UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD

QUALITY ASSURANCE
PANEL MEETING

The Adolphus
Sam Rayburn Room
1321 Commerce
Dallas, Texas

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BOARD MEMBERS PRESENT

Dr. Don U. Deere, Chairman, Nuclear Waste Technical Review Board
Dr. John E. Cantlon, Chair, Quality Assurance, Nuclear Waste Technical Review Board
Dr. Clarence R. Allen, Nuclear Waste Technical Review Board
Dr. Melvin W. Carter, Nuclear Waste Technical Review Board

Dr. Roy E. Williams, Consultant
Dr. Sherwood C. Chu, Senior Professional Staff
Mr. Russell K. McFarland, Senior Professional Staff

I N D E X

P R O C E E D I N G S

DR. CANTLON: Good morning. We're going to convene the panel meeting for the QA Panel of the Nuclear Waste Technical Review Board.

My name is John Cantlon. I'm chairing the Quality Assurance Panel. We're going to look today at an agenda, the second of a two-day set. Yesterday, we spent some time looking at the QA aspects of design. Today, we're much more focused on the research end of the spectrum. We're concerned, of course, that we have a credible quality assurance program for the whole aspect of both site selection and for repository development. We're also concerned that the QA process, as it's deployed and as it operates, creates and sustains a climate that will keep high quality basic researchers innovative, looking broadly at what needs to be done in research, and if the QA system can be as unconstraining there as possible, I think that's to the advantage of the program, and so on, and what we need to do is to look at that sorting mechanism of what has to go into a highly constrained, rigorous QA system, and what can be handled in a somewhat more open process that will allow the researcher the opportunity to innovate as research leads permit.

So with that as a background, we're going to try to speed the agenda up so that we can adjourn at three so some of you can catch your planes. So we'll start, then, with Don Horton.

MR. HORTON: Good morning.

Since yesterday went so well, I thought I'd add a little excitement to today's agenda and change it around a little different than what you have on your paperwork. Today we're going to discuss the workshops that we've had, and we have several people that are going to be on the agenda.

First of all, Larry Hayes and myself are going to provide a little introduction, and then we're going to discuss Workshop I, which is the scientific area. Joe Schelling, Dale Wilder, and Bill Steinkampf will provide some information on that, and then Workshop II, which is the software, will be provided by Les Shephard from Sandia, and then Larry will provide a summary, and both Larry and I will give closing remarks this morning.

If you recall, last--I forgot the date.

DR. CANTLON: November 1 and 2?

MR. HORTON: Right, November, we identified the problems that were identified in our meeting in Denver. The first one was the scientific, the quality assurance concern, which was the lack of flexibility in the application of the QA program during scientific research, the acceptability of peer review, further definition of the requirements, and the procedures

commensurate with acceptable (good) scientific practices.

The second major issue was the computer software QA program. It was too complex, does not allow freedom to develop conceptual/prototype design/analysis, and excessive documentation during the development, and lack of flexibility, and a lengthy change process.

The other two areas included data, data definition, what form, when it is complete and, most importantly, the time limitation for transfer of this data to the appropriate participants' data archive. Currently, there's a 45-day requirement within completion of the data development.

And then the fourth major area was it was apparent that inter-participant and the project communications are limited and needed improvement.

So these areas are the ones that we're going to discuss today, and identify what's been done since our last meeting, and with that, I'll turn it over to Larry Hayes right now.

MR. HAYES: Thank you, Don.

John, I think you hit the key for why these workshops. We need to develop a QA system that is compatible with scientific research. I think it's not secret, in the past we've had what a lot of people have viewed as an overly restrictive, too often changing, poorly understood QA program. A lot of improvements have been made, but more improvements need to be made in order that this program can really operate with the needs of the scientists to do research, to have flexibility, to go out there and when things aren't what they thought they were, to be able to respond to these differences.

We initially met in Denver on August the 7th to really just discuss what were some of the problems, and I think the important thing I'd like you to get out of this little view graph, it was a meeting of scientists, managers, QA people. It was a meeting of the laboratories, the Survey, DOE. A lot of people were involved. We were wanting to know what all these different people felt. It was really one of the first times everyone had been brought together and said, "Okay, what's your problem? Let's find out what your problem is." At that meeting, about 80 different concerns were identified.

DR. ALLEN: What are TPO'S?

MR. HAYES: Technical Project Officers. Those are the technical managers for the laboratories and the Survey. There's a lot of other things they call us, Clarence, but no need to get into that.

Okay. Following the August 7th workshop, we met in Las Vegas to deal with these approximately 80 general QA concerns. Most of these concerns were boiled down into a few major problems, and the fellows who follow me will talk about those problems and how we're working towards solving them, and

that gives me an opportunity to say I'm going to try to run through what I've got rather quickly here, because I don't want to put you to sleep. The important things are coming with Joe Schelling, Dale Wilder, Bill Steinkampf, and Les Shephard, scientists who have to work with this program, and I think what's important is what you will hear from them.

So, again, the important thing here, you can see a lot of different people from different organizations getting together to solve the problems, not just QA saying: "Here's how you're going to solve it," or not just scientists saying to each other, "But we can't live with that." They're talking to each other. They're working together to solve the problems.

A couple of additions to Las Vegas that I think were very critical to our success is NRC and Edison Electric Institute. I see Tom Colandrea out there, and Tom was very instrumental in helping us gain some understanding of how industry viewed some of our problems and what we needed to do to get on with the work. Paul Prestholt, John Gilray with NRC were really invaluable in helping us understand the needs of the regulatory environment so that while we were working out our QA problems, we weren't ignoring what those people needed. So the addition of NRC, EEI was critical. We had Nye County in because we need to be concerned about what the affected county people think about all of this.

What I think I'm saying here is this was people coming together. You've got a problem, I've got a problem, let's hear each other's problems and see where we can go. We're not working in a vacuum with each other.

The first workshop, as I said, was to identify and come up with resolutions to general concerns about QA and why QA appeared to be getting in the way of doing good, credible science.

The second workshop, that you'll hear about from Les Shephard, is largely directed towards some pretty serious problems we have in the QA software arena. I was talking to one engineer from REECO, and he said it was so bad he was going to throw away his computer and go back to his slide rule. It was easier to work out problems by hand than deal with the QA program. I think this group has met, and you'll hear from Les some very positive things.

Again, you'll want to note, a lot of people. We brought more people now into this second workshop because now we're dealing with needs of the engineers, the design people, as well as the scientists. Anyone who has to use QA software was brought into this workshop. It was considerably expanded. Again, we need to know what the concerns are of everybody.

The goals of the workshop. The very first bullet, I think, is the primary one we've been talking about so far this morning; compatible with scientific practice. Flexible, not

rigid. Open to change. We cannot plan for all the knowns in the unknown situation we're working at Yucca Mountain. Documents. The research and development process does not restrict it. Too many cases, it appears that either through our misunderstanding or perhaps inappropriate QA, the QA process was restricting. We needed to help us document, but not restrict.

We understand our work must be done in a way, if this work goes to the licensing arena, we can stand behind it; NRC accepts it. Consistently written, interpreted, and stable. The program's history has been just about the time you train to some implementing procedure, it's changed. So people had a very difficult time in understanding the procedures, learning the work to them, because they were so changing. Stability. We need some stability.

I've talked about facilitating R&D activities. That's flexibility. Initiative at the working level. The scientists, the engineers who have to work with the QA program now, through these workshops--and to some extent in the past--are very actively involved in helping develop the QA program and how it will be applied. They're getting in right up front as we develop some of these implementing procedures, from up line requirements, to help us understand whether or not we're setting up a process that is simply dooming the scientist to failure. So their up front involvement is critical.

Doesn't manage line activities. Too often in the past QA has been put into procedures that they were administrative or management issues. There was no reason for QA to be involved. We're looking at those and taking the QA out of those things where it doesn't belong. Also, too often management has said, "Well, you know, I really don't want to do this, but QA says I have to do it, so go yell at Don Horton." Well, we've got to get away from that. Management has to stand up and say, "We're doing this for good management reasons," and let's not say it's because of QA when it isn't. That simply makes the QA program more difficult to get acceptance.

DR. DEERE: Larry, when you say that the history of this has been one of change, but isn't this good? Hopefully, the changes are being brought about because they find out things aren't workable.

MR. HAYES: Unfortunately, Don, change has not always been good because we simply went from change that doesn't work to change that still doesn't work. You're right, change is good and the workshops will result in a lot of change, but this time, I'm quite confident--through this interaction we have with all the people involved--the change will result in something positive, not just change because somebody new came into the game and interpreted something different, and now respond to that interpretation.

DR. DEERE: Thank you.

MR. HAYES: But you're absolutely right, change is vital, and that's really a key to the workshops; change. But well thought out, productive change.

Here is where we hope to go, you know. We've been in the past--and I acknowledge this--where QA was you either fight it or you ignore it. That leads to stop work orders. That leads to very unpleasant issues. We've moved from that, I think, in general, all participants and DOE to understanding, okay, we know we have to do QA. We'll do it, but do we really have to do it this way?

What I'm hopeful the workshops will do--and I think I see indications of this--through the help of the scientists, meeting of minds of the QA people, the scientists, management, we're going to get into a really cooperative stage where we accept QA as beneficial to science. Right now, I think that's still an open issue. I think we're just touching on that now, that the scientists would accept QA as beneficial. They do accept that QA is necessary if their work is going to be useful in a regulatory environment, but we've got to move on a little bit from that. We have to have a program, I think, that the scientists, the engineers will truly accept as beneficial to their science, and I think the workshops, the emphasis Don Horton is putting on open communication and this positive change, Don, is going to get us there.

With that, I'll turn it over to Joe Schelling, and Joe is going to talk about the process in the workshops a little bit.

DR. CARTER: I wonder if I could ask a couple of questions, Larry?

MR. HAYES: Sure.

DR. CARTER: You may not be the appropriate person to respond to them, but at least during the discussion I'd like someone to address them, and let me just put them on the floor.

One, Don Horton mentioned the acceptability of peer review, and it's not clear whether he's talking about the acceptability or the lack of acceptability of peer review as one of the problems that you hope to resolve through the workshops. That's one I would like to have someone address.

MR. HAYES: Okay.

DR. CARTER: Because obviously, peer review has been used in the scientific process for an awfully long time, and I thought it was generally accepted.

MR. HAYES: I would give you my perception of that, and perhaps Dale or Bill might have something to add.

I think what the Survey scientists see is lack of acceptability of peer review as meeting a QA need; that in the Survey, we've had peer review for a hundred years, and we find it works very well. It is the way we check our science. When

we talk about QA being more compatible with a scientific method, that's one of the things we're talking about. Let's put more emphasis on peer review. Let's accept that peer review is an awfully good check, and from my perspective, that has not been used to the extent it should to document good work.

DR. CARTER: Okay. The second question is the impact or the lack of impact of quality assurance as far as report review and approval, that procedure or process within the project.

MR. HAYES: That was one of our short-term actions. The DOE had a procedure for reports, for submitting them to DOE, getting DOE approval. A lot of us felt that that wasn't really a QA issue. Susan Jones took the action to revise that procedure, and she's done a darn fine job, and I think now what we have is a procedure that is one of those cases where the "Q" has been taken out of something that wasn't needed, and now we've got a procedure that we can simply move a report forward because what DOE is doing at that point in time is looking at a report from a policy viewpoint.

The peer review, before the report got to DOE, is where the report has been checked technically, so I think we've made a gain there with what Susan Jones has done in cleaning up the report processing procedure at DOE.

MR. BLANCHARD: Larry, I'd like to help you answer Mel Carter's first question about peer review.

Just to make sure we're communicating, Larry's use of the word peer review was not the same as the use of peer review when I described the process the project office uses to go to outside peer reviews in a formal, documented way, to review a part of the program, as we discussed it yesterday, where we identified people that are not funded or not part of the program, and are called to come in and, for instance, critique the planned unsaturated zone test program or something of that sort.

He's using it in a more traditional sense, where if you are preparing a publication and in order to get it published from a scientific journal--or, in this case, from within the Geological Survey--there are people who weren't associated in the Survey with producing that work, and so the internal review is called peer review by them. So we need to make sure that when we discuss peer review here, that there's different definitions, that's all. I just wanted to avoid confusion on that.

MR. HAYES: In the Survey, when a person writes a report, he has to send it out for what I call peer review. That report goes to someone who has not been involved with that work, but who has equivalent expertise or understanding of the subject matter of the report, and the Survey requires, normally, at least two of these type of reviews to where

people who are not closely associated with the work can back off a little bit, look at it, make sure it's technically sound.

DR. CARTER: The reason for bringing it up, it wasn't obvious, and that was certainly one of Don Horton's four principal areas or part of one of those that the workshops were hopefully designed to resolve.

The third question I had is, again, from the scientific and technical area. What areas of the QA process are especially difficult to design and implement? And I'm sure there must be some of these that, through collective experience, you've identified.

MR. HAYES: I think just a brief answer on that. We are doing front-line science in this project, and many of our study plans, we can only discuss in general terms what we think we're going to run into and what we need to do when we run into those situations.

The QA program, at least in some people's perception, seems to not deal with changes very well; that the scientists will lay out a scheme of attack. They'll run into something that says, "Wait a minute. I've got to go back and look at this." The rigidness of a QA program as we've had in the past--and I think it's changing, and I want to note that--made it very difficult, or at least from the scientist's viewpoint, the scientist felt it was very difficult to stop and take a different direction because he'd learned something that indicated he should take a different direction.

But I'd rather--maybe some of these fellows, Dale, or Bill, or Les might have a--because they are working scientists. They are probably a little closer to it, and might have a different view.

Bill, you got any thoughts? Dale?

MR. STEINKAMPF: Well, I'll kill that snake when I get up there, I think.

MR. HAYES: Okay.

DR. CARTER: And the fourth question--and I'll add a little preamble. Don Horton didn't necessarily ask me to ask this question, but what I'm interested in is the most onerous requirements as far as QA--as far as the scientific folks are concerned. What's the worst parts of the process?

MR. HAYES: I'm going to let those fellows address that again, because I'm afraid, as a manager, that my view is somewhat colored just out of necessity of being a manager, and I think the guys who are down in the trenches honestly have a better answer.

DR. CARTER: Thank you.

MR. HAYES: And so, when they get up, they'll talk about that. Like I say, the important stuff is coming up. Hearing from the scientists, I think that's what's really important.

MR. SCHELLING: I guess my part of this presentation will

be on the--providing you with an overview of the process that we've been using to work out some of these problems through the workshops. My focus will be on the results and the approach we took during the first workshop on the inflexibility of the QA program with respect to science, but the same methods and techniques are used for all the workshops that have been done and that are planned to be done.

I'll try not to be too redundant with what Larry went through, but I'd like to give a little of my feeling of what we were attempting to do here. At the meeting in August, there were a lot of problems raised by the scientists on the program on what I would view probably in a negative sense. There was a lot of harsh criticism on how the program has been implemented, but on a more positive side, it seemed like for the first time in a number of years, we actually had QA willing to listen to us and willing to work out a solution to some of our problems, and we've seen this continued support throughout the whole exercise here.

Following the August meeting in Denver, then, we had the meetings in Las Vegas in October, I believe it was, where what we were really trying to do was given this huge list of problems, what really are the root cause of the problems, which ones can we solve, what are the impacts of these problems on our work, and to start interactions going and getting consensus among the group on what the solutions to some of these problems might be.

As I've already mentioned, the first one was convened to deal with questions of the inflexibility of the QA program, and we had approximately 40 people there that represented a pretty good cross-section of the laboratories and USGS as management, technical people and their QA representatives, and one or two people from the DOE, and the observers from the NRC.

What I think most of us found to be the most positive aspect of this thing--and we felt that it was rather productive--was the fact that it was professionally facilitated. There were people standing up there really showing us how to go about this exercise, how do we build a group consensus, get people talking, how do we work to get solutions to problems that'll stand up over time, and I think we all agreed that it was very positive; that the approach we took was to, you know, let's recognize we have a problem. Let's find the solution to it. Let's break down some of those barriers between people and have an open discussion. Let's work toward getting real results out of solutions to these problems.

The basic process we've been using in the workshops to date, we generally start off with an introduction and a description by these facilitators of what steps we're going to go through over the next few days, and I was actually somewhat

surprised by how quickly--using these techniques they had--everybody in the room was on a first name basis within about a half an hour, and easily communicating with each other. All the barriers to communication seemed to be falling away.

Then we sort of laid out where it is, where are we in the program now, what is the problems we're having, where would we like to be when we get finished solving these problems, and then we spent the next day and a half going through the structured technique of working out solutions to our problems, defining how we were going to work together to integrated solutions that we could present to Don and DOE management, and we made up a transition plan for some of the problems we felt were a little bit too large for us to deal with in the next couple of days, how would we get those worked out in the future.

Like I say, we started with quite a list of problems. There were 67 items that resulted from the discussions held in August at the Denver meeting. We started off by trying to group these down, remove some of the redundancy and group similar problems together into 33 areas of concern, and then out of these 33 problems, with only 40 people there, we had to pick the ones we wanted to work on, so we looked for what were the fundamental problems, the sort of underlying root cause kinds of problems, which ones did we feel we could--felt were amenable to solution.

We defined the problems we wanted to work on very carefully. We broke the group up into two separate groups; one to deal with each of the two questions, and after each step in the process, we'd get back together, make sure everybody in the room came to agreement on the situation.

The first group felt that the problem they wanted to solve was they recognized there seems to be a lack of understanding between the technical staff, the QA people, and the scientific people down in the trenches. How do we adapt scientific practices to satisfy the licensing needs of this program? How do we relate those QA requirements that flow down to us to the way we normally do our work? And how do we get the QA program to recognize that professional judgment is a big part of how the scientific method works, and how do we balance that against what we felt were overly prescriptive controls?

A second problem we dealt with was written a little more concisely, and it was that it seemed we were having problems because it appears that management policy was being merged into quality assurance procedures. That had impacts on our productivity and our understanding, I think, of what the QA program was.

Both of these problems, to me, remind me of something that was said yesterday, where QA is being used as the police on this project, and I don't think that's their

intent, and I think we're all starting to understand we can work together and end up with a good project here.

The six basic steps that we went through, we'd break up into our little groups for a half an hour, 45 minutes, come together and discuss the progress we had made. We started off by identifying what the problem was in some detail, who caused the problem, who does it impact, what's the problem, when does it occur, how bad is it, things like that. The second step is to go out there and, you know, let's see some real evidence that we really have a problem, and where does it show up in time.

Then we used some of these formalized methods to go through and identify the cause, what really is the root reason that we have this problem, and some of the techniques they had were these fishbone diagrams that kind of focus in on a root cause; brainstorming, where everybody just throws out whatever they think might be a solution to a problem, and then we go through and evaluate those many options we came up with.

We'd come up with a list of possible solutions, and then we'd go through and try to set some criteria; the cost, the impacts on the work, how much benefit would we get by taking this path, and then at the very last step, after we've done all the work, let's lay these out in some integrated list of recommendations on how we should next proceed to implement the solutions.

This last little view graph repeats that a little bit, that at the first meeting, first workshop meetings we had, we sat down and sort of laid out, here's the approach we'd like to take. Then we went and, at the next meeting, we got together again, looked at those, refined them, tried to make sure we were really coming up with a productive solution, and merging the two action plans from the two separate groups into one combined set of recommendations on how we felt the solution would be reached, and I think Dale's going to get up next and talk about the short-term actions we thought were necessary, and then Bill will get up and talk about the more longer term progress here.

MR. WILDER: Well, I am going to be speaking about the short-term recommendations that came out of the QA workshop, but I'd like to--perhaps at the risk of getting bogged down for just a second--try to respond to a couple of the questions that you asked, Mel.

One of the problems that we have had--and I say "we," the people that are in my group--have had with the QA program in the past was that it was being asked to do more than just QA, and so many of our procedures were being asked, in extreme detail, what we were going to do, recognizing that we couldn't give those kind of details. And so we got really bogged down in trying to write procedures that were too specific.

And the other area which was probably most onerous for us--well, I guess there's really two areas. We had real problems with our field testing. It took forever to get those procedures through because of that. There were too many bosses, if you will, that had to be satisfied, and the second was in software QA, and I think both of those are going to be addressed today. I know I'm going to speak briefly to them, and I'm sure that Bill's going to speak to them, also.

So let me go ahead and tell you what the progress I see that has been made in the short-term recommendations which did come out of the workshop. Short-term recommendations were made during the workshop because I think most of the participants recognized that there were improvements that were needed in the QA, but they were probably going to take a fairly lengthy time, or at least, certainly, a long involvement on the part of the participants in order to implement them. And because of the unacceptable level of what we called "pain"--and I'll put that in quotes--or cumbersomeness in implementing the QA, we did not want to impede getting some relief waiting to do the long-term process.

And so we identified some things that we thought we could begin to address the QA issues, without impeding that long-term process, and that we could integrate those short-term objectives with the overall process; that is, we wanted the results to be positive, and such that they could merge with the long-term, and we felt to do this, we would have to address the real causes, rather than just trying to doctor symptoms during the short term.

One of the benefits we felt that would come from the short-term resolution was to produce credibility. It is our judgment that most of the technical staff were rather skeptical. They had been through several changes. You mentioned change being good, and that's true, but they'd been through a lot of arbitrary changes, and so the technical staff was rather skeptical. They were willing to accept our judgment; that is, the technical management's judgment that things were going to work, but they remained rather skeptical. And so we felt that short-term results were very necessary to help the technical staff.

Secondly, we felt that the short-term benefits would be in demonstrating to the management that this was a workable system; that the technical people were not just trying to throw out QA, or to fight QA, but really were trying to make QA workable, and at the same time, be able to produce the technical product. It's kind of trying to demonstrate that we weren't opening up Pandora's box.

The other benefit is that right now, our technical staff are very fully committed, and in times of constrained budget, we felt that streamlining part of the QA process would

free up some of the staff that's necessary to work on these QA issues. And so getting short-term results, we felt, would be very helpful.

Also, I've mentioned that it gives us a history to evaluate. In the technical work that was done at G-Tunnel, one of the objectives we had was to try the QA procedures, even though they were not quality affecting type of activities, and we found that very helpful, and I see this as a similar kind of a prototyping, if you will, of the process of change that's needed in the QA.

Now, one which we had not actually identified as a short-term benefit, because it seemed more in the camp of the long term, but has certainly turned out to be a very significant benefit is the beginning of the dialogue to come to a common understanding between technical management and QA staff.

There were four short-term focus areas identified during the workshop. One was the publication release process, and of course, that's already been asked about, and I will be talking about that. Another was to establish effective but not excessive training; to simplify the procedures and to allow them to maintain flexibility for the work to be done; and to clarify the document hierarchy.

Let me start by talking about the publication release. Larry's already alluded to the work that Susan, among others, has initiated here, and I think we've made some significant progress. Our approach was to emphasize the participant technical review. Now, this was not always the case. Very often, when reports went down to the project office, they were reviewed for technical content, as well as the overall program issues. And so, the approach that was being recommended was that we recognize the technical role of the participant organizations, and that the project philosophy has been changed to look for the big picture, the political project-related kinds of issues.

Now, we recognize that this places some real requirements and responsibility on the participant organizations. I think the organizations are willing to accept that responsibility. It also utilizes the normal scientific review process, and the question was asked earlier about the peer review. One of the things that we recognize is that even though we may follow a process, a rigid process of review, that that is not, ultimately, the technical review that's required, and I'll use a couple of examples.

Some of the work that we're doing right now in hydrology is really pushing the state of the art in fracture matrix flow in unsaturated conditions. There are not that many people who are qualified to review this work, and so although we could send the work for review internally, and so forth, and we could get portions of it reviewed quite

adequately, the ultimate judge of the adequacy of that work is going to come from the technical peers at large, the profession as a whole.

I look at what happened with cold fusion as perhaps an example of this; that it was only as that got out into the technical community at large that that really received an adequate hearing. And so, merely following a procedure that requires two or three reviewers, in many cases in these areas where we're pushing the state of the art, is really not an adequate hearing. And so we recognize that it's very necessary for us to get it out into the hands of the technical community at large as soon as possible.

Now, there's some risk in that, obviously. I mean, once again, not to pick on cold fusion, but the University of Utah could have very well taken the approach, no, we're not going to let things be released until we're absolutely sure. But I don't think the University of Utah has suffered in their reputation. They've been a very sound, technical contributor in many areas, and of course, they're not the only ones that have tried to push the early release of information so that it can be well reviewed. And so that is a little bit of a philosophical change, and I'm very pleased to point out that I think that that change is coming about in our project.

There is a typo on your handout, and maybe the typo helps to clarify or amplify the progress that's really been made. Report reviews were covered by APQ 1.3 in the past. 1.3 has been revised in February and it's no longer APQ. It's now strictly an administrative procedure, and within that administrative procedure is a commitment for a very rapid review of our reports, and a guideline as to what kind of review is provided at each level, and I think it's very positive.

The work that was done at G-Tunnel, the prototype work that I mentioned earlier, we had our first internal review report October of 1988 on that report, on a progress report, excuse me. It took four months of internal review and one year of project office review, including the comment resolution. It has just finally been published. The final report on that same work has been submitted to the project office, and we are expecting--although the time has not expired, so I can't really give you results--but we are expecting a one-month project review, which I think is a fantastic improvement, and largely comes about as a result of Susan Jones' efforts and the project office in releasing AP 1.3.

DR. DEERE: A question.

MR. WILDER: Yes.

DR. DEERE: Going back to your second point, to utilize the normal scientific review process in the way you describe the fracture matrix flow, but really, what you're advocating

is peer review after the fact.

MR. WILDER: Okay. Well, let me clarify. We still go through technical review internally, but what I'm saying is that we don't go through an internal technical review and then a project technical review, and deciding, do we need to go outside to get a rigorous, formalized peer review that Max referred to. Rather, we say, okay, once the organization--Lawrence Livermore or USGS or whoever--has reviewed that for its technical content and are willing to stand behind it, then we try to get it out into the society, or the technical community at large as soon as possible, so that we can then get that reviewed by people who have a breadth of experience, rather than the narrow focus on Yucca Mountain.

DR. ALLEN: But what does all this have to do with QA? I mean, this is a procedure we would be going through on any--hopefully, on any kind of a public--of a publication. What's unique, or how does QA tie into this?

MR. WILDER: Well, I think that's the significance of having taken the Q out of this AP. In the past, QA--this is my opinion. In the past, QA was used not only for QA functions, but also for management functions and other control functions, and so, in the past, there was a lot of requirements built into the QA program to get reviews beyond what we've just described as the normal review procedures.

I mean, it was the only program that I'm aware of wherein a technical report would be reviewed first by our line management, by our technical management, then by our QA staff, then by project office, technical staff, and so forth, and those were not required by QA. QA required that we document that the reviews were done and that it was properly reviewed, and not that it had to have several iterations of review, very often that added nothing to the technical content.

DR. ALLEN: Are you saying that the QA staff does not play a role in this except to make sure that it works?

MR. WILDER: The QA staff makes sure it works, and the project office makes sure that we've addressed those big picture items, what I call big picture; the project-related items. The participant organizations have the responsibility --which we are now accepting, I guess, or being allowed to accept--to take responsibility for the technical quality.

It looked like you had a comment to make, Max. Okay.

MR. HORTON: Could I address the comment there?

MR. WILDER: Sure.

MR. HORTON: Previously, prior to this procedure being changed, Clarence, QA organization, plus many other organizations, was an in-line review to these documents prior to their release. We removed the QA review for these documents, and made this a--not a quality-affecting procedure, so that they turn these documents around in a faster time now.

MR. HAYES: Essentially, what we're doing is putting the process back to the way you just said it should work.

DR. CARTER: Yeah, because I presume in the past, then, you could have a potential clash between QA requirements in terms of their time that it took to do them, and the fact that you'd like to get this out as quickly as possible to a wide, or very broad provincial scientific community.

MR. WILDER: And that's why I used the example of the G-Tunnel work. This was work which has received a lot of interest, and we've been very anxious to be able to get those results out into the technical community. And as I say, the work was finished--the actual work was finished before October of '88, and we've just now published that work, and that was because of the impediments within the review cycle. And I'm very hopeful that the final report, which was just submitted to the project office about three, not quite four weeks ago, we really are expecting that there will be quick turnaround.

Now, it may be that it won't meet the one-month turnaround which had been agreed to, because what's been happening is the project office has been taking care of all this old backlog, and that's one of the things that kicked out the progress report. It may have even been longer--although I can't say that for sure--had we not streamlined the review process.

Let me talk for a minute about the focus area of effective training. The approach that was suggested by the workshop is that we train as needed, not use blanket training; that we use read and sign when appropriate; and essentially, do the training when it's needed.

I think that there's a lot that we can point to for progress here. A lot of it, perhaps, is more within the participant organizations. Let me share with you my perspective. When we first started really trying to implement QA, whenever a procedure was written, anybody who might be anticipated to ever, within their career, use that procedure was required to be trained in classroom training. And so we had classroom training that literally included 50-60-70 people in a room in classroom training for a procedure that they may not use for the next three years.

That has gone away. In my technical area, I have, with the support of my TPO, taken the approach that we will train people when they're ready to start the work that that procedure applies to, and that if it's quality affecting work, we will rely on readiness reviews to make sure that the training has been done before we start the work. For some of those activities which are not qualify affecting, some of the scoping calculations, some of the developmental work, we have administrative procedures set up which will check, essentially, time cards, what someone's charging time to, to make sure they've been trained for that activity. And I think

that's a tremendous step forward.

We forgot what we had been trained to before we ever applied it in the past.

DR. CARTER: Well, what you're saying now is that's essentially a management decision?

MR. WILDER: It's a management--

DR. CARTER: Routine management.

MR. WILDER: It's a management decision which has come about because of the efforts of the workshop, and the QA folks giving their approval to this approach. Read and sign is being used much more extensively, and for those procedures which don't require a larger perspective, read and sign is used exclusively; especially for things like technical implementing procedures.

The other thing which I think is a very positive thing that has come about--and some of these things were already starting to be developed or worked on even before the workshop, but one of the problems we've had in the past was having multiple training; that is, the project office would have an APQ that covered an activity. Our QA procedures would take those APQ's and turn them into QP's internally, and so we would be trained for the same work on a project office APQ, on a Livermore QP, and if we were doing work that involved interagency interactions, like very often going down to Sandia on the ESF, we may have to be trained to their procedure, and that is being backed off, also. And so I believe that the training is a lot more effective now, because we are looking at what really needs to be done.

The other thing that has happened recently is that there is a training survey that has been produced as a direct result of our workshops, which is being sent around to the participants to see how the training can be made more effective.

I mentioned the simplification and flexibility, and to a large extent, I would have to say that this is a mind set more than any specific procedures that have been developed, but let me talk about progress in three areas.

Software QA. I mentioned software QA was a real hurdle for us in the past, and that was because all software was considered equal, and so as we were doing developmental software, there was a philosophy expressed that every time we changed a line of code, it had to go through a changed control process. That no longer is the case. We've been able to get recognition that we have baseline codes which do need to be changed controlled, but we have developmental codes in which we can document the changes in scientific notebooks, and we can keep good documentation, but that we don't have to go through a rigorous changed control until we're satisfied that we have developed that code to the point that we're ready to now change the baseline, and then we go through the very

rigorous QA procedure. I think that's a giant step forward.

The other thing that we've been doing is grading, and I notice that you did have some discussions on grading during this presentation. One of the things that we've recognized is that we can take exception, or at least recognize the different needs for control, depending on what the work is. And so a lot of our scoping calculations, a lot of our preliminary work, we're able to recognize that in the QA process, and we're using the scientific notebook procedure to a very great extent now, which helps to address the issue that Larry brought up, of being able to provide for flexibility to make changes.

The last area that was a focus area is document hierarchy, and the approach that was recommended was largely one of education, and I think the progress has been wider than just education, and let me talk a little bit about the ESF as an example. That's what I'm perhaps most familiar with in this regard.

When we were first trying to develop the documentation for what testing was required within the ESF, there were a number of documents that controlled that work, including study plans. There was an exploratory shaft test plan that never got published, but from that came an SDRD. Then there were test description documents, and there were just a myriad of documents that covered the testing.

Part of the effort to look at the document hierarchy has been to decide that it really isn't necessary to have multiple documents. As a matter of fact, I've always argued that it's counterproductive, because one of those documents, I guarantee you, is going to be out of step with some of the others. And so now we're trying to simplify that to where we have a single document that controls a single activity.

The other problem that we had--and this gets back to my earlier comment about the problem with specifying in detail--the designers and those that are going to construct the ESF needed to know what kind of activities we were going to be doing, and they needed to know, for instance, what kind of drilling we needed to do, the amount of drilling, and so forth. But because of a desire for more control or whatever that existed in the old QA process--or let me say management-at-large process--our documents would be required to specify a hole layout, a location pattern, and so forth.

Well, we haven't written the study plans yet. We haven't seen the fracture patterns, so we really could not determine what those layout patterns were. But this was being required in advance, and put into procedures which became part of the QA process. So if we changed the hole location, of course, that could generate a deficiency report of some kind.

Now, what we've been able to do--and I think, to a large extent, what's happened out of the workshop because of

this communication, is that many of us that felt all along that that was wrong now have a little bit of added courage or whatever to fight the process, if you will, and so now what we're telling them is we need approximately 30,000 feet of NX core, and we will determine where that core goes when we get there, and I think that that's being accepted. So I think that that's a big step forward in the simplification of document hierarchy.

I guess my conclusion, which I think I've already given you, is that progress has been made, and I think that the common understanding between QA, management, and technical staff has been a significant short-term benefit, and with that, I'll turn the time over to Bill Steinkampf to talk about the long-term progress.

MR. STEINKAMPF: Thank you.

Just so everyone knows where we are, this is where we'll start, but we're not going to do that yet.

Interesting question from Mr. Carter, the most onerous. That's kind of difficult, I think. One, because we come from a fairly wide spectrum of both organizational and professional backgrounds. There have been a lot of complaints about the QA program, its implementation, and the impact on the technical program, which I'm sure you heard quite a few as you've made your travels. I initially listed three. I said the inappropriateness as it's applied to technical investigations and site characterization is one that rankled everyone, I think, to a significant extent, and that covers a multitude of sins, largely because what we seem to view as an overly prescriptive suite of procedures, which tend to either preclude or inhibit the application of the scientific method in the work that we do; the fact that the manner in which we were required to address and construct procedures didn't really allow for the kind of iterative-type work that you have to do to, the hypothesis testing. There are a lot of things we just don't know what we're going to have to do until we get out and start to try to do them. Many things can be described and delineated very well at an early stage, but other things tend to evolve.

Another gripe that seems to surface, especially after a more prolonged contact with the program, was that the initial developers, those who transcribed NRC regulations down to a project level, and then from a project level to a participant level--and by participant, I mean USGS and the labs--really didn't have a good feeling for how they were going to impact the technical work that was going to go on, so that there seemed to be a lack of relevance between the thoughts entailed in the procedure and the work that was actually to take place.

So I'm not sure how to point to that which is most objectionable. I don't think that I can really do that, and

I'm not sure that anybody else really can, other than from a local perspective. But I think those points address the general consensus.

The implementation of the QA program has had quite a few results. The most detrimental, I think, has been the sense of frustration and dissatisfaction within the investigative staffs at all the participants. These frustrations have had several manifestations initially, which were largely undesirable. Some of these were diminished enthusiasm and morale among the staffs, and, indeed, loss of staff.

I can speak from my experience. I've been associated with the project and the Survey for four years, a little over four years. We've got about 15, 18 principal investigators in the water resources side of the Survey's work, and I've seen five people leave. So you're talking about 30 per cent.

DR. ALLEN: Leave for that reason?

MR. STEINKAMPF: Leave either the Survey to go into private business, or move--transfer into another assignment within the Survey, and largely from the sense of frustration that arose from the implementation of the QA program, yes, sir. It's a frightening statistic, and that didn't really hit home until I started counting heads and empty offices, and looking at the new people that came in and out. I think that's changed. The slope on that curve has changed quite a bit, if not reversed.

DR. CARTER: Let me ask you, what's your interpretation, I guess, a couple of things; one, when the program started at Yucca Mountain, of course, you didn't have all the QA requirements, so they've sort of been force-fed, if you will--I use that in a desirable way--to the project, and I presume now, at least in the last few years, when you recruit people, and so forth, particularly if they're going to work on the Yucca Mountain thing, the ground rules are all known, the QA and the whole process. So I presume there'll be--there could be a significant difference between what's happened in the past as far as morale on the project, and what may happen in the future, and the current circumstances.

MR. STEINKAMPF: I think the morale, speaking from the Survey's side, is significantly improved over four years ago when I got here. My perspective is perhaps not completely representative, because when I got here the Survey had already been--had the work stop order imposed upon it, so I've never been out in the field to do any of the stuff that needs to be done. And so I, perhaps, don't really feel as impacted as perhaps some others do who were in the midst of collecting information or constructing data collection sites.

But within the Survey, the cognoscente are aware of what's going on, but out in the field, again, from water

resources, this is a remarkable institution to work under, because we don't really do this kind of work, normally, in the Water Resources Division. We're more of a resource appraisal on a state and municipal cooperative framework. We don't work in a regulatory environment under NRC and DOE guidelines. It's a new ball game. There's some interaction with EPA which smacks of that somewhat, but there's not a great appreciation for the environment we work in, and so that the general consensus is, among outside technical staff, outside the Yucca Mountain project in the Water Resources Division is that it is a less than desirable place to go, but I think that is changing to some extent, also, as there's more contact between the staff and people are beginning to see that it's not, perhaps, as bad as the New York Times Sunday Magazine says.

DR. CARTER: This is a USGS Gulag.

MR. STEINKAMPF: I'm not--no, I don't think Gulag is really the appropriate term.

DR. CARTER: How about Siberia?

MR. STEINKAMPF: That's perhaps a little more appropriate.

MR. HAYES: It's the place for our best and brightest, the most challenging work we have. How's that?

MR. STEINKAMPF: I'll yield to that.

DR. CARTER: I'll average those two comments.

MR. STEINKAMPF: I'll certainly agree with the most challenging in a lot of respects.

Another of the results of the work, the frustration and dissatisfaction that has been evinced in the Survey and the other organizations is that we finally had this August meeting where everybody could get up and do a little spiel about the problems they saw, or firsthand experienced, and Dale noted that at that point, credibility seemed to begin to creep into the picture, and I think that's appropriate. I think it's--it was sometime after the August open forum, probably coincident with, you know, the middle of the workshop, first workshop period that this recognition of QA and management on both project and participant level was, indeed, gaining coinage with the technical staff.

As Joe noted, the major problem that we worked on in our workshop was that there appeared uniformly to all the technical staff, that there was an inadequate meeting of the minds between the technical quality assurance and management staffs, and that this was something that had to be resolved for successful implementation and operation of the project, for the QA program to work, and to integrate with the technical program.

The workshop yielded some long-term recommendations which we'll take a look at now. I think probably key to the recommendations that we came out with was that to establish technical advisory groups. The technical advisory groups we

saw as a means to get our licks in at a much earlier time when it can do us a lot of good in both the evolution and additional development of a plan. We saw that these technical advisory groups would provide a means to establish a forum for technical quality and management exchange, and that the TQM is both fortuitous and semi-intended.

We felt that these technical advisory groups would be able to allow people to identify, or at least provide the means to identify and clarify appeals processes, means to work within the QA system either that existed, or needed to be implemented.

We also felt that the technical advisory groups would provide a means whereby participants on the trench level would get a better understanding of why we had to do some of the things that were mandated by the quality assurance system. As an example, several people voiced the concern that they didn't understand why we were doing a lot of the stuff, and we didn't have any contact with the NRC, which seemed to be, to many, to be the prime source of information. And we said, we need to get together sometimes either on an investigator level with some NRC staff and get a little explanation, so we need some technical interactions.

Well, I, for one, found out at the workshops that these technical interactions already exist, but I didn't know about them, and I daresay that the majority of the staffs didn't know about them.

There were some things that we saw going on, meetings to present unsaturated zone study plans, or unsaturated zone studies to the NRC, but they were not presented or represented to the technical participants as technical interactions. They were just another, let's get out and put on another show and run through the plans for the NRC this time, rather than someone else. So those things do exist, much to everyone's pleasure.

And the licensing workshops are something that came up. Somebody said, it would be nice to understand just why we're doing all this type, and how it relates to the licensing procedure, and if we can see a relation to the implementation of the QA plan, and how it goes further down the road, why we have to do everything we do in the fashion that's mandated. And this is something that the technical advisory group will be looking into, is to ask the NRC to kind of put us through the wringer, so to speak, and give us a feel for what the real world is like as we approach the licensing process.

DR. CANTLON: Before you take that off, the forum for your technical quality assurance and management people, what level of people are you talking about there?

MR. STEINKAMPF: Okay. I'm going to address that in the next overhead.

DR. CANTLON: Good; thanks.

MR. STEINKAMPF: This was something that came out in some of the first discussions in the workshop, and persevered throughout.

The first thing we had to have was management buy-in. We see the technical advisory groups at two levels: first, a local or participant level--national labs and the Survey. These groups will consist of a variable number, anywhere from one to as many as the TPO feels is appropriate, technical staff. TPO gets to pick, and these groups, if they're more than one person, will meet on some sort of a regular basis, either monthly, or perhaps ad hoc.

We see their function as being a sounding board for participant level QA problems. They will be mandated or charged with interacting between QA and management to address problems that the principal investigators or the scientists or the technical staff view as essentially unresolvable at their level. If a guy can't work it out with is QA staff, he can come to this group and say, "Look, it's not working. We're not having a meeting of the minds." And so this is an initial facilitation.

The additional benefits we see from these types of groups on the different levels is that it's a means of communication within the local organizations to the project level, and conceivably higher, as appropriate. Also, possibly--and very likely, in some cases--a means of information dissemination that would not ordinarily either come through the memo stream or outside someone's technical field, yet with some relevance so that people are more aware of what other people, particularly outside the organization, are doing.

And another benefit was resource identification, find out who's doing what in another organization so that you're not reinventing the wheel, and conceivably, have some mutual benefit. This will enhance significantly the technical integration that goes on within the project.

Yes, sir?

DR. WILLIAMS: Could you explain how the groups are formed and how many there are?

MR. STEINKAMPF: Okay. What we're talking about on the local level is one for each organization; one at the Survey, one at Sandia, one at Los Alamos, and one at Livermore, and Larry gets to pick ours, our members. Les picks them at Livermore, and so on.

They are to be from the investigative staff, not from management staff or quality assurance staff. From that population of members, we will go to a project level, Las Vegas level group. This group--the charter for which was recently completed and, I think, sent to Carl and Don for their blessing. You might have to help me here, Larry, because I missed the meeting. We're going to have seven

members?

MR. HAYES: Correct; eight now, I believe, with the chair.

MR. STEINKAMPF: Eight because of the chair. Okay, we're going to have eight members, seven of which will represent one member from each of the local groups. So you're going to have four that represent the participants; Survey, Livermore, Sandia, and Los Alamos. Three will be from the project level; one from QA, Don's staff; one from Carl's technical staff; and one management representative, and then there's a chairman, Mr. Hayes.

This group will interact with the participant level groups in that they will be able to address problems that the participant level groups cannot resolve at their strata. So the tough problems get forwarded up to the project level group for resolution. This group will also participate with the project QA and the management staff in the evolution of--and let me say the evolution of the quality assurance program on the project level. This is the ultimate meeting of the minds in that we can actually get together on the project level and provide a technical perspective to the planned modification or implementation of quality assurance procedures.

DR. CARTER: Let me ask you a couple of questions. This group now at the Las Vegas level, this is advisory to whom, or what group?

MR. STEINKAMPF: I would say to Don and--largely to Don, but also, to some extent, to Carl.

MR. HAYES: And I'll get into that in more detail. I have a separate presentation on this group and what it is, what it's functions are.

DR. CARTER: Okay. The other question is, how formal are the processes there in terms of setting up these advisory groups and committees, and, you know, do you keep minutes and all these sorts of things? Is the process kind of formal?

MR. STEINKAMPF: Yes, sir. There'll be a records process and a reporting process on both activities and progress. I think Larry will address that to some extent. The first meeting was--the first meeting of this group was March 14th.

MR. HORTON: By the way, Mel, it's not a quality document, so...

DR. ALLEN: Could I ask a question? You have talked a lot about how at the, you know, at the level of a working scientist, you're going to adapt and change and make this system workable, and so forth, and great. But looking down the road, do you see areas where you think the QA procedures as promulgated by the NRC and the DOE management are so stupid or so unrealistic that they're going to have to change? All you're talking about is how you're going to change.

MR. STEINKAMPF: Well, it was suggested in the workshop that we rewrite the 18 criteria, so it seems to me that the

possibility exists for change at that level. How successful such a thing could be remains to be seen, but perhaps this gets back to the most, or potentially most onerous aspect, was that the promulgation of a QA program initially, or the initial appearance to myself after a couple years of exposure and--was that the NRC requirements were Items 1 through 3, and the next tier of implementation, just to be sure that everything was covered, had ten items, and then the next tier --just to be sure that they covered those ten--had a hundred items, and pretty soon it was a question of not being able to maneuver within the framework that was imposed.

But no, I think that one would optimistically hope that reason holds out down the road. It's recognized and within the last year or so it's been acknowledged that the QA program derived from a power plant construction and siting mentality, if you would, and did not really reflect the type of work that has to go on in site characterization, and I think that with that acknowledgement, that that's a sign of progress that we can work within the program and, if need be, changes can be made. I'm somewhat optimistic, but I don't see anything that'll stop us; not at this stage.

MR. WILDER: Bill, could I interject a comment?

I think part of the problem we have that this is trying to address is the involvement of the technical staff in the production of those procedures. I remember when I worked for Carolina Power & Light Company, as the principal engineer of the siting committee, it was my responsibility to write the QA documents, the procedures, and so I and my staff wrote those procedures, with consultation with the QA people within the organization.

At Livermore, the QA staff, with the support of a contract engineer, wrote the procedures that we would be implementing, and I think that this is trying to correct some of that problem, to get the people that are doing the work involved in the writing of the procedures. Now, it may be that there are some things that have to be negotiated with NRC and others, but I think to a large extent, much of the problem is kind of self-inflicted in that we have written procedures kind of in a vacuum of the users.

MR. COLANDREA: Tom Colandrea from Edison Electric Institute.

I'd just like to take you back to the point of November of last year, when the point was made very clearly by the NRC and others that there is sufficient latitude in the existing requirements, as reflected by Appendix B, 10 CFR 50, the NRC review plan, and the new regs for DOE--and I think Don Horton concurred with this--for DOE to work within the existing requirements. There is that latitude.

I think Dale put his finger on it. The problems that have been seen through these workshops, and voiced by the

scientists before that point in time, are largely of their own doing. They tended to take the existing requirements and make them more onerous than the original intent. So, just to summarize, then, there is sufficient latitude--at least the way most people see it--to work within existing requirements. That's not to say that if something came out of the quality integration group or future workshops, that when all is said and done, reflected a requirement that needed to be adjusted, that it could not be adjusted. Indeed, I think the NRC and others would listen to a case in that regard.

Thank you.

DR. CARTER: Let me make a comment, though. I think you've got to be very careful here. It's still a judgment thing and, you know, this normally has been the NRC course of action when things come up when they've tried to use--or have, indeed, used--requirements for other parts of the program that they've had experience with. They have quite characteristically said, "Well, there's lots of flexibility here and you can apply it to other things." So I think you've got to be a little bit careful in following that, or whether, indeed, these folks can, to a big extent, influence their own futures and that would be, for example, to make modifications in those 18 criteria present if it seems warranted or justified by the program on which you're embarked.

MR. SHEPHARD: If I could add something relative to the software QA process, in fact, the primary recommendation--as we'll discuss here in a few minutes--that has come out of the second workshop on software QA is, in fact, that a small group of individuals will get together and define the optimal requirements for software quality assurance, to withstand what we believe are the rigors of the licensing process, and that is going to be a key objective that will probably take place over the course of the next six to eight months, perhaps even longer, and it will also involve, as you'll hear, interactions with the utilities, with the Nuclear Regulatory Commission, and other areas as well.

MR. STEINKAMPF: All right. What we have, to run down it again, is that this project level group will interact both to a lower level, and also at OCRWM and headquarters level, conceivably, as is appropriate on an ad hoc basis. It's the meeting of the minds. It will also provide the means for this forum that we addressed, kind of a non-discrete entity, but a means of information transfer and communication, and this will be through the--or implemented in the course of the regular meetings of the project level group.

The DOE/NRC technical interactions, this is desirable, you know, just for clarification sometimes on a participant level with regard to upper tier documents or technical comments from the NRC. It was felt that we did not have the access to the NRC that was desirable. A statement

was made during the course of the workshop that there is no project prohibition regarding communication with the NRC. There was a memo at some time that perhaps was indicative of a different aspect. The schedule interactions will be, I think, more readily identified now and more meaningfully used by the participants.

Another thing that we indicated here was the appeals process on the first slide. This derives from the inflexibility complaint, the investigator perception that requirements didn't allow discussion or modification. Here's what it is, and you're stuck with it. Well, it appears that we learned that the means to modify do exist, but they weren't very well known, and so these will be identified and clarified as appropriate so that we can have an inter-understanding between the three aspects; management, quality assurance, and technical as to how and where to work within the program, how to modify, how to add, both on project levels and, conceivably, at the OCRWM level.

And what this is all getting down to is an enhancement of the extant quality assurance program. No one wants to go out and say, "Let's scrap the whole thing and we'll write our own," which would be an incredibly onerous task. The program is certainly viable and it's certainly useful, and we recognize that it's, what would you say, a necessary unpleasantness, perhaps, but it's the order of things. It's the framework within which we work, and everyone recognizes that the nature of the project is such that--in French, it's a "tiny papier," the paper trail has to be.

Participant consensus was that we can contribute to an enhancement of the existing program, and we felt that the technical staff efforts, both on the local and project levels, would be to identify the QA controls in technical investigations through a review of the current QA program; as appropriate, get in and look at what's really going to impact you, and come up with some sort of an assessment as to how serious the impact is, and begin to factor that more realistically into your planning.

We need to identify the traditional R&D quality controls that are a part of the way we work. Everyone's QA is not the same. That's immediately recognized. Some people take better notes than others, and some people write it all down when they get home; some people. We won't name names there. But to incorporate the already existing manner in which we regulate or control the goodness of our products seemed to us quite reasonable, to the extent that it's possible.

Now, there's no way to go in and just insert everyone's procedure. There has to be some uniformity, but to introduce the concept of using information that's already established, and procedures, essentially, that are already

established--which perhaps would have to be more formalized--seemed to us a realistic and attractive aspect, and this will come from participant and investigative inputs.

We also need to develop an understanding of the licensing requirements, which would greatly enhance--I think most of us agreed that it would greatly enhance our ability to work within the program so that we can see, because you all know very well that technical people like to have a reason for the things they do, even if the reason is onerous, then there's a better understanding of why we're doing things.

Again, the input, in addition to the participants and the project level, we also have to have input from OCRWM and NRC, and the communication between the NRC and the project participants is a means to establish that.

The final thing that we saw with regard to technical staff efforts was to maximize the utilization of quality grading. There seems to be quite a bit of potential there to save us a lot of grief. If we can cut out some things early on, we can save quite a bit of time and money, and dissatisfaction. So there's a large potential benefit there.

And what we see, then, as the product of this is recommendations or recommended revisions or additions to the program which would incorporate the maximum utilization of the scientific method and established practices in the program. But none of this happens, none of this can happen without QA and management review and approval and support, and so, ultimately, we get to the point where the ball is back in Don and Carl's court.

One thing I'd add at the end here is that--and I'm not sure if everybody has really thought too much about it yet--is the amount of time that's going to be taken away from the technical work in coming up with this enhanced program. Carl has acknowledged that this is very important and he supports it wholeheartedly, and that's welcome words for everybody who is involved in the workshop process, but we've still got to see the buy-in, and when that comes, then we have even greater coinage.

Thank you. Les will now give you the software show.

MR. SHEPHARD: I think I would be remiss if I didn't, at least in part, offer a few comments of my own relative to Mr. Carter's comment or question earlier about the most onerous problem, and I agree with what my colleagues have said. They've identified a number of specific things that are important; the lack of flexibility, rigidity of the program, limited understanding of the requirements, a lack of emphasis on standard scientific and engineering practice as part of the quality assurance program.

But I also would like to emphasize the fact that six or seven months was the first time in the five years that I've been involved in the program that the quality assurance staff

has come to me as an individual, as a technical staff member, and said, "I want your help. I want to see how you can help us improve our program," and so that's something--we can dwell on a lot of the problems, but I think, also, we need to emphasize the fact that we are working together, and I think the software QA workshop, and I think the QA enhancement workshop are examples of how that is working. We certainly don't intend to have all the answers, but I think we're moving in the right direction.

During the course of the quality assurance enhancement workshop, a number of issues specifically related to software quality assurance were identified by the participants, and as a direct result of that, the Department of Energy decided to have a second workshop to address specifically the software quality assurance program, and I'm representing the software quality assurance workshop team here today and I'm going to attempt to summarize the results and recommendations of this group.

The workshop actually was convened in two separate sessions; January 22nd and 23rd, February 4th through the 7th in Las Vegas. Participants included scientists and engineers who are responsible for developing and implementing software as part of their routine daily basis; quality assurance staff responsible for the overall quality assurance program, as well as for specific elements including software QA aspects; administrators responsible for the development and maintenance of databases, as well as information management systems; and then managers whose responsibilities really transcend the activities of these other groups.

Each of the project participants were represented at the workshop, as Larry indicated, as were representatives from the Yucca Mountain Project Site Characterization Office. In addition--again, to reiterate what Larry has said--a number of very significant contributions were made at this workshop by the observers, EG&G, but in particular, by the Nuclear Regulatory Commission participants, and Tom from Edison Electric Institute. They brought to the workshop a very interesting and different perspective on what the requirements for software are, and what is needed for supporting the licensing process.

The charter of the workshop was to identify specific issues associated with the software QA program, and to develop recommendations for improving this program.

The process that was implemented is very similar to that that Joe Schelling discussed for the overall enhancement workshop. It was a facilitated meeting. It was well organized and orchestrated by the facilitators from MacTec. It emphasized group consensus building, which was particularly effective toward the end of the workshop when the group, in general, were developing the action plans to implement the

recommendations from the workshop itself; and also implemented a formal problem solving process, which consisted of a series of steps, but always emphasized a positive approach, open communication, constructive discussion, and results.

The first two days of the workshop, January 22nd and 23rd, the emphasis was on firstly identifying the issues, concerns, and problems with the existing quality assurance program, and defining a concise statement as to what this problem is, and then defining a statement of the goals for an ideal or optimal software quality assurance program.

The results of these efforts are summarized here, firstly, as a problem statement, which best can be paraphrased by: What are the requirements? Why are they needed? To whom do these requirements apply, and when must the requirements be applied?

The goal for the overall workshop itself and for a future software QA program, an optimal program, is, in fact, to identify a common set of precisely defined software QA requirements that will produce deliverables to withstand the rigors of licensing, and that are also acceptable to the users by allowing flexibility and avoiding unnecessary controls; I think very important elements not only to software QA, but the other aspects of the QA program.

The second session between February 4th through the 7th actually emphasized the--or initiated the problem solving process, where we addressed each of these issues and generated an action plan with a series of recommendations to resolve each of these issues. As a result of this formalized problem solving process, 82 issues were identified by the workshop participants; 74 during the workshop itself, and eight had been identified in the QA enhancement workshop that particularly pertain to the software quality assurance program as it currently exists.

As a result of implementing the problem solving process, three problem statements were identified, which explicitly address 69 of these 82 issues, and then 13 of the remaining issues are either implicitly addressed through these three problem statements, or, and will be, in fact, tracked as part of the follow-on action from the workshop itself. A fourth problem statement was identified and adopted by the workshop participants during the second workshop as being reflective of the type of environment in which we would hope to be able to improve not only the software area, but also the other areas and aspects of the software QA program. It was adopted as a credo by the workshop participants.

Essentially, it's to establish an interactive and dynamic process among the various participants, with specific emphasis on understanding requirements and understanding the needs of the participants themselves, understanding the need for the requirements and how the needs may vary depending on

the responsibilities of the participants, and then, finally, an understanding and emphasis on the end use of the software and its intended application.

And then, coming back to a point that was made earlier, once we develop an optimal software QA program, let the program have a chance to work. Let it mature. Gradually make changes to improve it.

The three problem statements as they were defined, essentially, were also the focus for three subgroups within the workshop itself. The first problem statement: "The current requirements are ambiguous, lack a basis for need, and are poorly understood." Secondly, "The software QA requirements must include a classification scheme based on the nature, importance, and intended application, and must be commensurate with the impact on quality," and then, thirdly, "Requirements focus on documentation of all phases and cycles of software development, not on the testing and validation. Emphasis is needed on the quality of the software required, not on the paper trail."

As an indication of the success of the group consensus building process, the three groups worked together and actually came up with a major recommendation which, again, incorporated the vast majority of the points contained within these three problem statements. This recommendation is to establish a standing software advisory group to identify the optimum software QA requirements for licensing. This advisory group will employ a rigorous and deliberate process, which will include examining current regulations, DOE orders, et cetera; consulting with outside experts, including the Nuclear Regulatory Commission, utilities, and other organizations and agencies; and will also emphasize accepted scientific practices to develop the optimum software QA requirements.

In addition, this group will standardize definitions and software classification systems, use software classification systems to provide flexibility in the application of controls imposed on software, and then, finally, in the long term this group will continue to provide clarification and interpretation of requirements, resolve software issues, and continue to stimulate improvement in the overall software QA plan as we proceed toward licensing.

DR. CARTER: Let me ask you a question.

MR. SHEPHARD: Yes, sir.

DR. CARTER: Of course, a number of the problems that you've raised in this area are rather fundamental or primordial, if you will.

MR. SHEPHARD: Yes, sir.

DR. CARTER: What sort of schedule do you have for resolution of these?

MR. SHEPHARD: In terms of some of these issues, we're probably looking--as I indicated earlier--on the order of, I'm

going to say six to eight to ten months. The software advisory group itself, as we'll see in a minute, actually will meet for the first time tomorrow, and it's at that point--they have a draft charter--which has been reviewed and revised--that they'll use to essentially lay out a schedule for what their overall objectives are.

We have a number of short-term recommendations which are either in the process of being implemented, or, in fact, have been completed, which we feel will have a very immediate and positive impact on the quality assurance program, such as actually reinterpretation or clarification of the requirements in the Quality Assurance Requirements Document, Section 19, to allow us flexibility in the manner in which we implement, say, the life cycle phase process for software, which includes such things as identifying the requirements and preparing a requirements document, completing a design and a design document, then actually doing the coding, going through a test and debug process and a qualification and certification process before one can actually use the software in a quality-related environment.

And one of the things that we're advocating is to allow us to go through each of those steps, but rather than go through that process in sequence, what we hope to do is be able to go through that in an iterative mode, so at the end, the documentation is in place at the same time the code can be applied to a specific problem. That's one example, for instance.

DR. WILLIAMS: Can I ask you a question?

MR. SHEPHARD: Yes, sir.

DR. WILLIAMS: I'm trying to clear up a problem I tried to address yesterday. On your problem statement slides--the previous one--and also in one of your previous ones, you said a number of the 13 remaining concerns were implicitly covered during the process of addressing the three major problems. On that slide, you've got, "Requirements focus on documentation," this is the third problem, "--of all phases/cycles of software development, not on testing/validation."

What do you mean by that?

MR. SHEPHARD: Essentially, the problem statement is driving at a view that, I think, the program as it currently exists is based on a compliance-based process, if you will, as opposed to a performance-based process. And we have a lot of documentation to support specifically what we have done, but what we really need to do is, is the software truly adequate to address the problem for which it's intended. So we have requirements, and the system is currently set up--from my view, anyway--to assure compliance with specific requirements as opposed to, really, is the software process effective, and will the software we've selected to address the problem do the job?

DR. WILLIAMS: Are you suggesting that QA can accomplish validation? I mean, guarantee the validity in a QA validation?

MR. SHEPHARD: No, sir, absolutely not. In fact, one of the things that may very likely come out of the software advisory group interactions is the fact that they may take certain types of validation for basic processes and mechanisms, say, that govern the unsaturated zone, and move that over into another element where they will impose the experimental controls that are necessary, as opposed to leave them in an area like this. So validation, in my view, applies differently, depending on whether you're designing the head frame for an exploratory shaft, or if you're actually trying to construct a model to look at the variability in the unsaturated zone processes.

DR. WILLIAMS: I think your group has already done that, hasn't it; separated them out? Your group has already separated them out, hasn't it?

MR. SHEPHARD: No. They haven't separated them out as of yet, no.

DR. WILLIAMS: That's what my trip report notes say. That's what I was told when I was down there.

MR. HAYES: Dr. Williams, Larry Hayes with the USGS.

If I might add something to that, one of the driving forces for this third problem statement is that we have some equipment that we use some rather complex software programs to run that equipment; a mass spectrometer. We'll run a validation of the sample. We'll see--we'll calibrate the equipment. We'll run our unknowns, then we'll go back and run another known.

One of the problems is, the software program requires the same level of documentation for those driving programs as they do for some of the performance assessment models that Les might use, and what we're saying, that's emphasizing QA software in the wrong way. These programs that simply drive equipment, we have other ways of checking that that equipment is working, and let's not apply the full rigor of the QA software to those types of programs.

DR. WILLIAMS: Thank you.

MR. SHEPHARD: I need to come back, though, to address your point. In terms of how we separated this out, within Section 19 of the QARD and within the Sandia quality assurance program plan, in fact, there is a section that talks about validation and verification of software.

What I think you were probably told at Sandia--and, again, not being present, it's difficult to make many assumptions--is that we have an experimental program as well, which is directed at validating various types of models for the unsaturated zone itself. The validation experimental program is, in fact, controlled by--I believe it's Section--

well, it'd be Section 20 of the QARD right now in terms of scientific investigation controls. So the testing program itself would be controlled under Element 20. I don't know if that clarifies it.

A couple of the shorter term recommendations that came out of this, which we already alluded to, in fact, address specific aspects of these three problem statements. Firstly, is to evaluate Section 19 of the QARD to clarify requirements and identify specific concerns for resolution, which can then be incorporated into the software quality assurance plans and procedures that are needed to implement QA at each of the participant locations, and have an immediate positive impact on these programs.

And then, secondly, as part of this effort to assist the software advisory group in making some decisions we have initiated, in fact, are well along in the collection of a reference information base containing things like software QA plan, DOE orders, industry standards, et cetera, that they can use to define the optimum software QA requirements.

Two related issues which are actually incorporated into other activities being conducted by the program, but which were discussed and identified as part of the software QA workshop: Firstly, as part of these licensing workshops that are currently being planned, we would like to ensure that the requirements that we have imposed on the software QA efforts are, in fact, viewed during the process of these workshops to see if they are both necessary and adequate; and then, secondly, as part of the ongoing evaluation for the quality assurance grading process which will be discussed this afternoon, again, we want to ensure that the quality assurance grading controls are specific to the intended application and use of the software itself.

As I indicated, a number of things have been completed or are underway relative to the recommendations. Firstly, we have formally requested that the software is considered as an integral part of these licensing workshops when and if they do occur.

Secondly, a draft charter, as I indicated, has been completed, reviewed by the various participants and, in fact, the software advisory group is scheduled to meet tomorrow in Las Vegas.

Fourthly, we have completed or are very close to completing a compilation of reference information, with the exception of some of the industry standards, which will be used to support this group.

Fifthly, the grading process, the participants at the grading process workshop scheduled for next week will include many, or at least some of the participants that were involved in the software workshop, who will bring to light some of the issues that we discussed at this workshop relative

to controls on software.

And then, finally, some of the participants have, in fact, evaluated either the software QA plans or are implementing procedures, have submitted these to the project office, and there is a meeting scheduled for April the 4th to go through these proposed recommendations and to see if, in fact, between--see if, in fact, the participants and the project office quality assurance organization can reach agreement and implement these proposed changes and clarifications.

So, in summary, a synergistic environment evolved throughout the course of the workshop collectively between quality assurance staff, managers, scientists and engineers, which resulted in, collectively, an improved--or should result in an improved software QA program. There's a focus on short-term improvements which can be immediately implemented in the software QA plans and procedures, and the software advisory group--as I mentioned--will meet tomorrow to begin to identify and define these optimum requirements.

This entire process is intended to remain interactive, with all participants actively involved, and hopefully, we will implement, then, a software program that meets the requirements--the regulatory requirements, the technical requirements--and results in a software QA program that is more effective to use than it is to avoid.

In conclusion, what I've tried to do is convey a sense of importance, a sense of commitment, and perhaps a sense of enthusiasm that many of the people at this workshop had to improve the software QA program.

But as has been discussed here by Bill and Dale and others, this requires a significant commitment, and our work has really just begun. We've done the easy part, and we've got a long way to go. It requires a significant commitment on the part of the technical staff to stay involved and to maintain their enthusiasm at, perhaps, the risk of, in fact, decreased or diminished technical work. It requires this commitment on the part of the technical project officers--like Larry, Tom Blejwas, and others--to ensure that the individuals involved in improving this program or the overall QA program are rewarded and recognized for their contributions.

In addition, it requires a commitment on the part of Carl and Max and Mr. Bartlett to ensure that in times of increasing pressures to generate tangible products, and in times of decreasing budget, this remains a high priority among the list of other myriad of high priorities, and with that, I'll be happy to address any questions.

DR. CANTLON: You suggested that you're maybe ten months away from fruition of the process?

MR. SHEPHARD: Well, and that really is just a wag, because the software advisory group will meet tomorrow. It's

not clear exactly how long it's going to take them to get organized, but certainly, they're going to start by looking at the existing information and see how it can be directly applied to the Yucca Mountain program.

DR. CANTLON: What would be a ball park guesstimate of the person-years that have gone into this activity at this time? Are we looking at 10 per cent of the effort of the software group, or 20 per cent, or 80 per cent? What would you guess?

MR. SHEPHARD: I'm sorry, I don't think I understood your question.

DR. CANTLON: Well, this process of trying to move toward a more acceptable QA system for software. That was a major hole in the initial deployed system. That doesn't come cheap.

MR. SHEPHARD: Absolutely.

DR. CANTLON: Because you've got to change the tire when the vehicle is running, so what would you guess the drain has been on the technical output of the group; 10 per cent of the effort, 20 per cent, 40 per cent of the effort? Do you have any feeling for it at all?

MR. SHEPHARD: Boy, it would be hard for me to draw an estimate.

DR. CANTLON: Yeah. You may be working too far down in the system to get a feeling, and maybe I need to address the question to Don or to Larry.

MR. HAYES: Larry Hayes, USGS.

I think this is one of our more difficult problems to wrestle with, all right? And I think just resolving the QA software issue perhaps will take as much time as resolving many of the issues together that you've seen on Workshop I. I think, frankly, we're looking somewhere--if you want to look at the total technical involvement and the impact to the people either being taken away from their work, or perhaps having to redo some of their work or not do some of their work effectively, I think we're looking at somewhere an impact of maybe 5 per cent to 10 per cent on the technical program to get the software.

DR. CANTLON: That's pretty modest.

MR. HAYES: That's not bad when you look at the results and you look at what we don't get if we don't do it, and I think one reason it's that low is we're trying to put together a group of people who are very dedicated to solve this problem, and they'll try to minimize impact on others, and that group--I want to say--includes QA as well as the technical staff. They're all working together to try to resolve this.

DR. CANTLON: Dale, I saw you shake your head.

MR. WILDER: I guess I'm shaking my head knowing what's happening with a couple of major codes that we have. The EQ 3/6 Code, the geochemistry code, I think we've spent at least

10 per cent in the past, and probably much more than that worrying about how we're going to handle it, and not having been able to handle the QA software.

The TOUGH Code I see as a major commitment. Matter of fact, I've tried to assign a person full-time to shop for a QA for the TOUGH Code, and then realized I'd probably lose her if I did that and so backed off on that. But I see it as probably a minimum 10 per cent of our time to try to do the software QA.

One of the big concerns is that that comes at a time when the budgets are decreasing in those very areas, and I'm not sure we're going to get there on EQ 3/6. We may lose that Code and its support people just because of budgets. I think we can do it in the TOUGH Code.

MR. SHEPHARD: I think to perhaps embellish a little bit what Dale said, I know at Sandia our estimates are, for codes comparable to TOUGH, we're probably looking at six months of an individual's time within the existing software QA program to bring it to a stage where we can actually apply it in a quality-related analysis. That gives you an idea.

DR. CANTLON: Other Panel members' questions?

MR. COLANDREA: Tom Colandrea from Edison Electric Institute.

Just a bit of a footnote on this question, John, that you asked. Whereas it may take some effort to address the problem, it's a good investment, and, indeed, to take that time and effort now will save considerable effort in the future. Case in point: If we're doing dumb things now, case in point, such as validating and verifying conceptual designs that will never see the light of day in the licensing process, if we're spending effort on things like that now, why not take some of that effort and work harder and smarter so that you don't have to do things like that in the future?

And I think that's the thrust of the software QA workshop. It's to get you to where you're working in a more effective manner than you were before.

MR. HAYES: And perhaps the difference between my response and Dale's would indicate why you really need to talk to some of the scientists, because management tends to expect that they will do this as well as all their other work, too. So the impact is not that great--and somehow, they do manage to do the other work, too.

DR. CANTLON: We have been around and have talked to a number of them, and we get much bigger numbers than that.

MR. WILDER: I think there is another point that I should have made, and that is, in both the codes I talked about, a major part of the development of those codes took place outside of the Yucca Mountain Project, and so we have a dual problem not only of trying to do the QA on the codes, but to recognize the significant contributions that can be made to

this project.

It's a real problem how to be able to continue to provide tremendous progress on these codes through funding outside of the Yucca Mountain Project, and still do the QA on the codes. And it gets back into the issue that Les raised of validation for use on Yucca Mountain. Much of the thermal dynamic database that we're developing for EQ 3/6 does not come from Yucca Mountain, and a lot of the concepts that went into the TOUGH Code were not developed uniquely for Yucca Mountain.

And so we not only have to have, maybe, a effort to do the QA for Yucca Mountain, but we've got to have an additional effort to how do we then capture that work that not only has already been developed, but is continuing to be developed on these codes outside of the Yucca Mountain Project itself.

DR. CANTLON: Let me address this question to Don. We've focused in our--this Board certainly is supposed to focus on the Yucca Mountain portion from OCRWM. Do you see the QA advances that you're clearly making here permeating beyond that into DOE?

MR. HORTON: When you say permeating beyond--

DR. CANTLON: Beyond your own line of oversight from OCRWM. Is it going into other divisions of the Department of Energy?

MR. HORTON: I think that we see some of the permeation already occurring in other groups of DOE. For example, the Nevada Operations Office on the test site have recently applied NQA-1 to all of their activities. Now, what I think they've done is over-committed in making NQA-1 applicable to everything, but that's an example of them taking NQA-1 and utilizing it for their activities.

We also are seeing the environmental waste management group at headquarters, due to our requirements on the waste glass producers, taking NQA-1 and our program and implementing those requirements at Savannah River and West Valley, New York, and in Richland. So there are some indications that this will permeate DOE.

DR. CANTLON: As an old manager that learned long ago to claim all credit and deny all blame, I think that one of the points that you can make is that you, because of what you've been doing here, have made an investment that's going to pay off, really, across DOE, and in a budgeting operation, I guess I would make a pitch for cost-sharing.

DR. CARTER: John, let me raise one question.

I think we, before we even had a quality assurance panel on the Board, we asked the question about the amount of resources that was going into quality assurance within the program, and that was, I guess, some two years ago or a little more. And we've had, of course, not only DOE responses from

various individuals, but certainly, from a number of the national labs, the contractors, and so forth.

I guess the thing that I've gleaned from this, of course, is sort of two things. One, I gather there's not a formal system to document the amount of resources that's going into the program, because certainly, we've heard a wide variety of answers. I think the first answer was on the order of 35 to 50 per cent. Now, those may not be exact numbers, but that was from one of the national labs. And at this meeting now, we've heard, for a program that's under active development and is really not in place, so I presume the costs for that are relatively high. So it's a program that's in the shakedown, and I'll use the software as an example of this.

The numbers we hear, of course, are quite low; 5 to 10 per cent. Don Horton even mentioned yesterday 11 per cent. Now, I don't think you can hone it that well, Don, from the numbers that I've gotten from everybody. Next thing you know, we'll be having it to three significant figures.

The question I've got, though, is there any program within the DOE to put a finger on the amount of resources that's going into the QA program? This is obviously a very important part of your programmatic efforts, and the question is, do you intend to gather reasonable data on that, rather than just, you know, sort of everyone's opinion of what may be doing on.

MR. HORTON: Mel, I'd like to say that, you know, QA costs are very difficult to identify. QA organizational costs, I have no difficulty in monitoring that and tracking it and identifying those costs, but it's hard to put a definite figure on the cost of quality because it's also related, what would it cost you if you didn't have it. You know, a QA program is just good management practice. Well, many of these things should have already been done in the past as good management controls. The specific documentation of those management controls were not always being implemented. That's one of the requirements of the formal regulatory QA program, is the documentation of those controls. That hasn't been done in the past.

DR. CARTER: Yeah, that's really the heart of my question. If you can document everything so well, why can't you document the resources? It looks like there is some incongruity here.

MR. HAYES: If I could, first, I think I may be somewhat confused. I'm not sure what numbers we are using. Are we talking about a percentage of cost of, for instance, the Survey's budget that would go to just the QA software problem? That's one question, and I've given you a number that some might view as low. Or are we talking about how much of the budget goes to the QA global issue?

If I talk about the QA global issue, I have to

separate it into two components. We have a formal QA program that is budgeted to do the QA development, to do surveillances, and so forth. That program is approximately 10 per cent of my budget. But then we have all the QA-related work that the scientists have to do as part of their work. That is not specifically budgeted. It is just rolled up into their project budgets, and depending upon the astuteness of the PI to live with QA, depending upon the type of work those PI's are doing, budgets that go to support to QA from the technical viewpoint can be anywhere, I think, from 10 to 20 per cent.

So you need to, I think, separate the components, and then you start adding up the cost, and QA is not a small cost, but I agree with Don, that cost without good QA is failure, and that's a pretty high cost.

DR. CARTER: Yeah, well, because I think I'd be interested in both those costs, and not only the division that you're talking about, but obviously, you need to break the program down into whether they're really sort of start-up costs, shakedown costs to introduce a new program, or whether they're steady state sorts of things, and I presume you've had experience with both now.

MR. HAYES: Okay. I've got some wrap-up comments, and I'll try to be brief because I know you'd like to try to get out of here at three o'clock. Before I get into my wrap-up comments, though, I did want to personally say what a challenging and enlightening experience it has been to me, as a manager, to work with people like Dale, Bill, Joe, Les, others in these workshops.

As a technical manager, I've learned a lot from these fellows. I thought I knew what some of their concerns were, but I found out I really didn't. In working with them, I think I, as a manager, have learned what some of their concerns are and what we managers can do in the program to help these people get on with their work, which is what they really want to do.

I only want to make a few points on these. You've heard much of this discussed already. The points I want to make: We're doing something. We're taking short-term actions. And the other point I want to make is we, okay. If you look at the organizations, the names, you see this is truly an interactive, dynamic process where people from different walks of life--QA, scientists, engineers, managers--and from different organizations are working to solve the problems, and we are making short-term progress, and that's important because, as some of the other fellows mentioned, we need to show some progress in order for the scientists and engineers out there to, frankly, continue to put up with the many difficulties, and keep their morale up and stay with the program. Again, all I'm saying here, now here are some long-

term actions, but again, people, different people, different organizations are working together to come up with some long-term solutions, and I'll talk later today about the technical QA management group and what it's going to do in this process.

Again, just an example of the same thing. This is Workshop II, the quality software problem; a lot of different people from different organizations working together, and we may have said it, we may not have said it, but the QA people themselves are really contributing to this process. They are part of the solution here. I think one thing the workshops did was to bring together the QA people and scientists, to where it's not just QA cops and prima donna scientists off doing their own thing, so that's important.

I will just skip some of the other slides on long-term actions and go into what some outside people--although I don't consider Tom an outside person--thinks about the workshops and what we're doing. These are some thoughts from Tom, and I think Tom, you fully support that people are coming together, they're enthusiastic, they want to solve the problems. It's just not some complaining about QA and how do we get out of it.

DOE's willingness to listen, we want to underscore that. That's been very important to the process. I think the most important thing I see here is the positive, cooperative spirit, and we're working towards this meeting of the minds so QA simply will be another tool we'll have in our tool bag to help us get on and do good work. It won't be a stopper.

Tom, would you like to say anything about these comments from EEI?

MR. COLANDREA: No. They pretty well describe how we feel all along in the process. We fully support the workshops and feel that they're very productive.

MR. HAYES: NRC had some similar comments, and at this point, I did want to really thank John Gilray, who I see sitting silently out there in the audience, for his help in helping the scientists and me, also, get a better feel for what NRC is facing, what are their needs, and they're just not some people out there to derail us. They have some needs that have to be met, too, and I think the comments are similar. You see that NRC feels we're getting somewhere with these workshops.

I want to give some special thanks here at this time, too, to Joe Caldwell, who was sitting out there. There he is back there hiding. Joe, Cathie, Herb, these people were very instrumental in helping us get through our initial little fights with each other and get on with solving the problems. So they deserve a lot of credit, and you don't--unless you knew them and you were there, it's hard to appreciate how well they did help us.

So the summary just sort of points out what I've

said with the EEI, the NRC comments, fully accepted by DOE management. We made a presentation to John Bartlett--similar to what we've given you all--and John was very impressed, felt that he saw something that was clear to him that people were working together to get the show going. So he was very supportive. Don is very supportive, and I know Carl Gertz is.

We're going to continue to focus on improvement. I think, again--and I've been accused sometimes of being out in La-La land here. I'm a little bit, maybe, too positive, but I think the program we have can work. It's simply getting the right people together and finding ways to make it work.

The technical QA advisory groups, I told you I'd talk about that. We have our software advisory group that will meet tomorrow, and I expect some good things from them. The appeals process, the two groups above are an appeals process. These people can, as Bill Steinkampf said, go through their groups and bring to management, to DOE problems that they feel are getting in the way that they haven't been able to get addressed through their regular management.

I think that's necessary. You might say, "Well, why can't they just go to their TPO?" Well, sometimes they do, and maybe we don't listen because we either don't agree or we don't understand their position. So they need another avenue to be sure they are heard.

Interactive with all participants. We're working together. That's the key. We're going to make it work. Joe and others have talked about this; requirements, action. We need action from the scientists. We need action from the QA staff, from management, and we need action from our regulators and others to help us come together, understand the problems, and move on.

Essentially, Les talked about this. That's our credo now for the project on QA. We're going to interact with each other. We're going to make changes, Don, as you said, where changes are necessary, but hopefully, we're going to make profitable changes and they'll mean something. And we're going to work on understanding and need. Why are we doing this? The end use. Then we're going to get on with the program and make it work, so that's how we're going to operate these committees.

Just a little humor. That's where we're at. The blue is scientists; red is QA--no pun there why red might be better for QA, but--and the green is management. We're going to work together. We're talking, and obviously, you know, not everybody's in agreement still. You see a little fellow out there and nobody's listening to him and he maybe has something to say, but we're getting there.

And I'll close this with some wisdom from Don here. We're not thoroughly convinced you're as nice a guy as you tell us, Don.

Conforming behavior. There is more than one way to do something, and that's what we're finding out. The scientists have a lot of good ideas. The QA folks have good ideas. We don't have to do things maybe the way it's been done in the past. We need to come up with some innovative solutions. So we can force people to conform if that's what we want, but I, as a technical project officer, have learned that conformance isn't always good. Right, Bill?

MR. STEINKAMPF: That's accurate.

MR. HAYES: And to me, this is a key; understanding. You've heard me harp on this all morning; understanding. People need to know why they're being asked to do things. You heard that from some of the scientists here, and they may not like it, but if they understand, they'll find a way to make it work, and understanding has not always been there, so we have to have some understanding. Then we'll get on.

Don?

MR. HORTON: Very brief wrap-up. I'm going to skip over most of my wrap-up slides because you've already heard most of it.

But you're aware of what we've completed to date as far as the workshops. In addition to what has been completed, we have the QA grading workshop is scheduled to be held on April 2nd and 3rd. During that workshop, we're going to review the QA grading process and try to enhance that overall process, and we hope to have all the participants understanding QA grading at all levels.

The other two problems that I started out, that was identified to you from our Denver meeting, was the data issue. A little update on that. We've completed surveys at USGS, Livermore, Sandia, and Los Alamos. The information is currently being evaluated for the necessity of having a workshop on that. And in the communications area, that's under evaluation at this time.

There's been a significant amount of work that's been completed on these problems. There were presentations made to both Carl and Max and myself on the recommendations. We agreed to these recommendations and committed to providing the resources necessary to address these problems, and then there was a presentation made to John Bartlett after we'd agreed to it, and I'll just relay some of the comments from John that he passed along to me.

He said that it was one of the most gratifying meetings that he has sat in in many, many years working in the nuclear power industry; that he hadn't sat in a meeting where there was a common understanding and agreement between the scientific, the management, and the QA organizations, with a cooperative effort of trying to identify and resolve the problems, and he was very impressed and he told me that whatever it takes as far as resource commitment to resolve

these issues, that he would be fully supportive of whatever's required, and with that, I think that we have full management support within DOE, and whatever's necessary to resolve these issues, he'll back us.

So with that, unless you have any questions, that concludes our morning session.

DR. CANTLON: Thank you very much, Don.

Any burning questions before lunch?

(No audible response.)

DR. CANTLON: All right. We'll reconvene. We're running a little late; quite a little late.

MR. HORTON: We did that so you wouldn't have any questions.

DR. CANTLON: Right. Let's convene about five minutes late. That'll give us 30 minutes for lunch.

(Whereupon, a lunch recess was taken.)

AFTERNOON SESSION

DR. CANTLON: All right. We're reconvening the Panel on Quality Assurance, and our first speaker will be Ram Murthy, who's going to talk to us about the grading process in quality assurance.

MR. MURTHY: Good afternoon. My name is Ram Murthy. I'm with the Department of Energy. For the next couple of minutes I'm going to talk about a very important quality assurance process called grading. I'm sure you heard about this yesterday quite a number of times, people talking about the grading packages and things of that nature.

Basically, I'm going to address: What is grading? Why is it done in Yucca Mountain Project? How is it done? And who does it? And I'm only going to talk about what we are doing currently, what is being done currently.

What is grading? Simply said, grading means identify the activity you're doing, the scope of activity you're performing, and what QA controls you need to apply to perform that particular activity, and you do this up front.

Why is it done? All right, this may be a time when we want to look at some of the requirements and the regulatory flow process that requires this grading process. You all know that Congress has mandated that DOE perform this investigation, build a repository, maintain, operate, and

decommission it under a licensing process. As far as I know, this is the first time a major, major federal government activity has come under licensing process, okay. That means DOE becomes an applicant and they have to comply with Nuclear Regulatory Commission's requirements.

Now, NRC has come up with their requirements through 10 CFR 60. One of the requirements of 10 CFR 60 is that DOE must perform all the activities under a regulatory QA program. That is explained in 10 CFR 60, sub-part (d).

Now, what are we going to apply QA program to? Okay. So NRC went ahead and gave us a guidance to NUREG 1318, that tells you on what to apply QA program and how to apply QA program. If I had to summarize NUREG 1318 in two sentences, it says: Identify the items important to safety. When I say items, I mean items, structures, systems, components that are important to safety, waste isolation, and the activities that affect natural barriers, and also, other 10 CFR 60 requirements, such as radiological safety, security systems, fire systems, things of that nature, and apply QA program to it.

Now we know what to apply QA program, but how are we going to do it? The project office; that is, Yucca Mountain Project Office, has come up with two procedures to implement this 1318 guidance. One procedure is AP-6.17Q. This is a extremely important procedure. This is the procedure that tells you how to identify items and activities that are important to safety and waste isolation. And the second procedure is AP-5.28Q. This is the procedure that deals with the grading; tells you how to do grading.

Okay. What is Q-List? What is a Q item? Q-List is simply a tabulation, a list that shows you what are the items that are important to safety and waste isolation that you should put QA program on. In the repository program, we have two kinds of items. This is where we differ from regular nuclear power plant. One is pre-closure items that could result in a dose of .5 rem. This is the important thing. If that item, structure, system, component fails, it is going to affect public radiological safety.

The other thing is the waste isolation part of it. Once you decommission this repository, it is going to sit there for the next thousands of years. You have to reassure the public that the repository is going to perform satisfactorily, and that the natural barriers and the engineered barriers will work satisfactorily. So those are post-closure items.

Since you have been seeing too many of black and white view graphs since yesterday, I thought I would show you some colored view graphs. This is an example of a waste package that is definitely an item that is important to safety and waste isolation, and here is another example of a

transportation cask that if we don't do a good job of building it, that could cause public radiological safety.

You have seen what are the items that are important to safety and waste isolation. Let us talk a little bit about quality activities. This is a new twister. Okay, industry is not used to the word, quality activities. They have a different meaning in industry for quality activities; whereas, in repository program, quality activities means those activities that may affect the waste isolation capability of a natural barrier. That is the catch, okay? It will affect the natural barriers.

When do we do these things that will affect the natural barriers? Typically, during site characterization, and when we develop our performance assessment models, we are telling public, "Hey, our repository is going to be held this way for the next 10,000 years. The natural barriers are going to hold up. The engineered barrier is going to perform." See, those are quality activities.

NRC is concerned about public safety. They have to grant the license to DOE. They said, "You guys should implement a QA program so that it can defend the work you have performed." This is where you differ from a regular mining activity. Yesterday, who was it, Dick Bullock was saying, "Hey, we have drilled so many mines. We did so many significant projects. We never had to go through these requirements." This is exactly the reason why you have to go through these requirements, and to date, of all the nuclear powerplants that were built in the world, the best are in this country.

Now, I don't know if you read an article--I happened to read an article in one of the--one of my travels in the plane. It's called Energy News, something like that. I forgot the title. It compared the reactors from France, the reactors from Russia, and the reactors from the United States. The kind of things we have in our reactors, the core characters and some of the emergency systems that are built into it, you won't find them in French or in Russian reactors. And that is the reason why, in spite of all the oppositions, the cleanest, safest energy so far we have in this country is nuclear energy.

Somebody has to speak for nuclear energy. I thought I should say that.

DR. ALLEN: You did.

MR. MURTHY: Okay. I just wanted to show you what the natural barriers are. I'm not going to give a speech on these natural barriers, because Max is the guy that has to do that. You know that the Calico Hills are definitely--Calico Hills formation is definitely important for waste isolation, but until you prove, through site characterization program, through site suitability program, through performance

assessment model that what is the barrier that is really important, that can hold the repository and that you can prove that the radionuclides won't migrate over the next 10,000 years and cause public safety concerns, until then, we are conservatively treating all the natural barriers as being important to waste isolation.

I wanted to show this view graph just to give you some kind of idea what are the activities that typically affect the natural barriers. Now, we are going to--during site characterization, we are going to construct ramps, exploratory facilities, all kinds of drifts, things of this nature. You do them by using the borders, tunnel borders, drill blasts. When you do that, you are going to affect the natural barrier, okay. So NRC's concerned that anything you do to these natural barriers, you should be extremely careful. So these kind of activities are typically called quality activities.

I just wanted to show this view graph here because these are just--these are all conceptual view graphs. How well this repository is going to behave is predicted by performance assessment models. Therefore, it is not only the activities that Larry's group does in terms of getting your water levels at drilling holes and getting samples, doing tests on the natural barriers. Also, the activities that are done with Sandia National Lab in terms of performance assessment, that tells people how this repository is going to behave over the next thousands of years are equally important. So NRC said, "Hey, guys, you've got to implement a good, solid QA program on these activities, so that the model, during the licensing hearings, you can defend yourself."

Okay. We have looked at activities that are important to safety, waste isolation, and quality activities. What is project requirements list? Anything that need not meet the definitions of these three, we put into project requirements list. We have applied a very systematic, foolproof process.

Okay. Now we know what to apply QA program to. Now, how are we going to apply it? How are we going to identify these structures, systems, and components that are important to safety, that are important to waste isolation, that are quality activities, and that are project requirement activities?

Okay. The project office has developed two procedures, has established two groups. One group is assessment team. This team is composed of technical people from T&MSS and other project participants. Okay, their job is to come up with these lists, and this team has been selected and appointed by the deputy program manager and the program manager--that is Max and Carl. This team reports directly to them.

And the other team is quality review board. This board has also been established by the deputy program managers and the project managers. Their function is to independently review, evaluate the lists, and accept the lists. In addition to that, the board also reviews the grading packages and accepts those grading packages.

DR. CANTLON: To whom does the quality review board report?

MR. MURTHY: Project managers; Max and Carl.

DR. CANTLON: The same as the assessment team?

MR. MURTHY: Right.

DR. CHU: So it's not a part of the QA office?

MR. MURTHY: Correct, it's not part, but we have representatives from QA and various other groups. QRB consists of technical people, and also, quality assurance people that have the experience. It is a mix of both so that we can understand what the problems are. In addition to that, the board has several advisors. They're all technical people.

Now, who maintains these lists? Any changes to these Q-Lists is maintained by the assessment team and accepted by the quality review board, and these are--I just wanted to show you these, what it looks like. This is a title page from the actual list. These are controlled documents. They are centrally issued by T&MSS document control center. Any changes made to this document has to go through the review process from the assessment team and the quality review board. Anyone can request a change.

Now we have seen what is grading, why is it done. The next step is, how is it done? As I said earlier, right now, 5.28Q is the one that describes to you how to do the grading process. The TPO or the division director selects the preparer. Typically, the preparer is the principal investigator, and the preparer looks at the scope of his work, looks at his activity, consults the WBS dictionary, makes sure what is the activity, where it falls in the WBS dictionary, goes to the lists, finds out what is the importance--is it a Q-List? Is it a quality activities list? Is it project requirements list? And then prepares the grading report.

The grading report will say: This is my activity. These are the controls I applied to this activity, and these are the controls I don't apply to this activity, and this is the justification. This is the reason why I don't apply any controls to this activity, or these controls do not apply to this activity.

Once that is done, the QAG report--the preparer signs the report, and then forwards it to the appropriate QA manager. If it is a participant grading the report, it goes to the participant QA manager. If it is a project office grading package, it goes to the project office QA manager--in this case, Don Horton--and then the QA manager signs off on

it. When the QA manager signs off on it, the QA manager reviews it for compliance with the procedure, and then the TPO or the division director signs on it, and then it is forwarded to the quality review board.

Now, it is the function of the review board--which contains both the QA experts and the technical experts--to review the grading package, look at the scope of the work, and the controls they have proposed; is it adequate or not? Once the board finds it is acceptable, the board agrees that it is accepted, and then the grading package is again centrally controlled and distributed by T&MSS document control center. Any changes you want to make to the grading package has to go through this review process.

MR. HORTON: Excuse me, Ram. You might want to identify what WBS dictionary is to them. I'm sure they don't know what that is.

MR. MURTHY: The WBS dictionary is our cost account dictionary, where all the activities are spelled out and cost accounts are assigned to that. That gives us a systematic accountability to make sure all the activities are considered.

DR. CANTLON: Before you take that away, when the PI proposes that this is not a quality-affecting activity and then must defend that with particular reasons, what are the constraints on those reasons? Are they stipulated reasons that must be complied with, and how rigid are they?

MR. MURTHY: Well, first of all, the principal investigator looks at the list, and he sees where the item is falling into. If it says at a higher level it is a quality-affecting activity, then he says one step down, as I say, at a higher level, this is a quality-affecting activity. For the following reasons, it is a scoping calculation, or it is a preliminary activity, will not be used in the licensing; or, this is a simply building a toilet outside the boundary area. Then he gives the justification in two sentences. It doesn't take too much.

DR. CANTLON: But those sentences are--they must comply with particular defined reasons?

MR. MURTHY: Yes. They should address why it is not important to safety and waste isolation. That is the catch. If it is not important to safety or waste isolation, then it's not a quality-affecting activity.

DR. CANTLON: That would be a reason?

MR. MURTHY: That would be a reason.

DR. ALLEN: I guess I just don't understand a little bit about the definitions here. Can you give me an example of something that is important to waste isolation, but is not important to safety? I sort of link the two.

MR. MURTHY: Right. The thing is, important to safety is pre-closure; 50 years.

DR. ALLEN: Okay.

MR. MURTHY: Items important to safety is pre-closure.

DR. ALLEN: Oh, okay. That I wasn't clear about. I'm sorry.

MR. MURTHY: And the final question is, who does it?

DR. CHU: Before you take that slide down, now if someone submits a grading report which is a very preliminary, explore-type of inquiry that has to do with site characterization, so the PI says, "This should be exempted from the QAL, but it should be part of the project requirements list."

MR. MURTHY: Yeah.

DR. CHU: And so now it goes through this chain, and your next to the last box, which says: "QA review and acceptance," but instead of acceptance, it's rejection. What happens then?

MR. MURTHY: We don't reject. We accept it. We accept it, but it's not important to safety and waste isolation.

DR. CHU: You mean you--if a PI says, "This should be exempted from the QA process," you always accept it?

MR. MURTHY: If we agree that it should be exempted.

DR. CHU: What if you don't agree, is my question.

MR. MURTHY: Okay. If we don't agree, we'll discuss with the PI. We call him. We talk to him on the phone, sometimes we have a discussion that, hey, many times we see the light, because the board has both technical people on it and also the QA specialists on it. It is not a one-sided board. So we see the light, where we are missing. In several places, actually, it happened the other way around. The PI thought it was important to place so many controls. We came back and told him, this is what we think. Then he saw the light and he agreed.

In several cases the PI's--see, where it is important to safety and waste isolation, it is crystal clear, you know. You don't usually run into problems. If it is a preliminary scoping activity that does not affect the natural barriers, waste isolation, or you don't want to use it in licensing, or you want to submit to some kind of qualification testing before licensing, you take into a licensing document, you are free as a bird not to place the controls there. But many times, especially Sandia, they want to place some controls in a flexible manner. We said fine.

DR. CHU: Yeah, but if you disagree with Sandia, and the person from Sandia does not see the light, is there any avenue open to that person who doesn't see the light?

MR. MURTHY: Yes. There is a boss that calls the shots. The deputy project manager is the one that calls the shots. Very often, they see the light. If you sit with technical people and QA people, there is no reason why you should not, because there are equal technical people sitting on the board. That is the catch.

In other words, if the PI doesn't see the light, he is contradicting his own technical people. He's not

contradicting QA people.

DR. CHU: So there is no formal appeals procedure?

MR. MURTHY: There is a formal appeal process. The formal appeal--

DR. CHU: Can you make an appointment to see an eye doctor? I mean--

MR. MURTHY: Yes. The eye doctor sits right there.

DR. WILLIAMS: I want to get this straight here. So you make sure, with each action that the board takes, that you identify a properly and an appropriately trained technical person, like, say, a hydrogeologist from MacTec or SAIC is on the board that evaluates each proposal?

MR. MURTHY: Yes, especially the lists.

DR. WILLIAMS: So that means the board doesn't always have the same members?

MR. MURTHY: Oh, it has. The board has six members, six voting members, and it has several reviewers assigned to it.

DR. WILLIAMS: So you have--of those six members, you have somebody that covers every type of discipline, training that can exist in the repository?

MR. MURTHY: Right. We change the member constituency. If it is a hydrogeology grading package and it is complicated, and if it needs technical expertise, we put a member from the technical advisory group who has the knowledge in the geohydrology area--

DR. WILLIAMS: So you have a whole library of different people you can draw from for any given board?

MR. MURTHY: Yes.

DR. WILLIAMS: That's what I asked you at first, and you said no. You said they were always the same.

MR. MURTHY: But the membership, the voting membership changes. One member will be replaced with the other member. That's what I meant.

DR. WILLIAMS: Oh, okay.

MR. MURTHY: Okay. Who does it? Everybody in the brotherhood in Yucca Mountain Project does it. We all have to do, including Horton, Larry Hayes, Max prepares several grading packages. We have all the grading packages in place. We hardly had any disputes on the grading packages, but we have to understand, in some places, the board doesn't understand what the scope of the work is. In some cases, the preparer doesn't understand where the board is coming from. That's where we have to have extensive opinions.

Okay, and the important thing is, it is a prerequisite. You cannot start any work unless you have a grading package in place, and as a matter of fact, Max is not going to fund them. They're not going to grant them funds unless you have a grading package that shows how we are going to proceed in this. This saves trouble down the road and gives protection for everybody.

And what are the types of activities we are grading? Right now, we are grading systematically all the activities. It is the grading package that says you don't need no controls, you need some controls, you need full-blown controls. And the grading packages right now are being maintained by document control, T&MSS. This is, once again, a central control and so far we have reviewed about 353 grading packages.

DR. CANTLON: Over what period of time?

MR. MURTHY: The real serious grading process started in September, September through--I would say over six months.

DR. ALLEN: I'm still confused on these categories. Category C is quality activities, which may include activities that may affect waste isolation, but items that are important to waste isolation are already under B.

MR. MURTHY: Activities means--that's where 1318 is kind of tricky. Now, activities, items are of different kinds. Waste package, engineered barrier, natural barrier.

MR. BLANCHARD: Clarence, maybe we can help on some of the confusion. We, from time to time, have a great deal of confusion trying to understand what was in NUREG 1318. I think more or less we've got it cleared up, but if you look at the bottom bullet, the bottom circles, "items important to safety." Now, Ram said that those were pre-closure; in other words, let's get that design base as--

DR. ALLEN: Well, shouldn't that be added to that to make it clearer?

MR. BLANCHARD: But this is the terminology of 1318, okay? Items important to safety are those things that go into building that waste handling facility, that if it collapsed during an earthquake, you'd have a release of radionuclides to the workers or the people.

DR. ALLEN: Okay. It's certainly not clear, unless you read it carefully.

MR. BLANCHARD: 1318 doesn't say pre-closure. Items important to waste isolation is the long term, and so--now, an item there would be a waste package. It's an engineered product. An item also could be a barrier, like the Calico Hills or the Topopah Springs, but then, there are things you do that can have an adverse impact on those natural barriers.

DR. CANTLON: Drilling holes, for example?

MR. BLANCHARD: Yeah, like drilling holes. And so, some activities that you do to natural barriers also are quality affecting, because they can have an adverse impact on that barrier. And so if you look at those three circles down there on the left, that constitutes what we currently call our Q program, basically. Then what's on the project requirements list are other things that you need to have management controls on in order to have a prudent program, to have adequate records and have trained people working on them, but

they're not essentially part of the full-blown Q program.

DR. ALLEN: I guess I can't disagree, but it seems like a convoluted form for categorizing these things.

MR. BLANCHARD: Okay, but we're following the regulations on this. We're doing the best we can.

DR. ALLEN: Okay, thank you. Thanks for explaining it to me.

DR. CARTER: I'm like Clarence. The problem I have is that those three circles at the bottom to the left, to me, every one of them has, or could have a relationship to safety. Safety's so generic. It affects the barriers and the waste isolation, or wherever the impact is. That's my problem with it.

MR. MURTHY: That's 10 CFR 60 definitions.

DR. CHU: Are things such as instruments used in characterization studies, are they items or part of activities?

MR. MURTHY: An item definition is a structure, system, component that is important to safety. If it is a structure or a--

MR. BLANCHARD: Woody, I'm not sure I fully understand your question. It sounds like you're talking about a test instrument, say a voltmeter or something like that. No, a voltmeter that's used during site characterization would not be on the Q-List. It would only be something you use to calibrate the conductance of a test, which would turn out to--

DR. CHU: Take that one, something you have to calibrate; that thing.

MR. BLANCHARD: Yeah. It would be used as a supporting activity or a calibration effort that supports a QA activity. In other words, it's in that third bullet over--or third circle over, activities affecting natural barriers. So it would come into the quality assurance program because it was an instrument used for calibrating some test, and the test that you were conducting could have an adverse impact on a natural barrier. Therefore, whatever measurement you got out of that test, you had to assure yourself that you had a properly calibrated instrument so that the numbers that you got meant something and could be traced back.

DR. ALLEN: Maybe I'm beginning to understand it, but it still seems like it could be better expressed in some way or other, I would hope.

MR. BLANCHARD: Well, it might be--you might be right. We've dealt--many people have dealt with the provisions in the NUREG 1318. We're trying as close as we can to follow the guidance that's in that report to the best of our ability, and it gets complicated very quick, and at least Q-List items are traditional in nuclear programs for powerplants, and have been for many years.

I think one thing that's new that didn't exist in

power plant programs has been the long-term aspect, the 10,000 years; hence, the reliance on natural barriers, and anything you might do now to learn properties that are characteristic of those natural barriers which may have a possible impact now or in the future on how that can retard radionuclides.

And so, it's the second circle and the third circle which are the new things that have come into this program over and above what's in a traditional nuclear power plant program, as I understand it, and I think since everyone has their own crystal ball and are looking at possible things that could have an adverse impact on a barrier 10,000 years into the future, by that crystal ball gazing, you must be aware that there's a certain amount of ambiguity or confusion about what are we going to rely on? How important is it going to be? What's the scenario that could cause a radionuclide release? How big will the release be?

And so, it isn't all that easy just to sit down with a pencil and a paper and start writing and come up with those lists. That's why Ram showed you a view graph that said, well, to be comprehensive, we go to the WBS dictionary, and everything we're funding we cover one way or another. Well, we conclude that no matter what you did in that funding area, you couldn't possibly fit that work into one of those three bubbles, and it's only under those conditions that we say that's not part of this Q program.

Don, am I--

MR. HORTON: You're doing pretty good.

MR. MURTHY: Thanks, Max.

That concludes my presentation.

DR. CANTLON: Okay. Questions?

DR. CARTER: Yeah. I wonder if you'd go back, Ram, to your sixth slide. That's the quality list, Q-List, if you don't mind?

MR. MURTHY: This is the one you're talking about, sir?

DR. CARTER: No. The one for pre-closure/post-closure.

MR. MURTHY: Yeah; right.

DR. CARTER: Yes, sir. Thank you.

First, I presume that the exposure there, a dose of a half a rem, is a public exposure, not occupation?

MR. MURTHY: Not worker, no.

DR. CARTER: Then the question is, the DOE recently--say, within the last year--have reduced their exposures, I guess, occupationally, and certainly to the public, and the public number now that's contained--I think it's in DOE Order 5400.5 --lists a value of 100 millirem and not 500 millirem, and I just wondered, how is this going to be handled? I presume this will be changed, because it's completely inconsistent now with the rest of the DOE guidance for the numbers to the public and the environment.

MR. HORTON: Do you know the answer to that?

MR. MURTHY: I guess this is a requirement that came from 10 CFR 60.

MR. BLANCHARD: Yeah. Let's put the other--that bubble back up. Working with 10 CFR 60 and its applicable regulations, and NUREG 1318, has given us those first three bubbles. Things that turn out to be prudent from a DOE order standpoint which call for radiation doses that are different than what's in the regulation aren't necessarily part of the license application or the NRC Q program, but they're part of the DOE program. Call it, if you want, "DOE order driven quality assurance program," or call it something else that people have referred to it as, management controls that we're going to place on the technical program.

So that's what caused the derivation of the project requirements list. Things that are on the project requirements list are kinds of activities that relate to just what you mentioned. Also, the kinds of environmental activities that are necessary to prepare and complete an EIS that would accompany the license application to the NRC, the EIS work will have to have a degree of quality assurance record keeping, trained people, and qualification of instruments and things like that that makes--allows that EIS to be viewed as credible technically; but yet, it's not part of the Q program. It's not driven by NUREG 1318 or 10 CFR 60, so in large part, those things that can have--that have to have quality assurance or management controls that are effective for people to believe that the work was done appropriately ten years ago--when you get to licensing--they fall down the PRL list side of this diagram, and that further complicates the things, but it's not part of the license application.

And so those kind of things that you just mentioned, and the EIS-type things, and a few others come down the right side where that dashed line is coming out of NUREG 1318, and it gets into what we call the project requirements list.

DR. CARTER: Well, I presume before it's over, Max, that the NRC will change that number. Now, I don't know. I don't know their process for doing that, but--because this sort of thing is what's gotten the DOE into some of the credibility problems they've got now, is in the past they have had different sets of numbers for different activities.

As you probably know, they had one set of numbers for peaceful activities. They had another for weapons testing, for example, and there were other examples of this. These things were inconsistent. Of course, to the political community as well as the public, that's very confusing to have two sets of numbers, and I doubt very seriously that anybody these days would try to make a case that waste disposal ought to have five times the exposure to the public that all other activities do of a nuclear nature. So I appreciate your

explanation.

MR. HORTON: Does everyone understand grading now? We may be the only three that do.

(Laughter.)

DR. CARTER: I figured that we'd pass. That's my bottom line.

MR. HORTON: I just want you to understand that, you know, the Q-List refers to an item. The activity refers to some activity, such as core drilling or something. Now, associated with each of those are functions such as records management, auditing, calibration control. All of those are functions that are associated with one of those specific activities or items on that list, so that's why you go through the grading.

DR. ALLEN: I'll sleep on it.

MR. HORTON: That's okay. That's why we have the workshop coming up.

DR. CANTLON: Any further questions?

(No audible response.)

DR. CANTLON: All right. Well, then, let's skip ahead and pick up Larry Hayes.

MR. HAYES: I'm going to rush through some of these view graphs because I know you're behind time.

DR. CANTLON: Well, we're really right on time now, so don't worry about that.

MR. HAYES: Obviously, at least, I believe the Board recognizes the need for flexibility in our QA program, that a very prescriptive QA program is not going to be what will work in the Yucca Mountain studies. That's just--the National Research Council, I believe, also recognizes that, that we need a different type of QA for an earth science program than what we've had for powerplants in the past.

I'd like to take you through a little odyssey on how I view the evolution of the QA program, at least from the perspective of the Survey, and also myself, personally. We are obviously going through some difficult times, and I sort of look that we've had three stages here. We fight, we ignore QA, we try to understand, we try to accept with a lot of buts, and then we move into cooperation, appreciation, and sort of between Stage II and Stage III, I think, is where we are right now, and we hope the workshops and, specifically, the quality integration group that I'm going to talk about a little later will move us fully into cooperation and appreciation.

Okay, Stage I, that's where we were maybe four years ago. It simply was not working. I don't know how else to say it. I said a meeting a week or so ago, rampant Bozo-ism, and depending on who you are, the other guy's a Bozo, but maybe some agreement from the QA folk and the scientific folk, where the management were the biggest bunch of Bozos, and that sort of left me, at that time, feeling sorry for myself and a

little bit like this. Management was not very welcome.

So I, personally, felt we needed to change. As a manager, I needed to do what I could to help move the Survey ahead, and the scientists and other folk needed to work with us, too, and I think you've seen this morning that that's where we're all heading. We're no longer here. Maybe there's still some tear and slander, but at least no one's taking QA away.

Understanding, but; acceptance, but. I sort of look at this as a shotgun wedding, and that's where we were up until, I think, just about when Don Horton came on the scene. The understanding sometimes was the fellow understood enough to know when to duck the QA club. He didn't really understand why some of the QA requirements were there.

Acceptance. If you're caught between a rock and a hard place, then, sure, you're going to accept things. But it wasn't moving us towards this cooperation and appreciation that we need.

To me, this is where we want to be with a healthy QA program, and I think we're getting there. I think we are now entering this stage. I think the workshops, as we've discussed this morning, have really helped us get there. I think the open attitude of Don Horton, Carl Gertz, John Bartlett has helped us get there, and perhaps, to me, most importantly, the cooperation and work among the scientists and the QA staff have really been what's been moving us into this cooperation.

Now we get into the quality integration group, which is--I hope will be an important vehicle for keeping us moving ahead. What we want to recommend here on this workshop is going to be a forum for technical/quality/management exchange. It will keep us talking to each other. It will ensure we continue to have a meeting of the minds, and probably our primary goal here is to try to help assure that we do have a flexible QA program that is in agreement with standard scientific practices.

I would suspect that some of the things you've heard this morning, you may have internally shook your head and said, "But that's just common sense. Why haven't they been doing it that way all along?" And all I can say is, we haven't always used common sense, and maybe sometimes we need to club ourselves against the head to ensure we do use common sense. Because good QA--Clarence, I hope you would accept, and others--really, good QA does tie to good science. They're not foreign to each other.

DR. ALLEN: I think David Baltimore may wish he had had a somewhat modest QA program here several years ago in his research.

MR. HAYES: Yes.

These are the members. At the back of your package,

you have a little information on each of the members, so I won't go into that, other than to say I feel quite pleased, frankly, and honored to be the chairman of this group. It's a challenging group to work with, and I hope we can do some good things.

As Bill Steinkampf mentioned this morning, we have a technical representative from each of the labs and Survey. Jim Blink is representing Lawrence Livermore; Rich Morley, Los Alamos; Susan Jones is a technical representative for DOE; Ron Price with Sandia; Bill Steinkampf for the USGS. Nancy is keeping us straight on QA issues. Obviously, we don't want to regress here and go back and just deal with science in a vacuum and come up with something and the QA folk, for good reason, say, but you're never going to get there with this type of an approach. So Nancy's input to this group is going to be very important.

DR. CANTLON: Now, are all of these people technical managers?

MR. HAYES: They're all involved in technical projects. Some of them are what we call PI's, principal investigators. They're the people who are really doing the work, and that's what we wanted on this board, people who were close enough to understand what some of the requirements mean in doing their day-to-day activities.

DR. CANTLON: Roughly, what per cent would be PI's versus project managers?

MR. HAYES: Okay, Bob--well, all the technical people would be what I would call PI's from the labs and Survey, okay? Bob Barton is a management representative for DOE, and obviously, I'm management, also.

DR. CHU: This is the formal name for the technical advisory group?

MR. HAYES: The formal name is the Quality Integration Group. That's what we finally came up with; QIG. I hope nobody goes back to the Caine Mutiny on that.

DR. CHU: Is this group going to be concerned with all of the four issues that were identified in the workshop process; in other words, the technical concerns, software, data, and communication?

MR. HAYES: That's correct. We would be concerned with those issues, as well as new issues that come up that might get in the way of a good QA program, and I'll get into that a little bit as I go through the talk.

DR. CHU: Okay.

MR. HAYES: We want to facilitate this communication, this interaction, this working together. We'll do that--as Bill Steinkampf said, again, the technical groups that are active at the participant level will bring to us problems that have been identified at the participant level, and they have not been able to address at the participant level. We do want

each participant to try to solve their own problems, but if they can't, we bring them up to the QIG, and we work with them as a project participant group to try to come to resolution.

Again, we want to contribute to a good QA program, a QA program that operates well with science. We do believe that these two things can work together.

We understand the importance of the licensing process, at least we're starting to. It's probably not correct to say we fully understand it--we being most of the scientists, and also myself--but we do acknowledge the licensing process is there. That's what we're working towards, and our work has to be done in a manner that that work can be taken to the licensing process. We're not doing science just to do science. Now, I want to make that plain to everybody.

Technical perspective, foster communication. Technical perspective is important. We need to keep in mind what we're doing. We're looking at Yucca Mountain as a potential repository. We're doing site characterization. The work that most of us are intimately involved in is of a technical nature, and we want to make sure that that perspective continues to get the credit it deserves, frankly. Sometimes we get tied up in a lot of other things; the paper trail and those sort of things, and we lose sight a little bit of the importance of some of the technical issues.

Sounding board. Again, people need to know there is an avenue out there that if things aren't working, they can bring it to someone's attention. They will be heard. Again, you might say that's just common sense, should have been done before, and it was partly done before. But, obviously, if we look back over our history, it sometimes wasn't done well. People did what they thought they should do to bring issues to management, to the QA people, and were left with a feeling that no one was listening to them. We hope, through this QIG, to have people walk away with confidence that they were listened to. If we couldn't work out their problem, at least we want to try to help them understand why things are the way they are.

DR. CANTLON: Larry, having spent 40 years almost in academe, which swims with advisory groups, I would say that one of the big problems you encounter after the honeymoon period of establishment is over, is the communication of the representatives back to their peers. So you should think about some way of formalizing the necessity that the representative talk to the people he's representing.

MR. HAYES: In fact, we have. That's part of our charter, this formal requirement for communication backwards. Also, one of the first things we agreed to do would be a newsletter--God knows we don't need more documents, but we think this is important--a newsletter to all the scientists,

engineers to give the important accomplishments that this group may have made, that DOE, others may have made in QA, and list some of the problems that were brought up, and either say, "Here's how we solved those problems or we didn't, and here's why." But you're absolutely right, if we don't keep that communications ball bouncing, this is going to die.

DR. CANTLON: I don't know the degree to which you have division meetings or whatever of your PI's, but if you can formalize a report of that rep to his colleagues at some level, because most of you know that newsletters and things age sometimes six months to a year before a guy gets around, in the priority of what he's doing, to read it.

MR. HAYES: That's correct.

DR. CANTLON: So there's no timely interchange.

MR. HAYES: The way we intend to do that in the Survey--and I think the labs are looking at some approaches, also, but in the Survey, we have what we call CASY, Committee for the Advancement of Science at Yucca Mountain. We have monthly meetings on scientific issues where we invite all the scientists to come and hear what their peers are doing, to try to accomplish a little bit of integration and give these fellows an informal forum in which they can talk about science.

At that CASY meeting, Bill Steinkampf, who will be the Survey lead for the participant group, will discuss any issues that are appropriate from the QIG work. Because you're absolutely right again, John. I don't know how well a newsletter would be read. I read a lot of things every day and don't remember what I read.

This is a little bit about the first meeting. We did have our first in March. We finalized our charter. I assume, Max, that that charter, once it's signed, would be available to the Board. It might give you a little better feel for where we want to go, and some of the controls we've put in to try to assure that we accomplish something rather than just setting up another board.

We clarified the roles, who's going to do what. We identified group tasks. Again, we feel a key here is to keep the action going. You've seen through the workshops this morning we've identified action items, and we need to show progress. We need to break these problems into pieces we can solve and show people that something is being done, so the group will continue to look at short-term fixes while we're looking at some of the longer term problems.

One of the things we're going to look at--it was brought up this morning--we do want to look at the up-line requirements, and we want to look at how those requirements are being passed down and develop some kind of matrix to see where we may be going astray, because as one of the fellows mentioned this morning, it seems an order of magnitude jump

every time you go down, and that shouldn't be.

So in doing that process, we'll try to identify where we are our own worst enemy, so to speak, and believe me, in some cases we are. And we also want to identify, is there a requirement up here that is just simply not appropriate? And, if so, that's the kind of thing we would take to Don and say, "Don, we don't see where this requirement is going to work. What can you do to help us?" So we are going to look at the up-line requirements and whether they're all appropriate or not.

Again, that comes back to Nancy being on our group. She can help us wade through some of that, understand some of those requirements, and maybe not be overly optimistic about thinking 50 per cent of them are not required.

DR. CARTER: Larry, you provide advice to, or suggestions and advice to Don Horton and to Carl Gertz, this group, so it is an advisory group. I wanted to ask you a little bit--I presume, again, that this is a formal thing. I was going to ask, though, how frequently do you anticipate meeting and that sort of thing?

MR. HAYES: Right now we set up that we would meet quarterly, or as needed. Frankly, we felt we had to set a schedule, or meetings might not take place. We could see the need for meeting more often, but with everyone's commitments, we simply couldn't because the people on the board, the scientists are doing their own projects. We simply have to find time to fit our meeting in, so we agreed we would meet quarterly. And we--in our charter, we have a requirement that minutes will be taken. Those minutes will be distributed to Don, to Carl, to the other TPO's, to QA managers, people who should know what we discussed, and so forth.

DR. CHU: Can I go back to the question about the scope? There were four issue areas, or was it technical or--yeah; technical, software, data, and communication, and the technical issue area kind of had the head start in terms of the evolution of this process.

MR. HAYES: Yes.

DR. CHU: And so the technical participants, then, identified a need for establishing a technical advisory committee, a TAC, if you will, and not a QIG, and then the software folks got in their workshop and identified a number of other issues, and they decided there was a need to have a software advisory or working group.

Will the first area, the technical area, still have some kind of working group to work on the nitty-gritties of technical aspects or the interface of technical issues vis-a-vis QA, which are not global enough for the QIG to worry about?

MR. HAYES: That's correct. I would assume that some of that will be done through the participant technical work

groups. Each participant will set up a little technical work group.

DR. CHU: Right, and this is where I'm having problem with what seems like a gap; in other words, every participant organization, there is a participant technical advisory group, but now how do you get together with common problems which are of a technical nature, and yet still not so grandiose that it's worthy of the attention of the QIG committee.

MR. HAYES: The way they would get together--remember, the QIG, each technical representative on the QIG comes from the participant technical work group. So while they might come together and they have some technical issues at the participant level, these people will get together through the QIG and they could, perhaps--if it wasn't something the whole QIG needed to deal with, these four people could go together and talk about some of their common technical problems that they might want to work out through their participant technical groups, but by coming together through the QIG, they are giving a more global perspective to their problem and, for instance, Bill Steinkampf, the Survey person who will be the Survey participant technical lead, and he'll have a couple other people working with him in the Survey, but he'll be there to look out for the technical issues within the Survey. He will come to the QIG meeting.

And then there is, let's say, Rich Morley from Los Alamos, will be there, too, and he will be representing Los Alamos from a technical perspective, because Rich will be heading up the Los Alamos technical group. They can then get together and talk over and see if they've got a common problem that they can take back to their technical groups to work out. And if it's broader than that, they would bring it up at the QIG.

I think, in summary, what I'm saying, this will allow those technical people to deal with technical issues that they really don't want to bring to the full QIG, but they want to talk about because they may have common concerns or factors, whatever, at the participant level.

DR. CHU: So do you see the QIG as a vehicle for, let's say as an example, for perfecting or improving one of the--the way you would write one of the criteria, let's say, Criteria No. 20?

MR. HAYES: I say yes, because, in fact, one thing the QIG outlined at our first meeting, we wanted to look at Criteria 19 and Criteria 20 and see whether, in fact, those two extra criteria are needed or should they really be embodied in the original 18 criteria, and because the QIG has this technical representation from the labs and the Survey, I think we're going to get a broad view on whether or not those two criteria are adequate or appropriate.

DR. CHU: Okay.

MR. HAYES: I'm not sure I've answered your question.
DR. CHU: I think you have.
DR. CANTLON: Other questions?
(No audible response.)
DR. CANTLON: Do you want to make any summarizing remarks, Don?
MR. HAYES: Before Don does that, I just wanted to say I welcome this opportunity to talk to the Board members, to frankly, I hope, leave you with some assurance that QA is alive and well at Yucca Mountain, and while we've had a lot of problems in the past and we still have a rough road, as Carl says, ahead of us, I think there's a lot of people working towards a good QA program and we feel that's a good sign.
DR. CANTLON: Thank you.
MR. HORTON: Well, for the past two days we've tried to present our quality assurance program for the control and design. Today we went into how we're trying to improve or enhance our overall program, in addition to identify to you an update on our previous workshops, and the progress that we've made to date, and give it to you from the perspective of the scientific and technical personnel that's working on the program. And we also tried to give you some basics as far as the grading process.

I did identify to you earlier today that we are going to have a workshop on this. April 2nd and 3rd will be the first meeting in which we hope to enhance the overall program that we have for grading.

With that, I hope that we've provided you some insight into our program, and that you're leaving this meeting with a better understanding of our overall quality assurance program, and that we have made significant improvements in recent months, and that we're still striving to improve that program and it's a dynamic program, and it will continue to hopefully improve, along with some change that we can foresee.
DR. CANTLON: Thank you.

On behalf of the Panel, let me thank you and your staff members and the management people for presenting what I think is a very lucid presentation of where you are in the system. I think I, for one--I'll let the other Board members speak for themselves--feel that the evidence of a forward momentum is really pretty dramatic, and obviously, we've been in contact with a number of your scientists at various meetings. Our staff members made trips out there, and we recognize--anyone that's worked with faculties and researchers for a very long time, they're not a homogeneous group, and so, clearly, there will continue to be opportunities for honing the program and you're obviously well aware of that.

We'll go back and try to summarize what we think the take-home lessons were, and if we have some fairly specific follow-up questions we'd like to do it. One of the things we

particularly like to keep track of is the progress that you make with these additional workshops, and we'll continue to try to get independent soundings of how the scientists view the program, because I think if we're going to be useful to DOE, an independent evaluation is going to be helpful, not hurtful.

And so, again, we thank you. I'll turn to the other Board members for comments.

DR. ALLEN: I just endorse what you've said. Thank you.

DR. CARTER: I'm just going to say nothing.

DR. CANTLON: It may be the first time.

(Laughter.)

MR. HORTON: By the way, Mel, I told Ram that he should present his presentation today to you, because you were from Georgia Tech and you do everything real slow. So I said, "Speak slowly and clearly." I said, "Remember the people from the south."

DR. CARTER: He did an admirable job.

DR. CANTLON: Well, thank you.

We're adjourned.

(Whereupon, the meeting was adjourned.)