found
2 when you start adding porosity to this sample is that
3 it is very simple. You get extensional fractures,
4 which are shown here between lithophysal and holes,
5 and once these extensional fractures form, it
6 essentially unloads an area and causes the load to
7 shun off to an area where you have a solid bridge.
8 And as you increase the porosity, you
9 decrease this bridge length, and it naturally
10 decreases the strength and decreases the medullas of
11 the material. And we found that really without any
12 fudging at all that we could reproduce the same sort
13 of behavior. If you want to go back to the original
14 slide that we had.
15 We could reproduce -- this is the same
16 plot that you saw earlier, a uniaxial compressive
17 strength, versus void porosity or lithophysal
18 porosity. We found that we could account quite nicely
19 for this logorithmic decrease in strength just by the
20 fact that you are adding holes to the material.
21 What we did then is that we started
22 modeling real porosity variations with the various
23 shape lithophysy, and we found out that we could
24 account for the range of property variation that
25 roughly we were seeing in the laboratory, and in the

1 field scale results.

2 So that is how we accounted for the effect

3 of lithophysal porosity. The next thing we did is

4 that we encapsulated this behavior into a drift scale

5 model.

6 It would be very nice if we could use that

7 PSC model to model the entire drift, but unfortunately

8 the computer resources would have to be enormous, and

9 we felt though that we could encapsulate that same

10 behavior in a larger discontinuum model, and that we

11 calibrated in the same fashion as the PSC model, and

12 that is what I am showing very roughly here.

13 We used this program called UDEC, and that

14 is subdivided into small grains again as the other one

15 with bonded particles between those grains, and we can

16 reproduce exactly the same kind of behavior that we

17 saw before.

18 This model, however, is capable of

19 simulating fracture underload in rockfall, and what

20 you are seeing here is a tunnel with a drip shield in

21 it, and some rock piled on time of it.

22 We can take samples out of that, and test

23 them, and make certain that it behaves in the same way

24 as the PSC and the laboratory material behavior did.

25 Okay. Some of our results from our

1 calculations. This shows rock fall calculations under
2 seismic load. First of all, I would point out that in
3 non-lithophysal rock, there is no rock failure in our
4 estimations from in situ stresses or from thermal
5 loading over the -- with the rock properties as they
6 are now.
7 The rock remains elastic because it is
8 quite strong. We also don't get joint slip behavior
9 or joint failure under those conditions, and that is
10 exactly what we observed int he drift scale test.
11 There were no block fallouts that occurred in that
12 test either.
13 What we did here was that we took our
14 model that I showed you earlier, our 100 meters on a
15 side model, excavated tunnels from it, and put it in
16 a drip shield, and we excavated enough tunnels to
17 where we felt that we had a reasonable statistical
18 variability of the rock properties.
19 We took that model, called 3-DEC, and we
20 subjected it to seismic shaking from the ground
21 motions that we received from the seismologist. What
22 we found out was what I have summarized down below for
23 the case of a 5 times 10 to the minus 4, which is a
24 preclosure motion.
25 And 1 times 10 to the minus 6, and 1 times

1 10 to the minus 7 motions, which are both postclosure
2 motions. As I mentioned, the 10 to the minus 6 and 10
3 to the minus 7 ground motions were quite enormous that
4 were given to us there.
5 The 10 to the minus 6 motion has an
6 acceleration of about 5G, and as I mentioned
7 yesterday, I don't believe that the -- we certainly
8 don't feel that those motions, which were produced
9 using a PSHA process, which is used for power plant
10 design, that those motions are physically realizable.
11 The strains that they produce actually
12 cause free field rock failure, which as I mentioned
13 yesterday, we did not observe anywhere underground,
14 especially in the lithophysal rock, and we feel that
15 would be obvious when we mined into it, that those
16 conditions would have occurred in the last 12 million
17 years, and we don't see anything of this sort.
18 We also have had a number of outside
19 reviews of the seismology, and I believe it is uniform
20 that people feel that we are extremely conservative.
21 So I just want to make that point, because it bears on
22 what you are going to see from the lithophysal rock.
23 Even with these motions, what we find out
24 is the prediction from the non-lithophysal rock, is
25 that we actually get fairly moderate rock fall. We

1 produce a mean block size of less than half-a-ton.

2 And it falls off quite dramatically as a

3 function of tonnage, and so that the maximum overall

4 worst block I suppose if you want to look at it that

5 way that we have produced, which falls from a maximum

6 height, was 14 tons.

7 And that was for one of the postclosure

8 motions. This information and the location of where

9 the impacts occur on the drip shield, are fed directly

10 to the drip shield design function.

11 In the lithophysal rock, I illustrate two

12 things that we did here. One is that we looked at

13 just standard in situ loading conditions for all the

14 bounding studies that we did for these different rock

15 mass quality, five different rock mass strength

16 categories that I told you earlier.

17 We compared those predictions to what we

18 see underground right now, and we feel that we have a

19 model that seems to predict for the mid-range

20 category, which is what we think represents best the

21 average rock conditions that predicts that material

22 behavior quite well.

23 Under thermal conditions, what happens for

24 this thermal loading. We find that we get actually

25 quite a small yield. It is hard to see, and I

1 apologize for this slide, but these are stress
2 projectories around the excavations due to thermal
3 loading.
4 And where it is white on each spring line,
5 that is where the rock has actually yielded and
6 unloaded. That level of damage is at the spring line
7 where the stresses are maximum is less than a half-a-
8 meter in depth.
9 So in other words, we are expecting from
10 the peak thermal loading to occur that we actually get
11 minor, quite minor spaulding of the rock mass or minor
12 yielding.
13 One of the reasons for that is that the
14 medullas of this material is quite low, and so it does
15 not build up high thermal stresses. But we by the way
16 validated this very model that you are looking at
17 against the drift scale test.
18 Only instead of putting in properties of
19 lithophysal rock at these contacts, we put it in
20 properties of the non-lithophysal rock, and we found
21 out that we were able to reproduce the spaulding
22 mechanism that you saw yesterday quite nicely, again
23 without fudging any properties of the material, but
24 just what we produced from our calibration against the
25 size and strength effect for those rocks.

1 What happens when you shake this thing
2 with a large close-closure ground motion is that we
3 get a collapse of these excavations for the 10 to the
4 minus 6 and 10 to the minus 7 ground motions.
5 This picture I think was actually the one
6 that was shown to you a couple of weeks ago, and that
7 is why I reshow it here. When you shake these, the
8 ground under those very large ground peak particle
9 velocity motions, you actually cause the failure of
10 this material due to induced stresses, and it fails
11 and drops, and bolts into the excavation opening.
12 The rock particles are quite small. We
13 feel that they are on the order of -- like I said
14 earlier, about 10 centimeters on the side. That
15 information is fed off again to the drip shield design
16 folks again for the non-lithophysal rock. They are
17 treating those two things differently again, and in
18 the TSPA calculations, we are treating them
19 differently as well.
20 Time dependent degradation. I think
21 probably the greatest -- and I would guess
22 disagreement if we have one with the staff from the
23 center, is in the area of time dependent degradation.
24 And that is how quickly in the absence of
25 these very large motions that we are talking about,

1 will these excavations actually fail and collapse. I
2 want to make a couple of points here that I did
3 yesterday, I believe, and that is that time dependency
4 estimation of hard rocks has not been extensively
5 studied.
6 So we are kind of in an area here where I
7 think we are plowing new ground. I want to point out
8 that the complete collapse of tunnels is not
9 inevitable. I think that the impression that has been
10 given is that it is an inevitable fact that these
11 tunnels will completely collapse, and it is not
12 necessarily true.
13 And I back that up by my next statement
14 here that many tunnels in natural excavations, and not
15 tunnels, but natural excavations, can stand for
16 millions of years without collapse.
17 And I suppose for me, as I mentioned
18 yesterday, one of the prime things that we can look at
19 are these very large lithophysy that have been
20 undergoing a static fatigue test due to the overburden
21 load for 12 million years.
22 And there is no evidence of any fracturing
23 or disturbance that has been created past the initial
24 cooling fracture stage in the material. In fact, we
25 have done a PSC model which we have used to generate

1 what we think are time dependent strength curves for
2 this material.
3 And we have actually used that to back
4 analyze lithophysy, and we get agreement with what we
5 see underground. Some other things are caves and
6 slopes. If it was obvious that these things had to
7 collapse, we wouldn't see vertically standing slopes
8 like we do, and we also wouldn't see caves that reach
9 equilibrium that have been there for many millions of
10 years with an arched roof.
11 What typically happens when something
12 fails is that it doesn't have the bulk to stop the
13 failure. You can form a stable elliptical arch to the
14 material, and if the time dependency of the material
15 is slow enough, it can actually stop its failure
16 process.
17 We differ from what the approach was that
18 you saw earlier in the use of this stand up time
19 curve, and I discussed that yesterday. So I won't go
20 into that again, but we feel that the use of
21 empirically related tunneling classification schemes
22 that were made for personnel safety considerations are
23 not applicable in trying to predict thousands of years
24 of failure.
25 What we did here is that the degradation

1 rate is a stress corrosion process, in which you have
2 microcrack growth under the presence of moisture and
3 stress. So you have to have a stress data in the rock
4 mass in humidity and moisture conditions that are
5 significant enough to cause strength degradation in
6 microcrack growth in that rock for time dependency to
7 occur.
8 We are using currently static fatigue
9 testing, which is the standard form of material tests
10 to estimate time to failure. You can also think of
11 them as a creep test if you want, although what we do
12 is raise the rock sample up to a given percentage of
13 its given compressive strength and hold that stress
14 constant for given periods of time.
15 Now, the data that we had in the past, the
16 preliminary data that we have been using was for short
17 time periods. There is no question about it.
18 However, the creep or the time dependency in this
19 material, the tuff is very small.
20 And we have been attempting to use
21 additional bounding calculations with other materials
22 that are better known, like granite. We know for a
23 fact that this tuff has a lower time dependency than
24 granite does because it is a uniform mineral
25 structure, as opposed to the non-hydrogenous fracture

1 or grain makeup of granite.

2 The URL in Canada has generated a very
3 large database of time dependency static fatigue
4 measurements for granite. So the first thing we did
5 was that we said, okay, we have got more granite data
6 than tuff. What if this material was granite, and we
7 know that it is going to behave in a faster failure
8 mode than tuff, and let's use that and see what
9 happens.

10 Well, we use that to begin with, and then
11 we took the small amount of data that we do have, and
12 estimated stress corrosion behavior for that, and then
13 ran our models with that, and we are trying to gain
14 confidence as we go.

15 We are currently -- we have a very large
16 static fatigue testing program going on at New England
17 Research right now to generate more data for us, both
18 for non-lithophysal rocks and on large cores of
19 lithophysal rocks at the U.S. Bureau of Reclamation.

20 But we think that we actually have enough
21 information right now to make some reasonable
22 estimates of what the time dependency would look like,
23 and I am just simply showing you two cases.

24 One is for the lowest quality lower
25 lithophysal rock, and these are simulations that we

1 have made with the same model that you saw earlier,
2 but with time dependency attached to the strength
3 properties of the material, where we actually reduce
4 its friction and its cohesion, and tensile strength as
5 a function of time. This is for 10,000 years of --
6 CHAIRMAN GARRICK: Mark, I can see now
7 that we made a mistake in calling for that last break.
8 Would you be able to wrap up in about 5 minutes?
9 MR. BOARD: You bet.
10 CHAIRMAN GARRICK: Let me just go over
11 this. If you look at the maximum amount of failure
12 that we expect right now in what we are predicting in
13 the lowest and the highest quality, we predict that it
14 is going to take a much longer time period to see
15 substantial failure than what you saw earlier, which
16 was that essentially when the ground support fails
17 that the whole drift is going to collapse.
18 We do not believe that that is the case.
19 We believe that it is a much longer time frame, and
20 that the amount of failure that is going to occur is
21 going to occur in a slow dependency process, in which
22 primarily the rock that yields during the thermal
23 stressing will simply be knocked out by small scale
24 seismic events that will occur.
25 And you will see that this sort of a thing

1 developing over time. On the next slide, what we have
2 done from a conservative standpoint is simply
3 calculate the load that material, if we assumed
4 complete collapse would occur, on the drip shield, and
5 how that load would develop.
6 You saw this same plot two weeks ago from
7 our calculations, and the one difference that we have,
8 and I believe the big difference that we have with the
9 center's calculation, is that we are trying to use
10 mechanistically based models to calculate load on the
11 drip shield, where you get significant arching of the
12 load that occurs around the drip shield, instead of
13 these highly conservative piping mechanisms, where we
14 assume that the rock packs together quite nicely over
15 time.
16 We feel that the load distribution on the
17 drip shield was actually much smaller, and I am just
18 comparing here these analytical methods, which are the
19 type of thing that the center has been using, versus
20 what we think are more mechanistically based
21 calculations that we are using for load.
22 So we get different loads, and I think the
23 main difference is that we get different loads on the
24 drip shield, and they occur much later in time than
25 what the center is doing.

1 And does this have a significant impact on
2 the design? I guess the only thing that I would say
3 is that if you assume that these things happen very
4 early on, and you affect the seepage, you can affect
5 the seepage to the drift and the temperature
6 distribution on the waste package.
7 So, yes, it may be significant. I really
8 don't know because we have not run the things, or I
9 haves not seen any runs where we have taken it all the
10 way through the TSPA model, but I think it is
11 significant in the differences in results that we are
12 getting. So I will leave it at that. Thanks.
13 CHAIRMAN GARRICK: Thank you. Ruth, do
14 you have any quick questions?
15 DR. WEINER: I would like to hear Dr.
16 Nataroja's response if that is okay before I ask my
17 questions.
18 CHAIRMAN GARRICK: Okay. Yes. Jim, do
19 you have any questions?
20 MR. CLARKE: Just a real quick one, Mark.
21 The premise that the compressive strength is a
22 decrease in function of porosity made a lot of sense
23 to me when you explained it, and it is very pronounced
24 in the mathematical model predictions, but it does not
25 seem to come through as well in the experimental data.

1 Am I missing something?

2 MR. BOARD: No, I think that slide, the

3 only thing that I didn't show was that was only for

4 lithophysal porosities of 10 percent or greater. If

5 you extend that picture to the left-hand side, where

6 the porosities drop, it is algorithmically related and

7 it very rapidly drops over the first 10 to 15 percent,

8 and then it sort of stays relatively constant

9 thereafter.

10 The thing that makes it important in what

11 we are doing is that most of the rock porosity that we

12 are dealing with is on that left-hand side of the

13 screen, where it drops fairly rapidly. So it does

14 have a reasonably pronounced --

15 MR. CLARKE: I was referring to Slide 11,

16 where the data seem to be not nearly as dramatic as

17 the model.

18 MR. BOARD: Yes, that is what I was

19 referring to, too. If you look at the -- and

20 unfortunately it probably was not a very good slide to

21 put in. This slide is cut off here at 10 percent

22 lithophysal porosity, and I don't drop it down below

23 that.

24 What you found out is that when you go to

25 the left on here there is a very pronounced drop here

1 that levels off at about or between 15 and 20 percent.
2 The only thing that I am pointing out is that most of
3 our rock mass that we are dealing with is down in this
4 range, where it is doing this kind of thing.
5 And unfortunately I cut it off to show the
6 higher porosity levels, but it is a significant --
7 MR. CLARKE: Now that you point that out
8 on the model predictions, that is where the major
9 difference is. If we could just go to the next slide.
10 MR. BOARD: And what you can see here is
11 where it rapidly increases here, and we are dealing
12 primarily in this range of the material, as opposed to
13 this range out here, although our calculations as I
14 mentioned, we did it over the entire range here to try
15 and see what the impact of that was.
16 I think the bottom line worst case is that
17 under seismic load, that if you get very poor rock
18 quality out in here, the tunnel under those very large
19 loads completely collapse, and that is what we are
20 using as our worst case analysis for feed to the drip
21 shield people.
22 And I think that it is highly worst case
23 analysis because of the size of the motions and using
24 those porous rock properties. But at any rate, we did
25 it over the entire range, which you find out that if

1 you do the calculations at this low range, even for
2 that 10 to the minus 6 motion, you still get a
3 collapse, because the motion is so large.
4 So it was a bit of a moot point when it
5 comes to the seismic thing with those large motions.
6 MR. CLARKE: Thank you.
7 CHAIRMAN GARRICK: Mike.
8 VICE CHAIRMAN RYAN: No.
9 CHAIRMAN GARRICK: The only comment that
10 I wanted to make was that I can see more clearly the
11 impact that this work has on design. I noticed that
12 Abe Van Luik is in the audience, and I was wondering
13 if somebody would care to make a comment on what the
14 impact of this work is on the performance assessment.
15 DR. VAN LUIK: Dave Van Luik, DOE. The
16 impact on performance assessment unfortunately isn't
17 available yet. These are some of the feeds into the
18 performance assessment model that have been put in on
19 a trial basis.
20 They seem to be very important to long
21 term performance, but we have not finished a complete
22 package yet to look at all aspects of the post-closure
23 case.
24 So there is really nothing available to
25 say from that this is really important or not. The

1 preliminary calculations show that it has an impact.

2 CHAIRMAN GARRICK: My intuition would be

3 that the major impact would be on the uncertainty in

4 the analysis, more than perhaps any significant change

5 in the central tendency parameters.

6 DR, VAN LUIK: Yes, I would probably agree

7 with that, but I would like to see the results later

8 next summer.

9 CHAIRMAN GARRICK: That's good. Okay.

10 Thanks, Abe. Did you have a quick question?

11 DR. WEINER: I did.

12 DR. WEINER: This is basically going back

13 to your Slide 5, I guess. Why wasn't the repository

14 horizon located more in non-lithophysal rock?

15 MR. BOARD: Well, there is an easy answer

16 to that I think.

17 DR. WEINER: That's good.

18 MR. BOARD: First of all, from a

19 mechanistic standpoint, I am not certain that it makes

20 -- well, I don't believe myself after doing all these

21 calculations that it makes much difference in which

22 unit the repository is located from a final

23 standpoint, okay? I will make that statement right

24 now.

25 It makes it a little more difficult to do

1 the calculations, and we have had to go through a lot
2 of work to try and estimate what the properties are,
3 but in the end result, I guess that is what we will
4 determine from the final performance calculations that
5 you asked about a second ago.
6 But the reason why it is in there is
7 simple. If you look at Yucca Mountain, these beds are
8 dipping off to the east in general, between a 10 and
9 20 degree general slope.
10 The area that the repository is placed is
11 bounded by the Solitario Canyon Fault on the west, and
12 the Bow Ridge Fault on the east essentially. And if
13 you go to locate the repository, which we wanted as
14 much as possible to make a single plane within that.
15 The thickest unit that we have is the
16 lower lithophysal unit. So if the repository is a
17 single plane, the majority of it will naturally be in
18 the lower lithophysal unit.
19 Now, of course, we took into account many,
20 many factors that we got, and a lot of it was from the
21 seepage folks and other people about staying so far
22 away from the PTM boundary, and all this kind of
23 stuff.
24 We had took all of that into account, and
25 you try to make a single plane of the repository, and

1 you found out just naturally that most of it falls
2 within the lower lithophysal unit.
3 We could have a multiple level repository,
4 which is what we showed before. There were two
5 planes. The current one was about like this, and the
6 other -- well, it is actually off it. It is like
7 this, and the other one is kind of off the page here
8 going like this, and the previous design that you
9 showed.
10 There is nothing -- I don't believe there
11 is anything theoretically that limits you to making as
12 many levels as you want, except that it becomes more
13 complicated from a mining and a ventilation
14 standpoint, and a transportation standpoint.
15 The only thing that I would point out is
16 that the middle lithophysal unit, if you look on here,
17 is the thinnest of those units. It is about 40 meters
18 thick. Dave, is that correct? It's about 40 meters.
19 DR. VAN LUIK: Thirty meters.
20 MR. BOARD: Thirty meters. If you take
21 the horizonal projection on that thing, and with that
22 dip of 30 meters the lateral extent is not very large.
23 I don't know what it is, but about a hundred meters or
24 something like that on that direction.
25 So all of our emplacement drifts right now

1 are about 600 meters in length averaging. So we would
2 cut the emplacement drift size down, and we would have
3 a multiple level repository.
4 We looked at all those options earlier on,
5 but we felt all-in-all that the best alternative was
6 to go with a single level from a construction end
7 standpoint. So that is really why it ended up the way
8 that it was.
9 CHAIRMAN GARRICK: Okay. Raj, did you
10 want to make a comment? Please give the recorder the
11 benefit of your full name and affiliation.
12 MR. NATAROJA: Thank you. I am Mysome
13 Nataroja from the NRC staff. Would you please put the
14 Number 9 slide up, please. Obviously this is not for
15 me to come here and rebut what Mark entered, because
16 this meeting is for Mark to present his views to the
17 ACNW.
18 We have already made our views known, but
19 I just wanted to make a couple of observations. We
20 have been discussing with DOE the geomechanics related
21 issues for nearly 10 years, and we have a number of
22 disagreements to start with, but eventually after
23 numerous interactions, DOE came up with this
24 particular approach.
25 You can also add to the horizontal access,

1 it not only improves information as you go further to
2 the right, but it also makes it more difficult to go
3 from the left-hand side to the right-hand side.
4 So the difficulty starts when you look at
5 the -- I cannot read that from this distance, and so
6 I will -- well, when you go to extrapolate from the
7 limited range of geological conditions to the actual
8 conditions, and to make predictions of the time
9 dependent behavior for 10,000 years, I think that is
10 really where the problem comes in.
11 But we have actually endorsed this
12 particular approach and I don't think that we have any
13 problem or major issues with the DOE approach,
14 although we have yet to review the official AMR and
15 the degradation. I believe it is ready to be
16 submitted to the NRC.
17 And once we have that, we will be able to
18 review that and give our official position on that.
19 But in the meantime, I think that we have no problem
20 with the -- no major issues with the characterization,
21 and as for the amount of work that is going on, and
22 the type of work that is going on, and we also believe
23 that the characterization will continue even as you
24 excavate the defined placement of waste.
25 So new information will be gathered as we

1 construct the repository, which will all be factored
2 into the final analysis. Secondly, as for the
3 modeling is concerned, I believe -- and I believe that
4 the center agrees with us, that the approach is
5 reasonable, that DOE's approach is reasonable, and
6 that using all of the right kind of models, especially
7 the particle flow code, which is a very powerful code
8 to be used to do some of the things that Mark
9 explained, and I think that the results that are shown
10 for reproducing in the laboratory gives us a lot of
11 confidence that it can be used for extrapolating some
12 of the repository conditions.
13 The next thing is that a lot of progress
14 has been done going from almost no data to some data
15 in the actual repository horizon, and not only in the
16 laboratory, but in large samples and so in situ
17 testing.
18 But having said that, the one thing that
19 I would like to bring up here is that we are looking
20 at (inaudible) activity, which is such a low
21 probability even, but we take it seriously and take it
22 to the consequence to see what the consequences are.
23 It is a low probability, but a high
24 consequence type of situation; whereas, the drift
25 degradation is probably the opposite. It will

1 probably have a low consequence, but it is a high
2 probability in our view, compared to the case
3 activities, which is 10 to the minus 6, and 10 to the
4 minus 8.
5 Drift degradation and drift collapses is
6 probably one in some cases. I a not going to say that
7 all the repository would be collapsed in a hundred
8 years or 200 years, or any such predictions. But
9 during the licensing hearing some experts will claim
10 that it is going to degrade fast, and some other
11 experts might give their opinion saying that it will
12 take a long time.
13 It will be left to the licensing board to
14 make a decision on what exactly is going to happen.
15 So it will be a futile exercise in my view to try to
16 argue who is right, and what kind of a built-in factor
17 is to be used, and what will be the exact load that is
18 going to come on the drip shield or the waste package,
19 and so forth.
20 Instead, I think that you have to look at
21 the whole range of conditions that are possible,
22 including some drifts being stable for a long time,
23 and many drifts having been degraded completely within
24 the period of 10,000 years.
25 And we have to look at its impact using

1 performance assessment, and I think the right question
2 was asked by the Chairman. He asked what happens in
3 a thousand years, and that is the question that will
4 be asked at the licensing hearing.
5 I do not think that there is any one
6 methodology or one model, or one test method, that can
7 be used to make the prediction accurately. So there
8 will be uncertainty, and taking that uncertainty into
9 account, how are we going to make the case.
10 So I think that the next step would be to
11 look at these possibilities and look at what happens
12 to the seepage, and what happens to the load on the
13 drip shield, and what happens to the potential
14 possible transfer of load if the drip shield collapses
15 on top of the waste package and so forth.
16 And what are the implications of
17 temperature distribution in the (inaudible) as a
18 result of possible drift collapse. So my opinion is
19 that the next step has to be taken, and it has to be
20 taken all the way through the performance assessment.
21 And a demonstration has to be made that
22 even the consequences are still within acceptable
23 limits, and I think that is probably what our opinion
24 will continue to be, even after we review the AMR,
25 although some details are to be worked out on the

1 actual post-closure seismic loads and other things.
2 I thank you for this opportunity.
3 CHAIRMAN GARRICK: Thank you very much,
4 Raj. There is a great deal of interest in this talk,
5 and we could go on for a long time, but we have
6 already invaded some of the time that we have
7 allocated for interaction with stakeholders.
8 It has become somewhat of a practice for
9 the committee to try and meet in Nevada once a year
10 and to each day that we are here to allow a certain
11 amount of time for citizens or whomever to make
12 comments, and we are going to do that now.
13 We have received requests from two people
14 to make comments. We urge the commentors to limit
15 their time and generally we try to follow the practice
16 of around 5 minutes or less for making any remarks.
17 There may be extenuating circumstances and
18 to allow for more time, but that is the practice that
19 we like to follow. The two people we have heard from
20 are Dr. Jacob Paz, and Ralph McCracken. So let's go
21 in that order. Please tell the recorder your full
22 name and your affiliation.
23 DR. PAZ: My name is Jacob Paz of
24 Environmental Services, Incorporated, and I would like
25 to address the committee on the issue of assessment of

1 (inaudible). I have provided you with some
2 professional literature, which I will send you more.
3 I would like you to review it, and make an appropriate
4 recommendation to the NRC on this issue.
5 First of all, we have to look at what are
6 the (inaudible) in Nye County, and we have two issues
7 here. One is from the Nevada Test Site, and one is
8 the contamination from radionuclide, and mixtures, and
9 the second is the proposed high nuclear waste
10 repository at Yucca Mountain, which probably contain
11 heavy metal, particularly chromium and nickel, and
12 various other nuclides.
13 And this is the major source of
14 contaminants. The second issue, which is a relatively
15 new issues, is the bystander effect, and the term
16 applies to a phenomenon when unirradiated cells, near
17 dose irradiated cells, exhibit a response similar
18 induced by the irradiation, such as (inaudible)
19 genesis, chromosome operation, (inaudible) cell
20 deaths, and possible cancer.
21 And the bystander effects has been
22 observed in one heat of one particle after two
23 (inaudible). And it is also observed after 35
24 generations in (inaudible) culture. This is just an
25 example to show you an apothesis of a bystander effect

1 of other particles, and I am not sure if it is one
2 heat, and you are going to see on the let,
3 particularly the red cell, is damaged by (inaudible),
4 and normal (inaudible) which are (inaudible) cell
5 death.
6 And there is a magnitude of difference,
7 about 400 or 500 times. One of the papers which you
8 have already submitted is (inaudible), which very
9 clearly stated that low level chemicals and their
10 radiation present in the natural environment can also
11 induce (inaudible) instability in cell and also
12 involved in the bystander effect, and in general
13 instability, we are talking about chromosome
14 operation, and possible cancer.
15 I gave you a recent paper which was from
16 the EPA, and to summarize it, it is stated that the
17 exposure to lower level of radiation and chemicals may
18 enhance the cancer potency, and particularly in Yucca
19 Mountain it is a very serious issue.
20 There are several potentials, and one is
21 transportation, and second, during construction,
22 interactions between the silicon and radian, and
23 possible aeronautic (inaudible) in the literature
24 would surely increase the placidity, and carcinogen
25 and chromosome operation.

1 The public at large, what is the real
2 risk, is unknown, and there is an issue, and this has
3 not been discussed at all at the final environmental
4 statement. It might be an issue.
5 And here is the summarized occupational
6 protection (inaudible) during construction, and what
7 is the real health risk to the public is unknown.
8 This topic should have been discussed in the final
9 environmental impact statement.
10 And finally the risk assessment conflicts
11 with nature, and the current risk assessment, which is
12 based upon single chemical or single radionuclide, is
13 scientifically inadequate, and should be addressed by
14 original research.
15 I have a debate with Yucca Mountain, and
16 I will continue this debate, and I provided a
17 publication which summarizes all these issues. Thank
18 you.
19 CHAIRMAN GARRICK: Thank you. Mr.
20 McCracken.
21 MR. MCCRACKEN: Thank you. What brought
22 me here today was primarily the enclosure that was in
23 your packet yesterday regarding the Anagosta Valley
24 Bus Tour.
25 But since I am here and saw a little of

1 this, I have got 2 or 3 very brief comments on what I
2 have seen here today, and what I observed in the
3 tunnels with you yesterday.
4 It is very easy to -- and an old sales
5 technique is that if something is wrong, talk about it
6 a lot and then move on to how it doesn't make any
7 difference.
8 And I think that you were subjected to
9 some of that yesterday. They gave these pores in the
10 rocks a very fancy name, lithophysy, and the bottom
11 line is that there is a whole bunch of pores in that
12 mountain that you are busy drilling holes through, and
13 connecting those pores.
14 And just keep that in mind when you are
15 looking at all of this, that you have got a porous
16 mountain, a leaky mountain, that you are trying to
17 store something for a very long term in.
18 One of the questions that I have not heard
19 answered is how did that chlorine atom that was fairly
20 rare in this world until the atomic testing in the
21 South Pacific, how did it in less than 60 years get
22 into the center of this mountain?
23 Chlorine 36, how did it get into the
24 middle of this mountain? Why was it found when they
25 were boring these tunnels and testing the sides of the

1 walls, and it is water carried. It just didn't happen
2 there.
3 I ask you to keep those things in mind,
4 that somehow this mountain is a lot wetter, or has
5 been a lot wetter, or can be a lot wetter than it is
6 right now.
7 Okay. Enough on that. Do you happen to
8 have that package from yesterday with you? No? Okay.
9 We will take it from the top then. The kind of
10 appendix that was added to the package that you were
11 presented with was actually written in 1991. It was
12 published in 2000. Well, in 1999 is when it was
13 written.
14 It was published some 26 months later. It
15 was written in August of '99, and was completed, and
16 it was published in October of 2001. So, 26 months
17 later.
18 Obviously, the data has described the
19 community, and it changes over two years, and then by
20 putting a cover sheet and a date on it, I think that
21 it was meant to be presented to you as how things are
22 today.
23 Well, things have changed radically in
24 some areas of the valley since this package was put
25 together. One thing in particular that jumps out in

1 my mind is that there is on the last page there, where
2 it talks about wells in operation. There is 130
3 wells.
4 Well, I made a 2 minute call to the
5 Southern Nevada Office of the State Water Engineer,
6 and he says, oh, no, there is close to 400 domestic
7 wells and probably another 150 or so permitted wells.
8 There is -- and in here it talks about 200
9 days of growing. Well, that is not so. We have
10 closer to 270 growing days per year. We are limited
11 in the months of December, January, and February.
12 Those are the months where you really can't grow
13 anything here.
14 We also have the dairy that is present
15 now, and things have changed since 1999. We have
16 approximately -- I talked to the manager of the dairy
17 today, and we have 8,600 milking head, and the dairy
18 alone farms 2,000 acres.
19 In this fact sheet, you are presented with
20 the fact that there are probably 2,000 acres that are
21 farmable. Well, the dairy does not do all the farming
22 in the valley.
23 The one ranch that you visited yesterday
24 with some size to it, the TNT Ranch, he says that he
25 has got 900 tillable acres with water rights, and the

1 TNT Ranch does not sublet any of their fields to the
2 dairy.
3 What I would like you to do is to consider
4 asking for some more recent data, in terms of
5 particularly the physical characteristics of the
6 cultural aspects of the Anagosta Valley when you
7 consider that into the rest of your decisions.
8 So I hope that you understand what I am
9 trying to say, is that you have got some old
10 information being presented currently. I am looking
11 at my sheet here, and some of these comments are a
12 little bit out of order, but I hope you will bear with
13 me.
14 I checked with our local well driller.
15 They have drilled 22 wells alone this year, and they
16 have another five under contract before the end of
17 December.
18 I think Mark was talking about caves.
19 Well, most of the caves that I have run into in terms
20 of just watching t.v. and being educated, and so on,
21 most caves, and the formation of caves, are water
22 related.
23 And the coarsing of the water wears away
24 the soft stuff and leaves the hard stuff, and of
25 course your caves tend to last for a long time. But

1 also what is a long time and what is a short time, and
2 what is a medium time.
3 And in his presentations I did not get any
4 sense of what he considered a short term. Is it 1
5 year, or 5 years, or 10 years, a hundred years, a
6 thousand years? What is medium time, and what is a
7 short time, and what is a long time. It is just near
8 term and short term. What does that mean?
9 And without being delineated, I am not
10 confident that you are thinking the same thing that he
11 is thinking when he says long term and short term, and
12 that kind of terminology. Thank you for your time.
13 CHAIRMAN GARRICK: Thank you. Any other
14 comments? Would anybody like to make a point? Yes?
15 DR. PAZ: Just one more point about the
16 elevated temperature effect. First of all, for how
17 many years are you going to see 200 degrees centigrade
18 elevated temperature. Second, how it will affect the
19 zero life matrix, and when it is cooler, and will it
20 increase the fractures in the long term.
21 This is a very important question because
22 it will affect the absorption of the metals and the
23 radionuclides, and the last is that there should be a
24 full large scale study on the impact of (inaudible)
25 absorption of heavy metals and radionuclides, and high

1 temperature and low temperature. That's all.

2 CHAIRMAN GARRICK: Thank you. Oh, yes.

3 Judy.

4 MS. TREICHEL: Judy Treichel, Nevada

5 Nuclear Waste Task Force. I just have two things. I

6 think that you need to request from DOE that you get

7 an absolute answer on the aircraft thing.

8 That is something that is important to

9 Nevadans, because we all know people if we have been

10 here a while, and we live in Las Vegas, we know people

11 who work at Nellis, and we know about people and

12 pilots that are involved at Nellis talk about things

13 that go on there, and some of the surprising and

14 rather scary stuff.

15 But I think that you need to know whether

16 or not the Air Force did indeed declare a no-fly zone,

17 or has volunteered to do so, or if in fact their

18 activities are going to be increasing, and making

19 things worse.

20 On the one hand, we heard that it may be

21 something that may be less risky, and on the other

22 hand, it may be more risky. The other thing that I

23 would like to find, and I have asked for this before,

24 but I have never gotten it, was what the performance

25 confirmation program is.

1 There was a site investigation program, a
2 site research program that ended with a site
3 recommendation. There was also supposed to be a
4 performance confirmation program that was laid out.
5 What we are seeing now is that there seems to be a
6 basket.
7 And when things don't get done in time or
8 the schedule gets in the way, they get called, and
9 there is just a new label put on it, and it is
10 confirmation work.
11 And that should have been defined
12 beforehand and it is should be defined now, and not
13 just a basket that is a catch-all for stuff that
14 didn't fit.
15 CHAIRMAN GARRICK: Thank you. I think
16 that there was a comment over here somewhere. Okay.
17 Well, this has been a very constructive day in my
18 opinion, and I am sure in the committee's opinion, and
19 we have a long day tomorrow to look forward to, and
20 with that, I think we will adjourn.
21 (Whereupon, at 6:10 p.m., the meeting was
22 adjourned, to reconvene at 8:30 a.m., on Thursday,
23 November 20, 2003.)
24
25

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Nuclear Waste 147th Meeting

Docket Number: n/a

Location: Las Vegas, NV

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Paul Intravia
Official Reporter
Neal R. Gross & Co., Inc.