

Meeting of the  
UNITED STATES  
NUCLEAR WASTE TECHNICAL REVIEW BOARD  
Quality Assurance Panel Meeting

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1100 Wilson Boulevard, Suite 910  
Arlington, Virginia 22209

MEMBERS:

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SHERWOOD C. CHU  
MELVIN W. CARTER  
D. WARNER NORTH  
ROY E. WILLIAMS  
WILLIAM D. BARNHARD  
ELLIS D. VERINK

PRESENTATIONS BY:

BILL DUDLEY  
U.S. Geological Survey  
LES JARDINE  
Lawrence Livermore National Laboratory  
DAVID SHORT  
Lawrence Livermore National Laboratory  
TOM BLEJWAS  
Sandia National Laboratories  
DICK HERBST  
Los Alamos National Laboratory

P R O C E E D I N G S

1:32 a.m.

CHAIRMAN CANTLON: We'll reconvene the panel on Quality Assurance of the Nuclear Waste Technology Review Board.

I noticed that most of the people in the audience were here yesterday. So we'll forgo the formalities.

Yesterday we heard from the agencies. Today we're going to be concentrating largely on participants who are providing the information and are perhaps somewhat closer to the scientists who are involved generating the data.

One minor change in the agenda, Larry Hayes of the USGS is going to start off preceding Bill Dudley, and then Les Jardine is going to do the speaking. David Short will be here and participate in the roundtable discussion.

We'll take a second break just before the roundtable discussion, so that the panel won't be sitting here with our backs to you.

Let's proceed with Larry Hayes. If you will start off for us.

Oh, yes. Let me comment that Ellis Verink who is a member of the Nuclear Waste Technology Review Board has joined us. He's a Professor of Metallurgy and Engineering at the University of Florida.

MR. HAYES: Dr. Cantlon, thank you, and the board members, for the opportunity to present to you some of the views of the participants.

My comments will be very brief. I just wanted to take this opportunity to try to say a few words, I hope, to convince you that the QA Program is not terminally ill. We have some sicknesses. But I think perhaps many of us are hypochondriacs perhaps rather than really ill.

Additionally, I wanted to share with you what I have asked Bill Dudley to speak for the USGS.

I think one of our problems that we're facing -- to me, perhaps one of our most significant problem -- is what we see up here, and we can replace character and courage with quality signs for the QA Program. We've got to keep all of our people involved. We can't take away their initiative, their independence. We have a lot of intelligent people in this program trying to do what's right.

And I think to some extent, we've done that to the scientific community. And I think we've realized that.

And one reason I feel very, very optimistic about progress in that we have recognized that is the workshop that Don Horton discussed yesterday.

A number of us went to that workshop less than fully enthused. We said we had been there before. What

are we really going to accomplish?

In fact, we accomplished one very, very important thing. Scientists, QA people, we are all working as a team to try to resolve some of these issues.

So frankly, I think we've found perhaps a potent medicine for our illness, and that is we've got to work together. We've got to share with the scientists how we're going to set up and operate QA.

The scientists have given us, I believe, their commitment that they want to do that and they will do it with us, that it will be their program. It will be our program, and we'll get on the way of doing good science, get well with QA and do what we need to do.

Now, Don North, I think you gave us the reason why it's been a long haul. We are talking about a cultural change. That's what we're talking about. And it's taken a few years for this to, I think, finally come to a point where we can accept that and work with it.

So I'm optimistic. I think we're on the road to recovery. And Bill Dudley and others will, I think, help you understand some of the problems we're facing and also that we're looking at solutions.

Now, the reason for Bill giving most of the survey presentation -- Bill has been a TPO for seven years. He's now the Science Adviser in the USGS Program. Bill

understands the issues from the viewpoint of management and science. So he brings, I think, a unique perspective dealing with that.

I turn it over, Bill.

MR. DUDLEY: This thing sounds like a whip cracking.

MR. WILLIAMS: Let's hope there's no symbolism.

DR. NORTH: You can stick that in your pocket. It will probably be more convenient.

MR. DUDLEY: Well, I appreciate this opportunity to speak with the panel. Larry, thanks for your opening remarks.

I'm going to talk about some experiences and recommendations regarding the application of QA requirements in the earth sciences. However, it is quote apparent for those working in the program that the principles are the same for all the earth-science investigations involved. And as a matter of fact, the engineering of the repositories for the site prove suitable -- is very much scientific in nature for a number of reasons, the principal reason being that the repository itself would be engineered within the earth's crust. So that that, too, is an earth-science problem.

In talking about the QA Program, I want to be specific and indicate that any time we talk about quality

assurance that we're talking about the type that Ken Hooks and Don Horton describe as Appendix B QA Program. This is a subset of the larger topic of total quality management.

Within the USGS, we have a QA Program that is in place. It's operating, and it has been accepted by the NRC and by the Department of Energy. We have yet to test it under a full site characterization practice. But we have every reason to believe from the attitude of the staff -- all of them really with very few exceptions are seriously trying to comply. But it's going to work. To some degree, it will require some modification. We have no question about that.

In fact, there are several instances where during audits, the scientists themselves have recognized that QA has helped. The auditors have made very constructive suggestions.

Therefore, I think we can say that the characterization objectives are possibly attainable. Under the present system, they are certainly attainable with some reasonable moderate investigations -- as Larry might say, "getting rid of the hypochondriacs."

However, we do think that as it is applied to an entire program -- perhaps without the focus that it needs -- that this may take an inordinate time, may cost a great deal more than it should and perhaps without any increase

in the actual quality.

We have a great deal of optimism, as Larry indicated, because of the actions that Don Horton has initiated to get the scientists, the managers, the QA people together and to examine the program, to reevaluate it and to try to change it in constructive ways.

The scientists as well as the managers and the QA people within the survey are strongly committed to participation in this process. They are strongly committed to a program -- a QA Program that does provide proper documentation of good quality work. But we do believe that there needs to be a refocussing of the program to emphasize those characterization activities that are important to safety or important to waste isolation.

I think we have lost that focus in the development of the program somewhat. We need to regain that focus because we cannot afford to waste the scientific or the QA resources in this program.

Now, the fundamental problem, as you've been hearing for years, I think, is that the program -- all of us are still trying to apply a QA system that was conceived and developed and has been shown to be effective for a fabricated system to an earth system. The differences, of course, with the fabricated system is going to be designed and constructed under strict controls. Whereas, the earth

system already exists, and we don't really know how it is designed. And that is indeed the thing we have to do -- is to investigate and find out that design.

The components in the fabricated system are discrete. They are things that are manufactured and constructed. And because they are put together in pieces or acquired in pieces, they can be directly tested, and in that sense then, sampling is almost unlimited. Whereas, the components of the earth system are variable -- very complexly variably. They cannot generally be tested for the desired functions -- desired functions such as retardation of radionuclides could be tested only in part on small samples in laboratories, and the sampling itself is very limited. There's no question about that.

It is compared with fabricated system where if you appoint it properly, you can sample almost everything -- test almost everything.

The inherent changes are quite predictable, again, in a fabricated system. Whereas, they're somewhat unpredictable; certainly, with any precision quite unpredictable as far as the earth goes.

Mitigation is possible. The components can be tested, replaced, repaired. Whereas, in the earth system, mitigation of adverse conditions is somewhat limited.

Finally, the functional performance in a

fabricated system, engineered system, generally we can say that they can be accomplished with a high degree of safety, and that is aided by applying factors of safety in the design and construction. Whereas, with an earth system, we're still going to have a high residual uncertainty. Therefore, we are going to have to be very conservative in making decisions.

Another way of looking at earth processes and earth conditions is: The earth is pretty opaque. The characteristics are hidden from you. They're changing in some cases, dynamic. They're discontinuous spatially and perhaps temporally at times. Therefore, the investigation is that of a scientific investigation. We have to form multiple working hypotheses. We have to consider alternative conceptual models and then test these. Unfortunately, they cannot be tested directly again. We have to use a large number of indirect methods.

Many of these indirect methods will turn out not to be fruitful. So there is going to be some wasted effort. We will not know in advance what all that is. We're going to have to go ahead with it.

Existing information is very important as well. This is one source of the problem. From all the existing information, the multiple methods and so forth, we're hoping to find convergence of indirect limited evidence.

If we were dealing with the criminal litigation, we'd have to say that we're going to rely on hearsay and circumstantial evidence for the most part. It's going to be very low and direct evidence that's applicable.

Therefore, there is a requirement for a great deal of professional judgment. That includes review and advice: a panel such as this all contributing to professional judgment and the decisions as to site suitability or unsuitability; and if suitable, then the development of a repository. There will, however, always be residual ambiguity, and as there is anytime, which we have to rely on human judgment.

Now, the National Research Council last spring issued a position statement regarding the state of the waste program. It wasn't directly focussed on quality assurance. In fact, maybe they overstated the case somewhat. But there are at least elements and reasons to believe that the program is overall and not just in QA, too prescriptive, too inflexible, and that it is based on an engineering approach to a fabricated system with a high degree of certainty.

Because the earth itself is less predictable than that, we have a program that, in some ways, is unrealistic and, in some ways, it is vulnerable to surprises. We certainly have seen unforeseen delays, costs that have

shocked the Congress, shocked even the program managers. We have frustrations -- some frustration among the field personnel, but I don't think it is as great as the National Research Council report indicated. And we do have indeed some loss of public confidence. That was discussed yesterday.

They described quality assurance as a system that's hostile to surprises in a world that is full of them. That's a reasonably catchy phrase there, one that does describe many of the problems that we have -- and suggested that the flexibility would lead to a safe repository more likely than would rigid redetermined controls.

They proposed an alternative, very much what we've been talking about all day yesterday, and that is to maintain flexibility. We have to define goals very broadly and try to develop increasing confidence in performance assessments throughout the period of safe characterization, not only to help identify what it is that was most important to investigate, but also to keep track of whether the site is appearing to become more and more suitable or more and more unsuitable as we learn more about it. So it is just an application of the scientific method, and the NRC position statement strongly endorsed peer review, as have almost any group that examined the problems and the

ways around them.

They also propose that the program should be given priority to major uncertainties and risks. This is perhaps what we talked about yesterday -- is collecting the right information to make the decisions. And this certainly is an effort that is ongoing within DOE right now to determine whether the site characterization plan does adequately give priority to the major uncertainties and risks, and there is a new effort directed at Headquarters level to take a very hard look at that.

One thing that they did not include in this report that, as I said, may be a considerable overstatement -- it was an understatement in terms of the proper role of quality assurance -- and that is to assure that we have documented the investigations that are very closely related to safety and waste isolation. The report is deficient in that sense.

In order to select the activities to focus our program on -- our QA Program that is -- on those things that are important to safety and waste isolation, we have to consider site characterization information that supports the design and the assessment of the site. Certainly, later on the design and actual construction for the critical systems in operation and the -- at the end of site characterization, the final assessment of safety and

isolation performance on which really the decision will be made whether to apply for license or not, if it is not made previously based on a finding of site unsuitability.

There are other things though that are not as -- quite as obvious. That is that the exploration methods to try to increase our very limited sampling could lead to damage of the site itself. So that even some activities don't need to focus on QA controls so much on the overall activity. We do need to focus on those aspects of the exploration that could lead to damaging the site irreparably.

Certainly, one of the considerations, however, is that the entire management system as well as the critics of the program need to remember that there are inherent limitations in understanding the earth. We have to have realistic expectations. We cannot be given guidance from the managers that we must demonstrate groundwater velocities with an error of not more than 10-to-the-minus-2 millimeters per year. We just cannot achieve the precision that we would like to receive -- or like to achieve.

Now, the current requirements, I think, are what we would have to call overkill in some ways. The guidance documents of NRC, the application of the program within the DOE, the application of the program within the participants, I think, are all overly conservative,

particularly in determining what is important to safety or to waste isolation.

The guiding regulation -- or guidance document, I should say -- 1318 -- wants site characterization and licensing information within the category of important to safety or waste isolation. Well, in a sense, that is true.

But some things are a lot more important than other things.

This is a somewhat burdensome approach to exempting criteria from the controls. If it's in the basic guidance, that all site characterization and licensing information are important to safety, and it becomes very difficult in the current system to extract the control system to get it to back off from any aspect of the activities related to site characterization.

The program -- as it has grown -- that, I think, is overly conservative. There is a reason for this. John Stuckless in our organization describes this as a callosity of always give them more than they've asked for. It was developed for students. You don't just aim for a C or a C-. If you're asked to write a five-page paper, you generally put in an eight-page paper and try to get an A.

The same philosophy has led to what I call a pyramid growth, downward growth of the program, that basically the NRC regulations have a certainly breadth or

scope of application. As this is passed on down to DOE, it begins to expand a little -- trying to get an A rather than a C -- down through the DOE structure even more, and as we get the requirement to build more depth to the controls and the procedures, have more specificity, then the mass of the program increases. But the time it gets down to the participant, it tends to become much larger, both in terms of depth but also in the scope, than the original regulations.

In addition, we have many outside things that are brought in. In addition the NRC regs, of course, we do have the regulatory guides, the technical position statements and the review plan itself. We don't have the force of regulation. But they, nonetheless, do impact and tend to enlarge the QA Programs that are responding to them.

In addition, we have things that really have nothing to do with QA, as Don Horton discussed yesterday; protocol agreements and time to release information and so forth. We have the DOE regulations and orders, and the participants are not without fault on this either because they too have taken the opportunity to put some administrative management policies mixed in with the QA Program.

Logically, this is not entirely bad because it

means that the investigators don't have to be familiar with one set of procedures here and another set of procedures here. You only have one.

The difficult comes when it comes to the auditing of quality assurance compliance. Where it's important is that the auditors look at the procedures and audit with respect to the entire procedure, not just that part that might be important to safety and waste isolation.

Some selected examples of things that have come in either as overkill or just as things that should not even have been included -- in procurement, the current procedures within DOE and within the USGS as well don't distinguish adequately between things that are important to safety and things that are not. We basically go through the same process which is, even to them, perhaps more burdensome than it needs to be, more time-consuming. It becomes very difficult to complete the procurement within a reasonable period of time.

In addition, the requirements to have vendors that have existing QA Programs or that can be qualified through inspections -- periodic inspections -- there are very few vendors particularly for commercial grade services or items with a history of quality. These companies are not really willing to open their doors to a bunch of strangers coming in saying that they're not doing a quality

job.

Our sample management procedures are rigid and still, at the same time, quite ambiguous. They're difficult to see how we're going to follow them. And as we get into a full scale site characterization program, we believe this is going to become very problematical.

The procedures emphasize the library -- archiving -- rather than the laboratory -- taking sample and using them to produce data.

Some aspects of the procedures, such as core staging and photography at the drill site, will guarantee unsuitable samples for some uses. These things are going to have to be worked out. Perhaps the study plans can overrule the existing procedures. But these are correctable things that will be worked out.

Outside the information as far as the fundamental guidance from NRC is concerned, we think, is much too prescriptive for most site characterization activities. It may be appropriate for activities with the highest quality grade.

In general, we believe that good scientific practice, principal investigator judgment and proper technical review are going to be the more effective means for most investigations.

One of our problems at the current time because

we're in the stage of development scientific plans and procedures is that excessive detail is required in our opinion, and it is beyond a reasonable or realistic ability to plan.

The format itself is quite inflexible. It is not appropriate to have exactly the same format for a geophysical investigation as it is for performance assessment or investigate in the unsaturated zone hydrology of the site.

And we have had a burdensome and time-consuming process for approval of the plans themselves and with exactly the same process for any changes that come in for reapproval.

Now, as Don Horton mentioned yesterday, this is one aspect of his -- immediately after the workshops -- going to work on and has begun to improve that situation.

The impacts if we do not improve some of these are that we're going to waste people resources, money resources and time resources, putting it into effort that is not truly productive and aren't really focussed on the things that need focussing at the Quality Assurance Program. It does invite the QA control of the entire process, which does slow things down.

More importantly from a scientific standpoint, it discourages the improvement of methods and approaches

because of the needs for detailed reapproval. Therefore, in some ways, we could say it prescribes mediocrity. The procedures do not allow as easily as they should -- although the QARD is better than the older ones -- for field changes and places scientists at risk getting his wrist slapped or perhaps having his work declared unsuitable or of poor quality if he makes necessary field modifications.

Some scientists refuse to work under this system.

I think if we have a system that is properly focussed as it should be, a number of scientists might not only become willing, but become excited about working with the assistance of such a system, and some scientists have been lost in the program who otherwise would not have.

Therefore there is a possibility that the overall quality would suffer if the program stifles application and investigation of the scientific method.

Okay. So there are problems. As Larry said, we're sick in a few ways or at least hypochondriacal or whatever the adjective would be for that.

However, there are solutions, and you heard Don Horton talk about some of those solutions -- at least the process that is in place and operating to reach solutions -- yesterday.

The pyramiding and mixing of QA and management

requirements, that's one that Don mentioned. We just need to refocus on what are the regulatory QA requirements and don't let our own plans get out of hand.

And of course, we do have to have guidance on these to make sure we're not under-allocating our QA effort. Therefore, I think we need to have at all levels interactions with the NRC on their guidance what you really mean. Don't you think you're overkilling a bit?

The procedures that have been described as scientists as being "wordy," "unclear," "redundant," "inconsistent," and those are the kinder words in their descriptions. The others, I didn't.

(Laughter)

This can be fixed, again, with careful preparation within a systematic framework. By a systematic framework, I mean that we should be looking at the impact of a change in one procedure; on other procedures, make sure that we contract them.

We can accomplish much better procedures by having participation of the users. And again, this is the activity that Don has undertaken to give the users, the scientists, in on the development of the whole program. This is true with respect to the procedures of the Governor Program.

And finally, we need to reaffirm our commitment

to thoughtful and well-documented reviews and responses. We have been criticized internally in the survey, and the survey has criticized DOE, and other parts of DOE have been criticized by others for not paying careful enough attention to the comments that are made by others. This is something that we need to make sure that we are recommitted to implement fully.

The fact that the procedures are overly prescriptive, I think that we can cure that mainly by making sure that the procedures emphasize the expected results -- not how to get those results, except when absolutely necessary -- therefore, to be written so as to allow flexibility in the application.

We talked some yesterday or heard some yesterday about total quality management, and I think that we do need to have a commitment to this concept in the Waste Program as well as other federal and important commercial programs.

In total quality management, we recognize QA as being an important equal partner to other things such as the management staff and the functions and to the investigation staff and functions. And if this were actually a talk on the entire program, the design would be in there and performance assessment would be in there.

We think that these have to be parallel, generally separate activities, but there may be some

overlapping. QA may get into the investigations area in places that are absolutely necessary. But rather than having the application across the entire field of management and investigations and then the great difficulty extracting the QA controls from those, we need to cross the boundary only as a conscious decision, one in which the program is innocent until proved guilty, if you wish, rather than the other way around as it seems to be at times now.

The functions of management in a total quality management system are to help the process. Basically, we need to make sure that the entire program is focussed on the objectives and does not lose track of those and to make sure that every action is indeed helping us to reach the final objectives.

We believe that the function of management is to foster and support the scientific methods; in this case, to protect it like a mother bear protects her cubs and not allow it to be fiddled with in any great or significant way. The function then is to keep the road clear to remove impediments to progress on the program and remove impediments to proper application and quality application of the scientific method.

Of course, we need things such as realistic schedules and budgets. We need guidance, if you will, in

providing the context for the various components of the program and how they fit together, and we need management to protect us from the impacts of external agreements and things of that sort. If it doesn't help the program reach its objectives very clearly, then there should be no outside influence.

And management as are other parts of the program should interact frequently with the Nuclear Regulatory Commission in an open and constructive basis.

The Investigations Unit, again, could also focus on the objectives. They must protect themselves -- not to leave it all to others -- by making sure that in the planning, they planned the inflexibility. This means that the investigators -- not the managers or others -- and the scientific integrators are the ones who should be doing the planning, and one thing they should always be keeping in mind is, "Am I painting myself into a corner?" They certainly are going to have to pay attention to the impacts of activities or the results of safety and waste isolation so that they can accurately identify those things that require control procedures. They are the ones that should be proposing the nature and application of those controls that are most effective to their own scientific areas.

The scientists need review. They need advice -- not only from other technical people, also from the Quality

Assurance Units and from management.

Finally, I think the one thing that we really need to do is to assure that we have kept the approval levels for planning for scientific investigations down as close as possible to those doing the investigations -- the lowest feasible management levels is what we call it here.

And as does management, I think the investigators have an obligation to interact with the NRC not only on technical matters, but also on QA matters so that they develop and understanding of what the NRC believes in their experience will be important in licensing application.

In the third component of our total quality management, the Quality Assurance Units, I believe that we need a more pro-active role for quality assurance to help in reaching the true program objectives.

The Appendix B/QA Program type procedures, they need to help us limit those to activities with potentially significant impact on safety or waste isolation.

However, there is an advisory and assistance role that I think is being under-utilized, and that is for the QA people to really be in there looking at the planning, looking at the operation and instead of issuing non-conformances or corrective action reports, helping the scientists in figuring out how to apply the criteria and the controls within a concept of greater QA.

The QA organization has an obligation, I think, as Don mentioned yesterday, to not undertake tasks on behalf of management just to make their job easier -- decline the attempt of assignment of management responsibilities.

Then in terms of auditing, to audit intelligently is one way it might be said, not just to look at the process and the procedures that have been followed, but mainly to audit for performance. Are we reaching those objectives and various components of the program? And included within those objectives are proper documentation.

And finally, interactions with the NRC are important there as well.

I want to skip the next three. I think they're more detail than we need to go over, and I'm running short on my time. Let's go directly to the Conclusions.

The conclusions are that the program is operating within the requirements, but it has some problems -- the QA program, not the entire program. The sources of these problems are both external -- they result, in part, from some vagueness and some over-conservatism on the part of the NRC guidance -- but they're internal as well. We've done a lot of it to ourselves.

The good news is that these problems are correctable, and the corrections are underway now and will

continue to be under way throughout the program. We believe that a concept of total quality management needs to apply in which management realizes that their job is to help the scientists as well as the QA process to be effective in the objectives in which the investigators apply the scientific process, but within proper controls and in which QA does stay in a more pro-active assistance role and becomes more of an operating member of the team rather than an outside unit that comes in an reeks havoc periodically.

Finally, then all units -- all the people in the program, I think, are going to have to interact more effectively with the NRC.

Thank you.

CHAIRMAN CANTLON: Well, thank you, Bill.

Questions?

Yes.

DR. CARTER: First, I'd like to make a couple of comments.

You started out with a few related to the Academy report on waste management, and I suppose that we all stepped back and looked at that on a considerate basis. I suppose a document that long, you could find things to criticize or things to applaud.

But I guess the way I would look at it -- and I

certainly could find both of those in the document. But what appears to me if you look at it on this basis is that the purpose of that was to defend science or at least the application of science, the technological things. I think that's a noble objective as far as I'm concerned.

I think the other thing it focussed attention on was a number of things that probably needed to have attention focussed on them. And also I suspect that the authors of that assumed that they were being helpful or useful to the High Level Repository Program in putting that report together.

So that's just some observation on a personal basis. But I'd like to talk about two things on a couple of things that you covered.

One of those is this bugaboo -- as I would call it -- about loss of personnel involving QA. And I just wondered how many definitive facts -- even the USGS or others -- have on that sort of thing. I will admit that's a spongy area. I don't think you could tell how many people QA has spooked or they haven't joined the program because of it. But I suppose to some extent, you could have statistics on the people that have left the program and give them a Johnnie Paycheck thing on the basis of QA.

So I wonder if you'd elaborate a little bit on the experience in terms of personnel, the impacts adversely

on scientific personnel in the program as a result of QA. To me, that's almost like, you know, when you -- over the years, anytime you say something to the Post Office Department, they say, you know, "We'll cut out Saturday service." That scares everybody in the damn country.

MR. DUDLEY: Yeah. That's the Washington Monument approach to budgeting.

I don't -- I have never kept statistics myself, and I don't know whether Larry has either. But I think that within the survey, you know, I would say at least four talented scientists within the last two years who were managing important aspects of the program who have left, in part, because they don't believe that they're being allowed to do their job fully, and they did not see the time coming when they would be able to do it.

Now, that is not all of QA's problems. Also, a legal problem: Can we get access legally under the state plans or within the State of Nevada with their objections and difficulties in permitting? Some of it is things that are properly management rather than QA decisions, such as the level of detail in a planning document, things of this sort. So I think it's a little hard to sort out. But I would guess that perhaps in our program, the equivalent of somewhere around two talented people a year could be lost that are in the program.

Now, there are others that we've invited into the program and would like to have in the program that have said, "I will not come work under those conditions."

DR. CARTER: These two, what pool of people are we talking about? Two out of how many? Two out of a thousand or two out of a hundred?

MR. DUDLEY: Larry, can you help me on the numbers that are --

MR. HAYES: Two out of 75.

MR. DUDLEY: Two out of 75, something like that. But very important positions.

DR. CARTER: Sure.

MR. DUDLEY: And what generally happens, of course, is that those people that are the most talented and the most vitally known are the ones that get the offers of good alternative jobs.

DR. CARTER: You didn't take any bad people, in case you any, and put them in QA so it would drive them off.

MR. DUDLEY: Absolutely not.

(Laughter)

The organization is staffed by scientists and technicians within the program, and they have had to learn their QA training.

DR. CARTER: Well, I think those comments are

useful.

The other thing I wanted to talk to you about -- and I suppose it's embedded in the whole process -- is the time constraint or the time dimension. But it would appear to me that you didn't address this directly.

Now, the problem I have, I think we can, you know, punch holes and we can QA drill pipe and we can do all sorts of things on a present-day basis or look in the foreseeable future, and the same way with nuclear reactors. You know, we worry about engineering problems over a period of 20 or 40 years or whatever.

But it would appear to me the real important thing that makes the repository different than most of our other things that we intend to build or construct, design and what have you is the time dimension. How do you QA things for long periods of time -- hundreds if not thousands of years? And that's not been addressed. So I wonder if you would have any comments on it. That, to me, is the difficult part. The rest is, you know -- it may be a problem, but it's solvable.

MR. DUDLEY: Well, one of the things that I stayed away from is the software quality assurance. I'm a computer illiterate myself.

Certainly, the problem of validating models to predict what will happen over time frames, thousands of

years or tens of thousands of years, is a major problem within the program as well as the quality assurance.

Quality Assurance can say, "You must validate these models," without saying how. And the scientific people will say, "Well, obviously, we can't do it directly.

We can validate only true professional judgment," and I think this comes into the residual or lack of precision. There is residual uncertainty that will result from the characterization process and from the assessment of probable performance of the repository.

I'm sure that there are others here who could provide a more eloquent answer to that regarding the difficulty of looking into the future.

DR. CARTER: Well, I'd essentially like to ask the speakers that we have if they'd give that some thought because I'd like to see it discussed.

I think this, to me -- like I say, it's the major new dimension, if you will, to those whole process. You know, we've engineered lots of things on short periods of time, and I think, in general, we've done a pretty good job of it.

But this one does have that new dimension, and I think it requires not only a lot of attention today, but an awful lot of effort. And I think we ought to begin to focus in that area.

MR. DUDLEY: I like that suggestion. I think we can assign it to Tom and to --

(Laughter)

CHAIRMAN CANTLON: Let me just pursue that one a little. There clearly are over the world analogues, geological analogues to the problem that uranium has been around a long time. Some of that has moved. Some of it has even accumulated and had reactions.

Similarly, in terms of container age and so on, Ellis has commented, and maybe, Ellis, you ought to be developing this question.

I'd like to, in a sense, set the stage for some of the future speakers. Do you want to pursue?

DR. VERINK: Well, it's certainly well known that there are a number of native metals which exist in nature, and the environment in which they have persisted over geological times could provide useful input in the sorts of engineering treatments that could be placed around canisters of materials of this sort and provide not only an instructive way of getting at the problem, but a chance to give a longer-term context to the solution.

MR. DUDLEY: Well, I agree fully with that. I would put that in the set of "in general." It's going to be what we would call "outside information," and that's where it would undertake a full characterization of the

sites and the mineral occurrence and things of that sort.

So that the admissibility of it becomes somewhat difficult. That's certainly a worth of mine. It becomes, in a sense, a calibration tool for the overall results of our predictions.

DR. VERINK: It also guides the kind of research necessary to see what's involved in --

MR. DUDLEY: Right.

DR. VERINK: -- reproducing that circumstance.

MR. DUDLEY: Yes.

CHAIRMAN CANTLON: Bill, could you give me a kind of feeling for what portion of the USGS's total activity -- the site characterization and so on -- amounts? Is this 10 percent or less?

MR. DUDLEY: Of the total USGS?

CHAIRMAN CANTLON: Right.

MR. DUDLEY: It's less than 10 percent, I think.

MR. HAYES: I think it's closer to 4 percent.

MR. DUDLEY: Four percent?

MR. HAYES: Four.

MR. DUDLEY: Yeah.

Not an insignificant program.

CHAIRMAN CANTLON: No, I understand that.

DR. NORTH: Since several of the specific questions, I was going to ask -- it's already been asked.

I think I will try to make a rather extended comment to summarize.

I'd like to commend you for your presentation. I think you showed us a clear view of the problems and the direction in which the whole program needs to be moving, especially the earth sciences component of it. But I think many of the things you said extend to other areas as well.

We will hear from the subsequent speakers on that.

But it all motivates me to pick up from the introduction that you were given by Larry Hayes, that we shouldn't conclude that the patient is terminally ill.

I'm reassured -- and I don't believe that, in fact, the disease is terminal. But I think the patient is sick enough to motivate, find a good medical care and proceed immediately to treatment.

(Laughter)

It sounds like that process has started with the workshop that was described yesterday accomplishing an important diagnostic stage.

There's a lot of treatment that needs to be done, and perhaps some more diagnosis focussing on some details, like what are we going to do about model validation and QA of computer software.

I'm delighted to hear my line about cultural transformation picked up because I think that may be the

essence of this whole problem. It's not a matter of details. It's a matter of getting the big picture focussed properly and the reorientation to do that. And I thought your presentation demonstrated that quite admirably.

You described in one of your earlier slides the points made by the National Research Council in their report. Two of these that you had under your third bullet, Alternative, I think, are particularly important, and I will note that I believe that this Board made those points also in their first report to Congress, which was released before the NRC report came out. And those were the issue of: broad goals, assessments of all the performance.

When we started out, we found that performance assessment was more or less at a standstill. Not much had been done, if anything, since 1986 when we were in the process of site selection. And it needs to be restarted.

Now, a lot of that is under way. And moreover, it is under way in a series of task force efforts that are trying to understand the major uncertainties and risks, point 3 under Alternative, and the science and priorities to these.

I would hope very much that as that exercise proceeds, it is going to be seen as very important information for how to reorient QA. And likewise, as those people proceed, I think they ought to pay a lot of

attention to what QA is trying to do and learn from the other side. So that's an interaction between the parallel paths that you were describing, which seems to me extremely important.

Now, yesterday, we heard from the EPA people as they described their QA program, and they made the point about trying to determine what sort of accuracy you needed in your information and what decisions that information was needed to support. And it seems to me that this is an extremely critical point and one that bears directly on questions like: What do we want to do about model validation and how might we do it? Should we just rely on professional judgment? Should we attempt to take advantage of some natural analogues or experiments and see, for example, whether some of these very complex geohydrology models do reasonably well against natural analogues? I would submit that that kind of activity might be extremely important.

And I hope that both the scientific integrators and the QA people will look at it very hard and, moreover, that they will talk to each other and see what they can learn mutually from each vantage point that will help the other.

So I would welcome your comments, and I hope that some of these points will be picked up in the subsequent

presentations.

CHAIRMAN CANTLON: Yes, Don.

MR. HORTON: Don Horton, DOE.

I guess because I'm in QA, I'm overly sensitive to this. But rather than saying or asking how many people were driven off by QA, how many people were driven off by closer management control of their work?

MR. DUDLEY: I thought that I had included that in my response, Don, and I certainly meant to.

DR. CARTER: Don, that's just a euphemism you're using.

(Laughter)

MR. DUDLEY: I would agree. You don't have to take the blame for everything that happens.

CHAIRMAN CANTLON: All right. Thanks very much, Bill.

Let's move now to the laboratories, and we'll start with Livermore. Les Jardine?

MR. JARDINE: Are we ready?

CHAIRMAN CANTLON: Yes.

MR. JARDINE: It's a pleasure to be here again and have an opportunity to talk this time about the Quality Assurance Program and the experiences that we're having in implementing it at Livermore.

Before I move into those kinds of discussions, I

think I want to echo -- and this is what Larry said -- in the sense that I have a lot of faith that the workshops that are taking place -- especially the October one -- is a very useful format to do that. And I have high hopes that that will continue, and I'm looking forward to using that as a mechanism to implement some changes that are needed as we learn better how to do this job of applying quality assurance.

And the talk that I'm going to give is I'm going to focus on the last two fiscal years of work that we have done at Livermore which reflects what I believe is a successful implementation and a culture change by a large majority of the scientists at Livermore to accept the program that we have implemented at Livermore. And I'm going to show you some of the reasons and the philosophy that we have used to implement it, to assist us in the culture changes and the implementation. And I'm also going to touch on some of the difficulties and sticky points that still remain.

Now I'm going to give some specific examples that will show you some numbers for schedules and things like that from which conclusions could be drawn.

So to do that, I'm going to break it into three different parts and give you some general information on our implementation, and it will touch on the basic approach

or philosophy in the policy-type things that we're using to implement the program. And I have to touch on the history so that it's clear to you as to why we're focussing on the last two years of experience and implementation.

Now, the second part will move into specific examples of implementation. It will touch on the training.

It will touch on the cost factors that we are experiencing and other specific topics.

And then I'll end with some final remarks.

So let me move into the general type of philosophy and approach that we're using there. Let's start off with this one. You could regard this as a policy statement or a philosophy, that the achievement of the quality is the responsibility of line management and the individuals doing the work. And we recognize that, and that is really the quality and how you're going to achieve that.

The second bullet, the Quality Assurance group, is a subservient to that, and it's basically responsible for defining and coordinating the Quality Assurance Program, and this involves the monitoring, auditing and reporting back to the management of how well we're doing in implementing the policies and procedures that management is the one that approves and puts into place.

So the last bullet, the Quality Assurance Program

includes all of the activities of the individuals performing the work as well as those that are associated with the quality assurance functions of the program.

So it's nothing but a general policy statement, but there is a key part. It is the quality is associated with the actual individuals, and it has to be those doing the work, the scientists and engineers, in order to have the quality into the product.

DR. CARTER: I'd like to comment, Les. I think what I'm saying is there is a great parallel, as far as I can see, in the safety program, radiological safety in particular, with what you're trying to accomplish now in the QA program, and that is that safety is everyone's responsibility. The manager may be ultimately, but everyone has a role to play in safety. And I think you could build that into the QA the same way on a parallel basis.

MR. JARDINE: Another way to say it is that you can't use the process or the procedures to build quality in. It has to come from the bottom up, and that's the actual people, the actual scientists. You have to understand how they're doing their job so you can reproduce the work in a way that they can accept, and both parties have to give. And I think we've made significant progress in our laboratory identifying how to control our

environment so that the majority of our scientists are able to achieve that.

DR. CARTER: But you really don't need to focus it on scientific and research people. Everyone in the organization, as far as I'm concerned, has a role in quality assurance. It doesn't matter what function or what job they have.

MR. JARDINE: No question. And I agree with that.

What I've got next is two viewgraphs that really reflect what summarizes what were key parts of why we believe we were very successful in the last two years in changing and reproducing the culture change.

The first and probably the most significant really was to have the top management commitment to quality and quality assurance and recognize it's the highest priority. And what I mean by that is that my boss whose boss is the department chairmen and other people had to seriously say we are going to implement quality assurance and since say that that responsibility is down to the line management, "But everyone, let's get serious about this and implement it," and that is a very important part that the highest level of management has to take it seriously and has to pyramid down. And that's really what I mean by that, that the responsibility will rest with the project

and the line management that's associated with it.

Similarly, sufficient resources have to be committed to do that, and we did that in the fiscal '89 time period, and significant resources were consumed in order to redirect and bring in the technical and line management to develop the Quality Assurance Program. It was very important.

The third -- next -- the technical managers who are assigned active roles in the development of both the technical and administrative procedures that were part of our program; in other words, that's called group leaders for this discussion. They were given specific assignments, "You shall oversee the records system." And they did that in order to have this responsibility assigned to different key managers in our organization.

The training, document control and records were assigned to experienced administrative staff. Prior to the two years in the past, it was assigned to Quality Assurance. We set up and delivered the functions and recruited appropriate experienced people to develop those systems.

Experienced QA professionals were procured through subcontracts, and we used those to assist us in developing our program. And by that, I refer to people who have nuclear power-type experience.

CHAIRMAN CANTLON: Before you take that off, let me press you on bullet no. 2 and bullet no. 4. In organizational management, typically you'd have other words assigned to those two bullets. One would be that the performance of your line managers actually would have as part of their performance assessment the extent to which quality was, in fact, an integral part of the way they did their management acts.

Down on bullet 4 -- again, the same thing -- the way you manage technical managers, you'd have to have in their annual performance analysis how well they can document what they've done in active oversight.

Is it just missing from the thing?

MR. JARDINE: No. Especially in fiscal '89, it was very true that my boss and the department chairmen solicited opinions from the staff as to who contributed to the turnaround. Those people, I suspect, received additional input into their performance evaluation which resulted in something probably.

CHAIRMAN CANTLON: Yes. You're rewarded.

MR. JARDINE: Yes. But the point is, that again, it was the top management starting with the Associate Director of the laboratory --

CHAIRMAN CANTLON: Right.

MR. JARDINE: -- and department or division

leaders.

Continuing on this theme is the key things that were important in recognizing the implementing. The procedure preparation was assigned to the experienced technical people and the management staff. It was not done by an outside organization.

We did utilize the nuclear power consultant-type people. We worked and lived with them because we had to have that experience. But we had to write the procedures to the way that our culture was and the way that business was done.

Document control, logging -- or document logging and control system was improved and effectively used, and this included a prudent action tracking system with one common database. So that we continually know where we're at on a daily basis, and certainly, on a weekly basis, that's reviewed by management with all the key managers.

Simplified change notice process was implemented so that as we uncover operational difficulties, we can change a procedure and not have to go through a lot of hoops to a lot of signatures. We recognize that because we knew we were developing a program over these last couple of years.

The training activities is tailored to the specific responsibilities and -- let's call it -- abilities

of the staff. We didn't abuse them and force them to go to classroom training if it was appropriate to have a read-and-sign procedure as a way to pick up the way the procedure should be implemented. Again, recognizing the culture is a key part of implementing the program.

Again, procedure writers were assigned to assist the line management. This is referring to the use of outside people. So that actually the technical people and those doing the work were the ones that were accountable or developed the procedures that we have put in place.

The last one here, readiness reviews are a process that we used by management to do a final check -- are all of the prerequisites in places? -- before we authorize or allow the work to start.

So those capture, in some sense, the key parts that we found to implement our program.

I want to put one up here on this topic. This is a listing of specific responsibilities that we assign to the Quality Assurance group or staff, and it's intended to reflect that they do have limitations. And there is a couple key parts that the Quality Assurance staff really only assist in training. They're not the ones that are doing the training. When it's necessary or when appropriate, we bring those people in to assist in the training.

Similarly, in the preparation of procedures, it's not the Quality Assurance staff that does that. Rather, if they're appropriate, we ask them to help. But they do not take the lead in that.

The rest of those things, I think, you can read. But those are a couple of points that I wanted to make to distinguish that we do that.

One other comment is that we use people with quality assurance backgrounds and assign them to the technical groups. We call them Quality Engineers. The philosophy there is that they will become one of the technical people to be trusted by the scientists and engineers and work with them to follow the rules. And this overcomes some of this audit-type person where a newcomer comes in to look at how well you're following the procedures. But this is a common practice in some of the nuclear industry -- at least in engineering-type organizations.

I want to move to this slide, and I have to give a few comments about it. It's intended -- what I originally intended to do was make a hierarchy of what is the flowdown of how the requirements are set, similarly to what Bill Dudley's slide was. But I gave up on trying to present this because I'm convinced I don't understand how to draw that. And I want to use this one to sort of talk

around the problem, and Bill's is a very good draft. We saw one from Ken Hooks yesterday, a similar-type thing.

But this is where the confusion starts to come in, and we've been very careful about trying to develop a Quality Assurance Program and implementing procedures which are restricted to the quality aspects. And we have different kinds of procedures that are outside of our Quality Program that deal with administrative things, internal laboratory management policies -- such as how you get a document number to a Livermore report, which is not a Quality thing. That is not in one of our Quality-implementing procedures. Those are laboratory- or management-type things. They're different.

We have carefully structured our program and our procedures to recognize that and not bring in extraneous things.

But let me go back and say that our Quality Assurance Program derives from sources -- from the Nuclear Regulatory Commission as well as the DOE and, of course, the -- it's intended to reflect what is really driving our program right now, which is this document, the Quality Assurance Plan 88/9 Rev 2, which shortly will be replaced when we receive that direction by this QARD that you heard about. We're still complying with this document. This has the source with the most details, and it's the most

constraining out of all these different documents. But it tends to drive what we have in our upper level Quality Assurance Plan document. This single document will have to go through a replacement and adjustment to our program as we're directed to implement the new QARD.

DR. CARTER: Les, let me ask you a question. That DOE Yucca Mountain project, the QAP, now, is that a stand-alone kind of thing or do you find yourself having to go back and look at QA-1 and 10 CFR 50 Appendix B and so forth or does that thing pretty well give you everything you need to perform a program or operate a program?

MR. JARDINE: Well, that is the driver of the thing. It has the most volume, the most words and the most context and the most appendices. And so it's a source -- you know, it's the compelling driver in our program right now.

DR. CARTER: But it's not so sufficient or stand-alone. You need other things.

MR. JARDINE: You have to be consistent with, you know, all of these things, and you can look at the slide that Bill Dudley used. There are these hierarchy of things and requirements, flowdown that you have to comply with. But I'm just making an observation that we're lined up. How we're doing our business starts at the top, and we construct a Quality Assurance plan, which has been approved

and accepted. I'll show you that. And then what we do is we structure implementing procedures as to how our groups do their work. This is intended to represent the technical disciplines that we have working on the project and support organizations that are a part of our project.

One thing is there is a question about other people's procedures and the project's procedures. We don't incorporate them directly into our implementing procedures.

We look at them and extract information that's relevant and sort it into management or quality and write a procedure that allows us to do our work.

So we deliberately try to structure a quality program and implementing procedures that reflect what we think are the quality aspects. We have other kinds of procedures that deal with management issues and laboratory internal policies.

CHAIRMAN CANTLON: Do the QA people from the various labs that are participating in the repository get together and compare notes on your implementing procedures?

MR. JARDINE: Do --

CHAIRMAN CANTLON: Do you get together and compare notes?

For instance, if NRC wants to look at all of the providers who may have provided services on the organization, are they going to have six or seven totally

different systems or does your QAP-88 give you enough homogeneity so that at least the DOE labs all look pretty much the same with modest differences?

MR. JARDINE: I don't know. I mean, I could ask my QA manager to answer that.

CHAIRMAN CANTLON: You just don't know.

MR. JARDINE: Or else I can ask David to give you an answer to that.

CHAIRMAN CANTLON: No. I just want to find out whether it's a thought that's crossed your mind.

MR. JARDINE: Listen, I'm not sure I understand the question. That's part of my difficulty.

CHAIRMAN CANTLON: Is there a regular --

MR. JARDINE: I'll let David take a shot at that.

MR. SHORT: David Short.

MR. JARDINE: But I think David is the one who is responsible largely for really getting our program in place, and he should be the one to answer that.

MR. SHORT: Our Quality Assurance program --

CHAIRMAN CANTLON: Is the mike turned on?

MR. SHORT: Our Quality Assurance Program Plan is based entirely on '89. That is the DOE -- (inaudible).

What we do with the other participants is share information on how we meet the requirements of that plan, and each of our implementing procedure, of course, is

geared around the culture of that organization.

What we do though is reflected in the requirements in a way -- (inaudible).

MR. JARDINE: Yeah. And that's where it's important that we're able to sort it out, and then we have to communicate it up to our -- to the project office as to how we are satisfying their requirements. We work at trying to separate things out into management and quality.

MR. WILLIAMS: Les, before you take that slide down, I have a question. Where do you get these people who do these procedures? I'm kind of ignorant in this subject.

Are there universities that graduate QA people? Are there degree programs in the QA for people that produce these?

MR. JARDINE: I was told at dinner -- and someone may want to correct -- that there is no university that offers such a degree.

So typically, quality assurance people are technical people or someone non-technical that has learned quality assurance by working on the job in some organization in a quality assurance umbrella. And that's how people become quality-assurance experienced -- in some kind of a previous life, but not a degree in quality assurance.

MR. WILLIAMS: There's no such thing as a license in quality assurance or anything like that?

MR. JARDINE: Maybe the NRC or someone could correct me. But my understanding is that I don't think there is.

There's Tom. Maybe perhaps --

MR. COLANDREA: Just a point of clarification -- Tom Colandrea, Edison Electric Institute.

There are a few colleges that do offer degrees in quality technology, quality assurance technology. It's not universal.

As Les said, many people do grow from other technical-oriented professions or, in some cases, non-technical into quality assurance -- electrical engineering or engineering, et cetera. It's more of a trend that way today in the utilities to interchange from line organization into QA.

As far as professional licenses, yes, there are several sources of professional recognition for a QA person. One is the State of California has a registered professional Quality Engineer, and that is a sign of accomplishment.

Another one is the American Society of Quality Control as they certify Quality Engineers and certify Reliability Engineers, both of which are an exam and experience-oriented credential.

DR. CARTER: Let me make one other comment about

this. Certainly, a number of universities and colleges offer specific courses in Quality Assurance or various aspects of it.

MR. JARDINE: But typically, you're better off -- at least in my past experience -- to take a technical person and put them into the QA organization in some junior position, and then some of them like it and will continue. Then they will become the graybeards in that organization.

(Laughter)

But the difficulty is you don't want to make them a graybeard before they serve their time because in an experienced operating nuclear organization, that's very important. They learn some fundamentals.

CHAIRMAN CANTLON: They like it or they tolerate it.

MR. JARDINE: Yes. And that's really what it is. I've seen people in and out.

CHAIRMAN CANTLON: Right.

MR. JARDINE: So let me switch now to talk a little bit about -- because I'm going to show you later some experience in terms of these things. It's the way that we deal with the planning of the work that we're going to do and how we believe flexibility for ourselves to do our operations and then, we would like to think, so the scientists can take some maneuvers as they go into the

scientific process and have to make adjustments.

This is intended to represent that in our program we produce some study plans, which you've heard about, but also some scientific investigation plans, which reflects work in general that's not site-characterization activities. So a lot our engineer-type work is not directly tied to that. Although we have study plans that deal with the near-field environment in part of the site characterization.

These are the kinds of documents that have to -- but are required to be submitted above us for some kind of a review and approval.

We implemented a thing called an activity plan, which is a document which is a little more detailed of how the work will be conducted, and it's an internal document that is within our control and our approval. It's a more detailed plan, and it doesn't require any outside submittal.

Under that, there's an option. This is describing the work that's going to be performed. There's a choice, as you heard several times yesterday, and the staff can develop, if they know thoroughly where they're going, if it's a preparation of a specimen for a technical implementing procedure. It's within our control and approval. And we down-delegate that to the appropriate

level. We don't try to bring everything necessarily clear to the top.

They also can write -- or instead of technical implementing procedures to conduct the work, scientific notebooks is the biggest build-in of flexibility that is available to the scientists to conduct this work, which is laid out in different levels of detail, and there is variation among the different technical people, and we allow for that or accommodate for it because there is a difference in some of the corrosion testing versus some of the hydrological testing.

CHAIRMAN CANTLON: All right. Now, what would be the audit track? It would be from the left to the middle to the bottom or the middle would be -- the scientific notebooks are auditable by the QA?

MR. JARDINE: Yes. Yes.

CHAIRMAN CANTLON: And the study plans are. But I take it cutting across the other way would not.

MR. JARDINE: In general. No. I was referring to -- maybe I shouldn't have. But I made a comment about a review and approval of certain documents.

CHAIRMAN CANTLON: Right.

MR. JARDINE: That's one thing that these are required to be reviewed and approval under the 88/9 from the Project Office.

There has been some changes that are going to be made as these things no longer have to be approved by the Project Office, the QARD. But we're still subject to that.

Now, when you audit, if we have written these into our procedures and our Quality program, as we have, we have a procedure that requires activity plans be written. That is auditable. We have a procedure that deals with scientific notebooks. That is auditable. It requires page initials. It's a witnessing.

CHAIRMAN CANTLON: So everything there would be subject to audit?

MR. JARDINE: Audit, but to the detail that we put into our procedures, and we -- our quality procedures, and we have kept some stuff out of there that we do not mix where we can avoid it, management things with the quality parts. And that's the part we're working on and continuously communicating with Don and his staff, as we try to explain how we are satisfying both the quality requirements and management requirements.

Now, this is intended to summarize. Again, we can set the tone here. It recognizes that in the last two years, starting with '89, there was a DOE audit at the start of fiscal '89, which was not very positive, and it resulted in both the Livermore staff and the management doing a self-assessment, which resulted in a serious

commitment to take the implementation of quality assurance seriously and resulted in the line management -- the highest management taking effort and commitment seriously, and it was a redirection of the staff from the top as well as the bottom. The staff really wanted to do it, and they proceeded to put on their track shoes and implemented a program, such that when the first audit was done in the June time frame of '89, it was passed without any findings.

A significant turnaround, but again, from the bottom up and also the top down, the highest level of management.

Then we did get a software QA program plan approved in December of last year in '89, and we had a second annual audit this summer again, which basically has resulted, as I'll show you later, in accomplishments of the full acceptance of our Quality Assurance Program at our laboratory by both the NRC and the DOE.

So that's a little road map to say that quite a bit has been done in this past two years, and we've learned a lot, and we certainly have a lot of discussions with one of the TPOs -- at least I do -- on how we do things, and I hear things where I know my QA manager is talking with the TPO manager, and they're sharing successes and failures so that we can all learn together.

CHAIRMAN CANTLON: The second annual audit was a DOE audit as well?

MR. JARDINE: That's correct. And in both cases, the NRC and the state were there as observers.

Let me move into the second part here of what are some key -- and give you some specific experiences on the topics that involve some general things, surveillance and audit, s planning, management, training and QA and costs.

In fiscal '89, the major accomplishments that were the start of this turnaround -- not as our plan that was approved in February of 1989 -- we had 38 quality procedures and an administrative system, which has these other kinds of procedures in them. We trained our staff. But we also developed/approved subcontractor QA programs at two other national laboratories in this fiscal year.

And we really started our first technical work in full compliance with our Quality Assurance Program in July of '89. Prior to that, we have this question. We were not fully up to speed, and this was right after our audit.

We have a program that does surveillance and audits -- and this is just a number count -- the internal means of things that were within our own program within Livermore, and the external means when outsiders, if you like, came in a looked at our program.

Is that correct?

MR. SHORT: We were not -- (off mike).

MR. JARDINE: These are the audits that we

performed on our subcontractors, the surveillance and audits. These were the number that we did internally to look at how well we were doing ourselves.

DR. CARTER: What's the distinction between surveillance and audits?

MR. JARDINE: I would ask, if you like, David to answer that because I'm not qualified.

MR. SHORT: The audit is a very formal way of --

CHAIRMAN CANTLON: Would you identify?

MR. SHORT: David Short, Livermore.

The audit is a very formal process of looking at the accomplishment of work and checking the compliance or conformance with written plans and procedures.

Surveillance are more an observation and a real time of how work is being done. We do go back, of course, and have to look at some historical things. But it's kind of a in-depth review of the work.

They both have qualified auditors present, both surveillance and audits, and result in framings of adverse conditions.

MR. JARDINE: Sometimes surveillance are very narrow and pick on one piece of your 18 criteria in your QA program. An audit tends to look across the whole spectrum.

This perhaps is another way to view it. Surveillance are done more frequently. You come out one week and look at

records. You come out another time and say, "Well, we're going to look at the scientific control process," and that's all.

DR. CARTER: So it's a modified or constrained audit. Is that correct?

MR. JARDINE: Don? I mean, I just don't want to say. Again, I'm not qualified to do that -- judge that, and he shook his head yes, for the record.

The second part here in fiscal '90, this represents that under our QA Program plan, it was accepted by the NRC in October, and I mentioned DOE accepted it in February of '89.

Another topic, our QA program -- not our plan -- was accepted in writing by the DOE in March of '90 and that in August of this year, our program acceptability -- meaning that the NRC had also fully accepted that -- was in August of this year.

We also have conducted internal audits and external audits and surveillance in this fiscal year. I want to talk a little bit -- not too much -- but show you some of the results of the audits and surveillance, in a sense, focussing again on '89 and '90.

The blue here tends to show, in my mind, the internal -- our Livermore Quality Assurance staff's number of findings. It tends to be relatively constant. The red

here is from outside DOE surveillance and audits, and you may see that there was a significant increase in perhaps a number of those findings or the number of audits and surveillance.

But just to make the point that we do find these things, these are good. The management wants them. I want them. We look at this, and we make adjustments to our program. That is how a manager views the results of quality assurance audits and surveillance in a very positive way.

CHAIRMAN CANTLON: Findings are all negative?

MR. JARDINE: Yeah. These are the way we plotted the data here. They're all negative.

And I'm not saying that everything is positive. But I mean, this is what you do. It identifies something.

It may be very frustrating to try to argue that the finding has no real merit. But the management wants to -- because what you look for is trends, and we find some trends, and we make adjustments in our program.

This last year, we found that what happened was that it takes a while to get a document reviewed. We could not find some comments on a technical report that took a year and a half to get through the review and approval process because the scientists had left the program. It got lost.

Well, we changed our procedure. That's when we internally review and approve it. We turn the records package into our record center. So that was a trend that was identified in the audit of this year. That's a positive example of how you look at it. You analyze it.

Basically, we still have three study plans under development, and we have 12 scientific investigation plans that are either being used, and four are still under development.

These activity plans, some are completed and some are still under development, just to give you a feel for the numbers.

To get down to the choice now, do scientists know enough to write prescriptive implementing procedures within our control or do they want to go to the scientific notebooks? I think this trend shows you that, generally, a lot of notebooks are out there, and we have not really completed or turned in any of them, which was a little surprising preparing for this talk. I need to look into why none have been turned in if someone has left the project. It may not be a problem.

But this is just to show you the trend. Similarly, we have software quality assurance documents, which are another thing. And in terms of our technical reports and papers limited to this fiscal year, we have 32

that are out of the system and 18 are in different phases of the release process. So we're able to do things and get some things out of the system, and we get hung up and it takes some time to do that. But we are getting things through our system and making changes to our procedures to make it more efficient and effective.

DR. CARTER: Les, do you have any specific information on the technical reports as far as the ones under development, how long they've been in the system from the time they entered the review process or whatever?

MR. JARDINE: Well, as I mentioned, we have a document control and tracking system, and we have all of that data, whether you need a number assigned to it, and all that's available. Yes, we have it. Just like Don said, we have the statistics. It's part of the way we implemented our policy, if you like, to do document control.

DR. CARTER: Well, if it's readily available, I'd certainly like to have a copy of it.

MR. JARDINE: I'm not sure what -- you need to probably clarify what you're looking for.

What we do have is -- you know, like I have a reports manager -- or not manager, but a reports coordinator. One of the things we have is the database, which is tied back to our system, which has the history, if

you like, of the document from the day it's turned in from our internal review, which shows it's hard for us to do our reviews ourselves because we have two reviews and certain hoops to go through, and then it goes to the next level for a review and approval, and it may come back. We have to fix it. Then we submit it back. It goes through these different loops. So that all that information is tracked in the way we structured it.

DR. CARTER: Well, I guess that's what I'd like to look at.

MR. JARDINE: Could you limit it to fiscal '90?

DR. CARTER: Oh, yeah.

(Laughter)

MR. JARDINE: I think you'll find that that's much more realistic. It's current, and it's also probably -- you know, it reflects the current things, that changes are being made.

DR. CARTER: The record looks better in that period. I understand.

MR. JARDINE: Yeah.

Well, as Dave said, some changes are being made. But there's still -- I mean, the 18 on there --

DR. CARTER: Well, you know, you can talk about delays and reports in the process and they get hung up, this, that and the other. But until you're specific, that

really doesn't help a lot.

MR. JARDINE: No.

DR. CARTER: I'm interested in the time it takes the paper to clear the system.

MR. JARDINE: You'll find it's highly variable. There is a trend there, and it's changing.

Now, I want to make this point because there's this thing called management assessments, and you may have seen it yesterday in a couple of places. But we take these things very seriously. They're part of the Quality Assurance Program. And what it means is that my boss asks someone not on the project to come in and take an objective and critical look at what the Quality Program is doing and write a report, and it's an annual requirement.

I've summarized for the two years what the major conclusions or recommendations were out of this. And again, they come around. They talk to the staff. They talk to the line managers. They talk to myself, and they formulate opinions.

But in '89, they concluded that they needed to perform another one of these assessments after the program was implemented further, you know, in terms of the technical areas. To continue this dollar trend analysis of the program cost is a very important thing to build up the statistics, and I'm going to show you that in a minute for

the last couple of years.

To close more fast or more quickly these findings that I showed you -- they were tended to drag on and take a long time.

In '90, the recommendations were to -- rather than play with the words, I took the words out of the report. So I can blame this independent review -- that it was "to press the DOE for more timely turn around of project documents." Again, remember they're going back to the grassroots and finding out what the scientist's problems are and concerns and filtering that to some degree. Then to work with the DOE to ensure that the QA requirements are workable, appropriate to the R & D and stabilized, and again, this is repeated. Let's get these findings identified, closed and worked more fastly.

And I know Don hammers from his end to get this fixed down to us, the participants. So we're receiving it on all ends and are working to try to do that, and we've had some problems that hung around because of calibration lapse. We had some difficulties in changing the way that instrument calibrations were done. It took time. We had to change the way the laboratory did its business in order to satisfy and remove some findings for this program.

Now, on the subject of training, some statistics, for whatever they're worth, but perhaps to point out that

in the fiscal '89, we had large classroom sessions because we implemented this new program. And we shifted in fiscal '90 to basically read and sign as opposed to classroom sessions. You know, we recognized people could read, and that's a more efficient and a more better way, really, to get the information to them.

And in terms of staff trained, basically, this is the number count that's in our record system. That's why it shows 147 people in that year and a total that had gone through to read and sign different things. It was 160 in this year.

And then perhaps touching no one of Mel's questions, it also showed the number of staff who left the project for one reason or another during the year counts, and it was 17. And this is a partial year only because we really can't be serious about our statistics until the mid-fiscal '89 time frame. And then in fiscal '90, there was a total of 39 that left our project for different reasons, and you should not infer that these are due to the commitment. It's a combination of other opportunities, budgetary adjustments to line up the work scope, and it's a combination. But those are the statistics that are associated with our training files.

Let me move on to software. I've got one slide on the software. And basically, I'm saying that we did get

our plan approved in December of '89.

The approach that we're taking to this is that rather than write procedures, since we believe internally we don't know how to do software quality assurance, we're writing and developing what we're calling guidelines because they will not be subject to an audit. It's how to deal with software and the large codes that we've got.

As we write these things and issue them and use them, then we're going to learn from that and then develop and issue as procedures, and we're moving where these guidelines have been issued. We have a computer specialist, if you like, or a professional person that's developing our software procedures. So this is the approach. It's a two-step phased approach to understand what are the procedures we really want to apply to our software.

And we're conducting the training of the people in the software. And this is basically software engineering. We're struggling with the decision that will ultimately come as to how much do we have to spend in resources and training people to do good software engineering, and that gives you quality, versus write a procedure, and that will give you a good product.

My software QA manager is in favor of training people and teaching them to do good software quality, and

that will give you a good product. But the program, on the other hand, wants documentation. So we have not yet gotten to the point where we have to make that decision, how we're going to balance those two. We're really getting our scientists involved in working with them to really try to understand how can we write some procedures ultimately that will allow us to do our business and not stifle, like the global climate R & D code that we have. We have a couple large codes that we've been using. And the one that most people perhaps know about is the EQ-36 code that's been around and has thermodynamic data, probably tens and tens of years old in it, in the database.

Let me move on to cost in terms of our implementation cost, and I'll have to explain a little bit.

I've shown only for the last two years -- and there's a thing in this pie chart that's QA direct cost, which is 12 percent. But the total budget that is in the Yucca Mountain Project here, you would have to add the 18 plus the 2.4 to get the total. But I divided that total cost for '89 into two parts.

The QA direct cost, I'll show you in the next one what that is. But that basically means when people fill out their time cards and they have a quality assurance subaccount for which we can approve and roll up the cost. That means it's the Quality Assurance group and the staff.

That means it's only allowed by the technical people in the part of an audit, for instance. It also includes the calibration labs, the people, because we've had to do extra things in our laboratory to comply with calibration of instruments. We have a significant cost item for that.

The fact is -- well, I need to make another point before I break down what that is. It's 12 percent of things that I guess I would define as, you know, the baseline things that you could ascribe to quality assurance directs.

When technical people are doing their planning documents, they do not roll up into that account. They charge their technical task. So they would appear down in this part of the budget.

So perhaps you could read this that the minimum or the baseline is 12 percent, and Hooks used a number yesterday of 10 percent, Don Horton, 15 to 16 percent. These are the numbers.

In terms of further breaking down how that 12 percent is distributed in both of those years, again, the QA staff is about half of the 12 percent. This includes our outside expertise that we bring in and build into that account.

The technical staff, again, decides -- if they're participating in an audit, one of the things we do in our

internal audits and surveillance to assure the independence, we go to other parts of the laboratory and bring a scientist over to be on part of the audit or surveillance team. He charges his time to that, and so that's what's part of this 36-percent breakdown.

DR. CARTER: Okay. All the costs we're looking at are direct operational costs in that sense.

MR. JARDINE: That's right. These are the direct that you can -- we can identify with our accounting system and our time codes. So these are real -- probably what you'd call real quality assurance operating costs.

The reason the calibration labs are on there -- I said it several times -- is that we've had to put things in and require extra things because of the Quality Assurance Program above what the standard laboratory practice was. But we've had to pay for that and develop some additional procedures in our calibration labs so we can comply with the requirements that are coming above, and you can add those two up and say basically we've paid a half-a-million dollars over two years to bring our calibration capabilities within the laboratory up to the requirements.

Before I leave the cost though, this thing about cost ranges, I want to clarify in the record. From the January 18th time frame, I think I stated -- I didn't think. The record says I stated 25 to 40 percent as the

range of Quality Assurance cost that might be ascribed when pinned to the wall by Mel Carter in the third go-around, and I refused the first two times.

(Laughter)

And that was sort of a top-of-the-hat judgment at the time, and I think reading the record again, what was not clear in there is that that was an estimate of the start-up cost that 12 to 40 percent -- 25 to 40 percent, which was what I said, really reflected a judgment that was, you know -- the record did not cleanly say it's part of the start-up-type cost. And I think the data I showed you today, at least the 12 percent may be ascribed to the direct quality assurance operating cost. That's in the fuzzy area of how you deal with the planning activities and the replanning activities and how you want to rack that up as we develop the program.

CHAIRMAN CANTLON: Do you think that captures all of the investigator time that's put in?

MR. JARDINE: I do not want to comment on that because it would require a lot more sophisticated analysis. It would be very difficult to extract a more refined judgment.

But you have to define what is it you want me to encapture and add to those 12-percent direct costs?

The other thing is that the budget change went in

a downward direction about 30 percent between those two years. Yet the quality assurance direct costs stayed constant.

CHAIRMAN CANTLON: Some of the investigators have reported to us that it might be on occasion 60 percent.

MR. JARDINE: Well, again, you know, the difficulty we have in this program is -- I'm like Don. I'm sensitive -- ways to find quality assurance, and then I'm going to ask you to separate into buckets. Is it a management thing? Is it a regulatory thing or is it an internal thing because you're a manager in the organization down in the chain? We have those three kinds of requirements, in my mind.

I have regulatory. I have DOE Project Office management, and I have my own management bucket. And those all contribute to the efficiencies and effectiveness of the way you do your work.

DR. CARTER: Let me make one comment on this. Of course, the question was asked, as Les says, back in January. Certainly, we have no problem with the answer that was given. There was no preparation. It was a spur-of-the-moment question and a spur-of-the-moment answer. You've got to give me an "A" for persistence so I at least get an answer out of you.

(Laughter)

However, the main thing that we wanted to focus on -- or at least I want to focus on -- and we're still interested in it -- is get people really thinking about the amount of effort, the level of effort that goes into quality assurance, and again, you certainly have to define what you mean by that process. But get some handle on, you know, what we are putting into it in terms of the sources and whether or not that level or those levels are reasonable.

MR. JARDINE: I think part of the problem we have is we're still learning how to implement the program, and we have to go back and repeat the preparational planning documents. Sometimes we revise procedures. And we're not going in a forward direction. This is part of what contributes to the staff unrest, that there is not a forward movement, and we're sort of turning. Are all those costs abandoned? That's the difficulty. Is that accrued to the QA cost? And that's the bad rap it gets, and Don is working at identifying the separation of those, and I myself am a big advocate to that.

So let me move to the conclusions of your here. There are some final remarks, and I really want to put just one slide, which is all I'm going use, to try to summarize, in a sense, what I want to say here. If I have to judge here what are our difficulties and our challenges that are

yet remaining to us, they are somewhat captured in these five bullets.

We have a tremendous challenge to come up with a workable and effective approach to deal with the software implementation for the R & D activities. We believe that we need some more relief in the QARD even that is out there. That may be a little contrary to what Don said yesterday. But then we're still sorting them. We have not had those opportunities yet to discuss where we need that relief. It's going to be a tremendous challenge to deal with the issue that Warner raised yesterday. It's an excellent example because it provides an example that all of us technical participants have to deal with.

The second bullet here is to -- as I've been saying, it's real difficult to identify and sort out and communicate what a requirement is and separate it as a regulatory requirement or a management requirement.

You've heard different examples. The one that I use, typically, is a requirement -- and I think it's a management requirement in the DOE plan that says in 10 days, thou shalt turn a piece of paper into the local record center. A regulatory requirement, I believe, would be worded that it is a timely turnover that's appropriate for that document into the record center. A management requirement, someone wrote in 10 days, and I think we've

identified that as an issue or as an example. Is the 10 days appropriate? It causes a problem if someone is on a trip for 10 days and an auditor comes along and writes them up. So we have to be careful, and we're working hard to identify the different kinds of requirements as management or regulatory so that we can negotiate or communicate them up above us to Don's organization and others to help them understand how they're imposing things in layer upon layers as it filters down, and we view that as a very significant contribution that we can make to help come up with a more effective QA program.

Another difficulty here is to deal with the frequent changes that are occurring in the upper-tier requirement documents. For example, the one new one that we're going to have to face and deal with is that the QARD, as referred -- as Don talked about -- has not yet been invoked upon Livermore and, I believe, the other participants yet. But we are operating to an older document, 88/9 Rev 2. So we will have to go through a process to do a matrix and show where the differences are between 88/9, the QARD and identify that we're satisfying the new QARD and, hopefully, negotiate some changes if we have some heartburn with that and then change our program accordingly.

And there are other documents lower tier that

this is happening, be it a management plan or a project procedure, that DOE uses.

I would like to make one comment that we use in our philosophy that I think is important to our success, and I didn't emphasize it. It is that the project procedures, the things that the Project Office develops, we receive those things, and what we do is we look at them and extract the requirements and write our own procedure. We do not take those procedures, which were written for another organization as to how they do their business, because we can't operate that way. But we certainly can find the requirements in there and sort them out and put them into our own words and our own procedure, and that's the way we deal with trying to make a workable system within our control. The fundamental rule is, in my opinion, the procedure you use should be written to the culture you're operating. You can't take some other person's or some other company's procedures and apply it in your other company. They just don't match. But the requirements can be identified, and you can write that in your own mind.

One of the rules that we use is that we generally reduce it in an order of magnitude and make it more concise and direct in identifying the requirements. It makes it more clear.

Fourthly here is to develop -- a challenge here is to develop a rational way to explain and communicate how we're dealing with data that we collected in the past when we've changed the requirements or we've changed the way we've done business. In other words, we have to have ways to develop transitioning old long-term test data that may have been going on for four or five years into the new QA Program. And there is methods available, the procedures and the NUREG documents that allow you to do this.

And it's also clear that if you keep a procedure that you used five years ago and when the auditor comes along, you can show him that procedure even if it's been superceded, and you cannot be written up for that. The point is you need to be able to show how you did your work at the time you were doing it. And so we're aware of that, and we're trying to deal with how do we, you know, make this transition of the old long-term tests up to the current -- the basic way that we're doing business in the QA Program is changing.

DR. CARTER: Les, I'm familiar in general that the NRC requirements in this process, basically, grandfather data and take old data in today's QA criteria.

You mentioned there's a process to do that. But has Livermore ever gone through that process on any substantial amount of data?

MR. JARDINE: No. We have not done that.

We have written a procedure which basically calls out -- is it 11? I don't remember the NUREG document that involves the process. But we have not yet applied that to some test case data and brought that up.

DR. CARTER: Have any of the other laboratories done that?

MR. JARDINE: No.

DR. CARTER: So this process has been talked about now for quite a while. Even though there's a procedure available to do it, it's not been done. I just want to put that in the record, if that's the case of fact.

MR. JARDINE: I think that when the time is appropriate, we should be doing that. It will probably be an interesting challenge to see how effectively that would work.

It's intended more for -- let's say data that was in 1950 and you know it's very good as opposed to how is it referring really to stuff that's four-years old and we are not -- it's not so clear that our recipe was or our procedures were that we were using at the time four years ago. It's more clear now. But it's we're continuously changing those things, and it's a difficult thing to deal with and track, and you have to have the right procedure saved in your record system in order to be able to explain

downstream of how you did your business. So we regard that as a tremendous challenge and a difficult one.

And then this last bullet is really intended to reflect and amplify -- and perhaps what Max Blanchard said at that pleasant meeting in August -- when we do the planning and then we lay out in our, say, activity plans, the work that we're going to do, then we have significant changes in the funding levels that causes -- we have to make -- where we were not flexible enough, I guess, and we happen to go back and make some readjustments. And so we find ourselves caught in this replanning exercise to change -- make adjustments. Some of the things that we've laid out, we were not quite clever enough to be flexible enough in our activity plans or scientific investigation plans to be broad enough to allow us, and sometimes the mission has changed. So we're caught in this replanning.

I think that's all I really intended to say.

CHAIRMAN CANTLON: Thank you.

Anyone have a burning question?

DR. CARTER: I just have a comment. I think that the detail you gave us on the QA has been helpful.

MR. JARDINE: Thank you.

DR. CARTER: We've got much more detail now than we had available in January.

MR. JARDINE: Yes.

CHAIRMAN CANTLON: We're running about 30 minutes behind here. Let's take about a five-minute break, and then we'll come back.

(A break was taken.)

CHAIRMAN CANTLON: Our next speaker is Tom Blejwas from Sandia National Laboratory. So how about it?

MR. BLEJWAS: Okay. Thank you.

I'm Tom Blejwas. I'm presenting the Acting Manager of the Nuclear Waste Repository Technology Department at Sandia National Laboratories. Tom Hunter is someone that many of you are used to seeing in that position, and my belief is that Tom will be back in this position in a few months. And from my perspective, having acted for him for a few months, I think that would be a welcome change for me.

(Laughter)

DR. NORTH: He's still around, but upstairs. Is that the situation?

MR. BLEJWAS: Yes. He's upstairs. Thank you.

I would like to mention that I have been on the project for five years. So I'm not new to this, and I'm not new to quality assurance. But I'll be giving you my own personal perspective of where I've actually worked a little bit more closely with the staff that have been implementing quality assurance.

But before I get into that, I'd like to give you just a little bit of background on our program at Sandia Labs and how it relates to quality assurance. I'd like to talk a little bit about the nature of our work, the philosophy that we've tried to instill in our Quality Assurance Program and how that's changed through the years, and then a little bit more history. So the philosophy and history will be a little bit mixed together.

First of all, we do a wide variety of work for the Yucca Mountain Project. For example, this is a plot showing the concentrations of a radionuclide away from the repository over thousands of years of time. This is the kind of work that we do in performance assessment.

We also analyze data and put that into graphical representations for the project.

We have programs in laboratory testing. This particular one is for a program in rock mechanics, looking at sample-size effects on the strength and characteristics of the rock.

We've conducted field programs in g tunnel. This one is from a mine experiment that we did in g tunnel, and we are planning to participate in this type of activity in the exploratory shaft facility when it gets constructed.

And an activity that we've been very heavily involved with in the past but are slowly attempting to get

out of is the design area. This one shows some waste receiving operations that we've worked on in the past.

So we have a large variety of activities: design, site characterization, performance assessment. And because of that, our Quality Assurance Program has to handle a broad amount of work, and it's caused us to do perhaps things a little differently than the other participants.

I'm moving now to the philosophy. I think several people have mentioned that in the ideal world, the quality assurance activities that you partake in on your program will be the same as the management practices and normal good practices that you do in your work, and it would just be a way of formalizing those.

And indeed, when we first looked at formalizing our Quality Assurance Program a little over three years ago, that was the thrust of our philosophy. And we tried to make these two circles overlap very much.

What's happened over those years is that the forces -- the external forces have caused us to push those apart, and so that now we have a lot of activities in our program that we would probably not be doing as managers at Sandia National Laboratories if it weren't for the nature of this program and the requirements of this program.

So the yellow area here has gotten much larger

over the last three years.

Now, a little bit more about the history of our participation. Early on we thought that we were leaders in this area, and we had to get educated in that. WE tried to make some thrusts, and I think in hindsight, it looks a little bit like the movie "Glory." I don't know how many of you have seen it. The final scene shows the people charging up against this highly fortified fort and just getting wiped out. Well, that's what our leadership felt like over the last few years or a few years ago.

So our program now, I think, does look quite a bit different than we attempted to make it look several years ago. I'm not saying that that's bad or good, but just that it is indeed different than we initially tried for.

That's partly because the environment has changed so significantly. As the Department of Energy has gotten a better grasp of what exactly they want for a quality assurance program, that's caused us to respond and change our program significantly.

There is one though net effect throughout the years, and that is that the effort has grown and grown rather substantially. And I'll get into that in a little more detail.

Before I do that, I'd like to just show you how

we're organized because, again, this affects our Quality Assurance Program. We have a central department at Sandia that deals with the Yucca Mountain Project. That's the department I'm presently acting as manager for. And within that department, we have work done by a variety of other groups, also. So that we have other Sandia support organizations that operate to the Quality Assurance Program that we have within our department. We have off-site contractors who also choose to operate to our Quality Assurance Program. Generally, they're too small to develop their own quality assurance programs.

And then also, we have support contractors who are relatively large -- had in place when we put them under contract, the Quality Assurance Program, and we've taken advantage of that, and they're operating to their own quality assurance programs.

Again, the main focus of our Quality Assurance activities is within the Waste Repository Technology Department. And I put up here the organizational chart. I apologize to those of you who don't have copies of the viewgraph. This kind of small. But I'm not going to get into the details on this.

What I really wanted to point out here is that we have a number of technical activities shown here on the bottom, divisions we call them, where the actual technical

work is done. We recently reorganized within the last year, and the main thrust of that was to put quality assurance as a separate division. So we now have a Division of Quality Assurance, and that was predominantly due to a variety of audit recommendations through the years. We've been encouraged to put more people into Quality Assurance, and it was a requirement from the auditor's perspective that our Quality Assurance have a supervisor that overlooked this Quality Assurance Program. So we changed our organization.

We also have an Administrative Support Division within our department at Sandia, and to my knowledge, we are the only department -- technical department -- within Sandia that has a separate Administrative Support Division.

But I don't want you to draw the conclusion that this is due just to quality assurance. What it's due to is the nature of the work we do on the Yucca Mountain Project.

Being prepared for licensing means things like records, training and so on, that, yes, you can say they're directly or indirectly due to the Quality Assurance Program. I choose to say that they're due to the nature of the work that we do.

So consequently, we have a significant effort in these two areas.

Just to give you kind of a summary of where our

personnel sit within the department -- it looks like we're a little management top heavy -- we have 11 managers. But that's consistent with the philosophy within the labs that typically a division supervisor has approximately 10 staff members under him. We have a Quality Assurance organization that consists of approximately eight staff members. We have support people that includes training, records, et cetera. That's about 25 people. I put a plus-5 here because I neglected to count the secretaries within our department. And then we have technical staff, approximately 50 technical staff.

Now, among the activities that we do -- that some of the technical staff do is they direct activities by other support organization and by our contractors.

Now, one of the things that has been confusing to us through the last few years is exactly what are the forces causing our Quality Assurance Program to change and grow, and I've tried to represent the flowdown of requirements to us in this viewgraph.

We start with the regulations, and then there's a lot of interpretation that goes on of the regulations by a lot of different people. And I've represented that by this single umbrella. I think ideally this umbrella would consist of a single document that would be, in the near future, our Quality Assurance Requirements Document. And

if we could operate our program just based on that document, it would be very direct and succinct for us.

However, as several others have mentioned, managers like to impose things on us, and the way they do that in the project is they have their own administrative procedures, some of which get a Q designation, which means they apply to quality, and they're management plans. And we have to implement those. And then we implement those within our program, we're audited against them. So, hence, I've shown them as driving our Quality Assurance Program.

There are other forces that drive it, and that's the auditors down here. And as I'll mention later, auditors tend to be very powerful people in the project. There's also NRC review that's occurred periodically throughout the program.

Another thing I would like to mention on this viewgraph is that when we get advice from the NRC, it isn't necessarily the people in this room. When we get advice from DOE or regulations requirements from DOE, it's not necessarily the people in this room. And so that can broaden out the requirements that we get beyond the experience of the people in this room. Sometimes, that leads us in directions that counter what we'd like to do.

Here I put down what I think the key elements of a QA Program at Sandia are. We start with people, and

people need to be managed. And then we have a series of steps that we go through for all of our work. We have plans. We have controls that we have to put in place. Hopefully, we get results. When we get results, we have to do something with them. Typically, they get reviewed, and we have processes for reviewing those. And then we have the documentation. So this is generally a flowdown.

I've put training off on the side here because it's an extremely important component of the overall process. It affects all of these.

The way we really though implement our QA Program is through procedures, and we start out with the external requirements. I've mentioned the Quality Assurance Requirements Document and the APQs and the Management Plans. But then we have to interpret those and develop our own documents that provide guidance to our staff. We then write procedures, and these procedures have evolved over the years, and I'll talk more about them later as to how we'd like to change them in the near future.

And then finally, there are a variety of implementing documents. The ones in blue up here predominantly are things we do directly for the project. So there's the study plans that we've heard about, work plans that we supplied to the project, and then there are the grading reports where the project determines whether

the grading we've applied to our work is appropriate or not.

Down here are shown a variety of implementing documents, and these will vary depending on the kind of work we do. DIM stands for Design Investigation Memo. A PDM is a Problem Definition Memo, where we define the problems that we're doing in our analyses and so on.

So when we actually implement the program, say for analyses, we have the same flowthrough. We start out with the plans. But then the controls are going to vary significantly depending on the nature of the work.

In this case for analyses, we have calculational controls where we do problem definition. We control the data. We have to have a software selection. Then we have to have software control, and that is something that we're trying desperately to implement adequately in our program, and that could involve validation and verification as well as configuration control of the analytical software.

We get results from the analyses and draw some conclusions. We have reviews that are specified in our program, and then there's other documentation that comes out.

The process is essentially the same for design, the key difference being here that the requirements for control will change and vary, and similarly, the process

will be the same for site characterization; again, the same general flowdown, primary difference being through the controls. Also, what we do with the results will tend to vary, and we have a different system in place for the various types of results that we get.

Well, then what's difference about this in the bottom line from what we would do at Sandia if we weren't working on the Yucca Mountain Project? I've highlighted the differences in four areas. I'd like to expand upon them a little bit. The procedures are different. That is we do our work to procedures. Whereas, in the labs there are procedures, but they're different types of procedures, a much higher level.

Presently, we have approximately 50 procedures that control our work. These would be our Quality Assurance implementing procedures.

If we're going to implement those, we're told that we have to have people trained on them. So training has become a very substantial component of the work that we do at the labs on this project.

As I mentioned, we have about 50 procedures that we train people to. Presently, we show on our records that we have over 500 people that have been trained in one way or another on a program. On the average, a person is trained to approximately 25 procedures. You can do the

multiplication yourself. It's a lot of training.

Most of the training now is done by reading the procedure and indicating that you understand it. Unfortunately, what we tend to do to satisfy our requirements is we tend to do the training when somebody is first assigned to something, not when he first needs to use the procedure. And what I've found is that it's most beneficial for me to read the procedure right before I'm going to use it. So typically, I've duplicated some effort there.

DR. NORTH: Could you give us some examples on that, and in particular, give us some idea what the difference is between the standard laboratory practice outside of the program versus the procedure within the program, how much additional detail there is and what the motivation is for having that detail?

MR. BLEJWAS: Okay. Let me give you an example, first, where I believe things tend to be about the same as the laboratory would do them. In the experimental area where we would be conducting an experiment in the lab, prior to the implementation of our Quality Assurance Program, we would have written the test plan. The test plan would have covered a variety of areas of how the test was going to be conducted safely and so on. We now have formalized that in our procedures, and we call it an

experiment procedure. But it's probably not very different in overall level of detail to what we used to put into our test plans.

Similarly, now we have technical procedures; for example, the details of how we would crunch a particular piece of rock, perhaps starting with an ASTM procedure. We have always taken the ASTM procedures and modified them and then use them. Well, now we formalize that more. We put it into a specific procedure that has to be controlled more carefully so that we can demonstrate exactly what procedure we did the work to. That's not too different from what we've done in the past.

The places where we would find that things are done more prescriptively would be, for example, where we have to -- what we have to do with our records. We have procedures for telling people how they have to control their records. We have procedures telling people how they have to be trained. It's prescribing the training. Basically, we go down the 18 criteria and look at procedures in each one of those areas so that all of those facets of the program, people can train on. And that's in addition to the type of training we would typically do in our program. So I'd say that probably 80 percent or 90 percent of the training is in addition to what we would typically do, and the procedures, probably 60 or 70 percent

are different than we would typically do.

DR. NORTH: I'm leading to the point on your next slide where you talk about --

MR. BLEJWAS: Oh, you're not supposed to look ahead.

DR. NORTH: No, I do.

(Laughter)

The program is too prescriptive complex procedures.

MR. BLEJWAS: Yes.

DR. NORTH: In record keeping and being a little bit more careful of which version of an ASME, the standard one uses, things like that, seem like they're --

MR. BLEJWAS: That's not too prescriptive.

DR. NORTH: That's not too prescriptive.

MR. BLEJWAS: No.

DR. NORTH: So could you give us a few more examples of where you think things are becoming too prescriptive and why they're too prescriptive?

MR. BLEJWAS: If I can pull out some viewgraphs that you don't have in your package, I'll try to do so.

DR. NORTH: Okay.

MR. BLEJWAS: Don didn't know I was going to -- that I had this stashed away.

I know the people in the back won't be able to

read this. But actually the reading of it isn't what I think is important.

This is one of the APQs that comes to us from the project office. It deals with test planning and implementation, and it's a good idea. It tells us what we have to do in terms of planning to go out in the field or planning to do something in the laboratory.

A typical step on this is coordinate development of job package outline with job package coordinator in accordance with AP521Q; prepare a test planning package outline using Attachment 2. Okay. This is the first page of five pages. So that we eventually get up on page 5 with Step 27 to monitor the test implementation.

In between, there are all 26 steps for how you get ready to do a test. This is in addition to a study plan. It's in addition to operating to another procedure that tells us what we have to do in order to get contractors to support our work on the project. This is not the result of quality assurance though. You need to be careful. This is the result of a manager deciding that he wants to control the work very, very carefully, and he is controlling it very carefully.

And I won't comment as to how much work gets through a system that has 28 steps. Right now, we are struggling with this because we're trying to get it --

DR. NORTH: Yeah. How much time would it take for that example to go through those 28 steps?

MR. BLEJWAS: We're not through the 28 steps yet the first time through them.

(Laughter)

We're presently preparing to start work at Midway Valley in January, and so for the last several months, we've had a principal investigator with his supervisor attempting to go through all these steps, and they worked on it for several months, and they're still now halfway through this procedure.

CHAIRMAN CANTLON: Who originated those?

MR. BLEJWAS: Who originated the procedures? This comes from the project office. It comes from the project office, and it was probably generated by somebody who works in the -- is supporting the people that want the procedures. I don't really know who wrote it. So I shouldn't have even said that.

Okay. So that would be an example of what I consider too prescriptive.

And I think you might agree with me that something like implementing 28 steps would take excessive time and effort, and also many of those steps require a lot of approvals.

Now, I want to reemphasize that this is not being

directed by the Quality Assurance people. This is not coming from Don Horton and his staff. This is coming from people on the project who feel that they want to control our work more closely.

When we have to deal with it, we have to deal with it through our Quality Assurance Program. The lack of flexibility may not be apparent in some cases, and in fact, I think perhaps this has been overemphasized. I think we can have flexibility as long as we're careful about the way we write our procedures, and we've been successful in doing that in the past.

Part of what we see as some of the problems is that is overly conservative management decisions, and I personally feel that 28 steps to doing work is overly conservative on the manager's part, and sometimes the desire of the manager becomes requirements. In other words, if the manager would like to see data into the record in 45 days, by the time we implement that, it becomes a requirement from the perspective of the auditor.

Maybe we can avoid that at our level. But in the past, we've had difficult doing that. We think that there is excessive attention to unimportant details.

And part of what we view as the problem and problems in the past is the fact that feedback has not been a part of the flowdown of requirements in the past.

Sometimes the controls that we're asked to apply to our work, we view as inconsistent with the technical work.

When our staff has tried to get the flowdown changed, at times they've been viewed by the project office as being uncooperative and argumentative and have been told, "No, we don't want your opinion. We want you to implement this procedure."

I think it's really important to emphasize that there is a changing philosophy there within the project, and I expect that that's changed a lot in the last six months.

DR. NORTH: So I could re-interpret that as they haven't been listening, but they are now.

MR. BLEJWAS: To a large degree, I'd say that's an accurate representation of my words.

I think in the past there has been an emphasis on the process and not the product. What I mean is that unimportant details in the process become what we get audited against and what become the highlight of a lot of attention.

I can give another example there. In a recent audit, we have in our procedure -- in our highest-level document -- a requirement that we do management assessments annually, and management assessments, as Les pointed out, are something that are very valuable to us.

When we put that requirement for annual assessment into our procedure, we wrote it up that we would do it once every fiscal year. The auditor decided that once every fiscal year did not satisfy the requirement of it being annual, and he wrote it up as a finding.

We discussed it with him. We couldn't change his mind. And hence, at least in my next comment, that the auditors are just excessively powerful, and I think that a process of appeal for these types of situations is important and, as something that Don mentioned, that we're looking for on the project because we don't want to perpetuate that type of thing.

The bottom line that I put on this is that I think that the morale of the staff is low. But I think it's actually bottomed out.

(Laughter)

I really do believe that people think things are getting better. When I talked about this with our staff at Sandia, many of them are optimistic. They've seen signs of it already, particularly the people that have been involved with the workshops. But that optimism has spread to the rest of our staff.

DR. NORTH: So the patient is beginning to respond to treatment.

MR. BLEJWAS: Right. Right. He's gotten the

first injection, and the first injection was the right choice.

You caught me off guard though, because I wanted to say something before I put this viewgraph up, and that was that I didn't want this and the next two viewgraphs to be viewed out of context because this makes it sound like the patient is already dead. And you have to get to my further viewgraphs to see that I don't believe that that's the case.

Something that's come up from others, and I'll reiterate a little bit, it is that if you have excessive details in your Quality Assurance Program, that will indirectly lead to a reduction in quality of your program as a whole. And we have seen evidence of that in our program at times when we have excessive details. That's the reason that we feel so strongly that now we have to take a strong initiative at Sandia for our own reduction of excessive details, but also working with the project office to see it reduced from our flowdown of requirements.

And the reasons for that is the quality of the work suffers. If it's excessive detail, there's less caring by the person that's doing the work.

Typically, what happens is that he sees this mass of details that he doesn't -- he just can't handle. So he ignores the whole thing rather than worrying about the

important parts of it.

And then some people just embrace it, and they say, "Oh, great. I know how to do that. So I'll concentrate on the QA details," and they make a career out of doing all these QA details, and they don't get any technical work done. I've seen examples of that, also.

Sometimes people make decisions that are based on quality assurance difficulties. In other words, they say, "If I go this route, I can reduce my difficulties with the Quality Assurance Program. That may not be the best technical decision I can make, but it sure will make my life easier, and that's the route he chooses to go," again due to the excessive details.

Secondly, the quality of the staff suffers if you have excessive details. We've noted a high turnover within Sandia in our department, particularly since we've implemented a very elaborate Quality Assurance Program over the last three or four years. And the real problem in my mind though is that many of the best staff leave first, and I don't have statistics on that, but it's real. I've looked at the details of which people are leaving our program and which people were able to bring in from the rest of the labs. And without going into any private information, I think it's safe that I can tell you that the conclusion is a real one.

From the perspective of somebody that's doing performance assessment, this is what I think he sees is part of the problem. He says, "Well, I've got to develop some representation of this parameter." Maybe he's going to use this in a decision for the exploratory shaft facility. Because he's using it for that and based on the Nuclear Regulatory Commission's concerns that we have to have that meet all of the requirements of our QA Program, he does that with all the controls in place, or tries to.

What he looks at for this parameter out here, what's the total uncertainty for that parameter? He sees a wide band. And most of that band is due to the fact that he doesn't know that his models are any good. A smaller part of his uncertainty is the fact that we haven't been at the site, and we don't have enough information on the parameters.

The lowest uncertainty he sees is that there's some mistake in his calculations that his software is screwed up, and it's giving him wrong answers. But since we can't get to the site, where is the Quality Assurance Program concentrated at? It's concentrated up here. So he sees the emphasis going into the area of at least uncertainty, and that's what causes him to be so disgruntled.

It's not to say that he thinks that doing this up

here is necessarily all bad. He sees benefit in doing much of it. But it's just not where he'd like to be putting the emphasis.

DR. NORTH: How are we coming along in fixing that problem as part of the treatment process?

MR. BLEJWAS: The quality assurance for software is something that the project has for its next workshop. And at Sandia Labs while we're presently struggling with trying to implement our software QA plan, I think we need the workshop real bad. I guess that would be my best representation of that.

DR. NORTH: I'll put in a plug for the idea. Let's put that last graph back up again.

It seems to me there's a lot known about how one goes about verifying and validating software using a range of methods from professional judgment to running different codes that do more or less the same thing against each other to going through line by line and verifying that the equation that's been coded is the equation that you would like to have there and that doing it by hand gives you the same number as the computer has been developed, the latter being an extremely laborious resource intensive task. Whereas, sometimes running against another model or having very expert people in the field look at the results can tell you a lot about whether the model appears to be

appropriate or whether the results just look crazy judged against experience.

MR. BLEJWAS: Right.

DR. NORTH: So it seems to me a very important aspect of quality assurance is to have a set of procedures and processes that reflect this kind of practice, which many, many organizations use in the process of developing software and having it done in such a way that it is sufficiently systematized so that it stands up to audit, and you can track back through it and see who did what and what procedures were followed.

MR. BLEJWAS: Yes.

DR. NORTH: I would very much hope that the staff perspective on the importance of models and the importance of parameters as sources of uncertainty is dealt with fully in the process and not allowed to be ignored.

Again, I'll reiterate the point that EPA made yesterday about the importance in deciding how much accuracy you need to support decisions. If it turns out that the key issue is, is your model any good, that ought to be highlighted, and we ought to focus a lot of attention on it as opposed to spending much of our time trying to figure out whether there's a calculation error in the model.

MR. BLEJWAS: I would like to say that all of the

aspects that you saw that should go into a Quality Assurance Program, I believe are in the procedures that we're using for software QA.

That isn't the problem with it. It goes back to the idea of being overly prescriptive in how we do our work, and that tends to slow us down and tends to make life difficult for us. But I think the quality assurance for software has many good things in it. It's just we have to pay the most attention to the important ones.

DR. NORTH: So you see the problem as stripping out that which is not needed as opposed to adding some things which ought to be there?

MR. BLEJWAS: I believe that's predominantly the situation, yes.

There are several important activities that are going on that are improving our Quality Assurance Program not just at Sandia, but within the project as a whole. But I'm going to emphasize the ones that are going on at Sandia.

You've already heard about the workshops that allow us to air concerns and recommend changes, and I truly believe that those are worthwhile, and everybody I know that's participated in those views them as being very worthwhile.

Another thing that we've done that Les mentioned

also was that we've had management assessments, as required by our program, and we've found that they are very good for evaluating the program effectiveness. For our last one, we put one of our best staff members on this. He's not independent. But he actually had a good perspective of what was important to the project, and we got excellent recommendations from him, and he suggested numerous improvements, and we're trying to work on several of those.

Among those was a big problem with our procedures. And at the same time that this was coming about, within Sandia we're turning to this total quality concept, and even though I haven't been fully trained in this, it seemed like it just fit right in with what we were trying to do in this area. And as a first step, what we've done is we've formed a process management team looking at procedures. And what that will consist of is managers, Quality Assurance staff, but also the people that use the procedures and write them, getting together and looking at the total picture of what we're doing with our procedures and how we can improve those. That will, no doubt, involve some interactions with the Department of Energy. But many of the things we can do to improve the procedures will happen internally within our own organizations. Many years of being pushed in different directions has caused our procedures to not necessarily be the best.

Some of the things we'd like to do with these procedures is provide varying controls; in other words, really do grading. You've heard about grading at the project level. I don't want to criticize anyone. I'm not. That's grading is not what's in NUREG 1318. That is basically just deciding whether a part of the criteria apply to your work, not saying how much control you're going to put in place on the particular activity.

What we have to do internally in our procedures is provide varying control and then tell the Department of Energy what level of control we're going to apply to that work. That's something that we haven't been doing, but I believe we have to do.

We hope to combine and simplify our procedures. We're going to try to eliminate some of the unnecessary specifications, and I think we can do a real lot in that area internally just in Sandia.

We're going to try to reverse what I call audit ratcheting, where one auditor comes in and says, "I'd like to see more detail in this area." So you expand the detail. The next auditor comes in, and he picks out some detail of that detail, and he wants to see more detail in that particular area. And you end up with a procedure that has much more in it than you really think is necessary, and I think we're going to go back and we're going to revamp

our procedures. It may cause us some problems in some future audits, but I think it's necessary because we've just gone beyond the sensible point. And in the new atmosphere within the project, I think that that will be looked upon somewhat favorably.

I think though that we're going to continue to rely on the users to write the procedures. That's something we've done in the past, and the best parts of our procedures tend to come from the parts that the actual users have written. It's the changing of requirements from above and other internal sources that I think have caused the biggest problems with our procedures, and we think that this should be a philosophy that's passed on up through the rest of the project.

Finally, I'd like to say --

DR. NORTH: As I understand, TQM -- this is an essential part of it.

MR. BLEJWAS: Right.

DR. NORTH: You get the worker people to develop the vision statement, and out of that, you figure out how you can make continuous improvements.

MR. BLEJWAS: Right. My understanding of it, also.

I truly believe that there has been a change in philosophy in this program, and I think it starts about the

time when Don Horton took over as the Quality Assurance representative for the project and for DOE.

I don't think it lines up exactly with when we started getting criticism from the NRC and others. I truly believe that we're seeing a philosophy due to the change in personnel.

I stole this viewgraph from Tom Hunter who used it in another presentation. But it's so appropriate that I couldn't help but use it anyway.

(Laughter)

"We still need more freedom from central authorities here." You will see that the quote though isn't from anyone on this project that's in this country. But I think the situation -- there's at least a few similarities with the same situation.

And that's all I have prepared for you.

CHAIRMAN CANTLON: Thank you, Tom.

Any questions?

(No response)

Okay. I think we've asked them during the presentation.

Let's move then to Los Alamos, Dick Herbst.

Dick?

MR. HERBST: I'm going to try to use some slides.

Let's see if I can keep from running back and forth across

a front of the third of the audience here.

(Pause)

I also would like to thank the Review Board and the subpanel for the opportunity to describe Quality Assurance implementation at Los Alamos this morning, subtitled, "How we got where we currently are," if you will, "and what we've learned in the process."

My name is Dick Herbst, and I am the Technical Project Officer at Los Alamos. And for those of you who may not know, I want you to understand that Los Alamos' support of the Yucca Mountain Project includes assessment of the hazards of vulcanism, both in terms of probability of occurrence and consequences, as well as what I'd like to call an assessment of the efficacy of the geochemical natural barrier at the site.

We also run a test manager's office, which will ultimately support underground testing. So you understand the perspective from which we are coming.

Oh, I was afraid of that. Okay. That's what happens when you get a manager loading slides, I guess.

(Laughter)

If it happens more than twice, I'll quit and go back to the viewgraphs.

What I'd like to do is I'd like to organize my remarks this way this morning. I'd like to tell you --

(Laughter)

You're reading backwards. Let me see if I can do two, and if they both come out backwards, I'll quit.

DR. CARTER: You obviously need some more central control here.

(Laughter)

MR. HERBST: I always worry about this with slides.

Let me back up and do it the other way.

(Pause)

This may be testimony to quality control.

I'd like to -- I organized my remarks, if you will, around this particular approach. And I'm going to be very brief, if you will, on the requirements and the mission and so forth because I think you've heard this from others already several times, if you will. And I'll try to get to where there are differences, and that is basically in the area of lessons learned on issues which we've dealt with.

We are trying to employ basically kind of a systems engineering approach, if you will, to the design of our Quality Assurance Program at Los Alamos. Where we begin from a fundamental understanding of a mission, if you will, and sort of disaggregate that into a series of functions, in this case, we'll actually be looking at what

we call a requirements analysis.

And then given that, we'll try to move to some kind of conceptual design, if you will, for the Quality Assurance Program and look at the tools that we'll employ to accomplish the mission. That's basically an organization and ultimately some kind of documents in which we will try to deposit our thoughts.

I'll take a few minutes to look at the status of the program over an interval of particular interest, I think, to this committee. That is the time from 1987 to 1990. I'll tell you a little bit about lessons learned, and by lessons learned, I'm talking about basically the issue which we have identified or problems which we've identified and for which we have also identified solutions and either have implemented or have made some progress in the implementation. I will talk about issues, and issues are basically problems or concerns we've identified and, frankly, for which we do not yet have perhaps an unambiguous solution. And then I'll talk a little bit about our revised mission because I think it will make some sense.

The difference I'm going to take is to get you back, more or less, into systems engineering mode, if you will, and look first at our mission statement. Our mission statement at Los Alamos -- at least at the inception of the

program -- and I don't mean to suggest that the inception was 1987 because we have been pursuing a Quality Assurance Program ever since we've been associated with the project or the program, if you will, and that frankly goes back to the legislation in 1982 and beyond.

Dave, do you think the slides or organized now?

(Laughter)

So we'll do this one more time and try it.

The mission statement, as you heard, is not distinctly different from what you've heard from the other participants. That is basically to make our work defensible or usable in the licensing environment.

I want to talk a little bit from where to the requirements derive, and in this context, I think we might subtitle this story, "Life at the End of the WIPP," if you like.

And you've got to look at it from the particular perspective of Los Alamos, if you will, which is a national laboratory and a component, if you will, of the DOE complex.

Our requirements descend upon us from several sources. In the first instance, they are a consequence of our involvement in this program and the federal regulations which apply. Those would be the Nuclear Regulatory Commission, specifically in the context of today's meeting.

DOE 4700, Part D, which is a result of the fact that the Department has concluded that in mine geological disposal system, it's a major system acquisition. Part D is the quality assurance requirement, if you will.

If you look critically at both 10 CFR 60 and 50 together, clearly there's been a consensus of agreement that it is the equivalent of NQA-1. If you look at Part D, it also looks very much like NQA-1.

On the right-hand side is yet a third order of the Department of Energy, which is a general requirement for quality assurance in non-defense programs. This one is somewhat different. Most quality assurance or NQA-1 as only a model, if you will, it does not require compliance or use of NQA-1.

The orders and the requirements cause, if you will, the OCRWM QA Requirements Document, and originally, it was a Quality Assurance Program. I think the document was B-3. IT has been subsequently superceded, as you've heard a number of times, by the Requirements Document.

The orders themselves generally cause an echo, if you will, throughout the system, and the area offices will issue a corresponding order. In this case at Los Alamos, it's 5700.6B.

Those combine then, if you will, to cause a program description, progress descriptions at both the

program level -- that is at the Office of Civilian Radioactive Waste Management, at the Yucca Mountain Project Office and at all of the participants.

A particular feature of this slide that I would like to call your attention to, however, which is a source of some of the difficulty that we have had at Los Alamos, has to do with this horizontal area at the bottom between administrative quality procedures, if you like, and our implementing procedures because, in fact, requirements descend on these parallel paths, and then we have this crossover at the bottom at administrative procedures.

From our perspective, that is probably where the complication of the compilation, if you will, of procedures is most obvious, as you've seen examples, I think, this morning from Tom Blejwas, an explicit example, if you will, of it.

I have one other which you might be interested in tracking for me. In NQA-1 or at the very top, I just looked at the document control where there are seven requirements, and by requirements, I mean sentences which could be the shell verb, which I believe in QA parlance is supposed to be an expression of a requirement, if you will.

By the time we get to the Yucca Mountain Project QA Program Description in its current embodiment, if you will, which is the QA Program Plan 88-9, we have 19

requirements. That in and of itself doesn't sound like it's too intimidating. We only have a factor of two.

But surprisingly enough, there are seven administrative procedures which implement that criterion. And if you take on the average 10 requirements in each APQ, you can see that we now have an order of magnitude, an increase in the number of requirements that we have somehow got to accommodate or consider in the formulation of both our QA program plan and the quality procedures.

This, I believe, is a source of some considerable difficulty within the current program, and it is a subject which I believe is going to be addressed in the workshops again to which a number of people have already referred.

It gives you some kind of perspective on what's happening, at I say, at the end of the WIPP.

What is the organization that we employ to accomplish this Quality Assurance Program mission that is primarily at Los Alamos? It is a Quality Assurance project leader, and we have, again, disintegrated, if you will, the quality assurance mission into four functions. I'm going to go from right to the left instead of the other way.

We have a QA verification function, which is primarily the responsibility of the contractor. I'll have more to say about that in a minute. The program implementation and the program development, which are the

responsibilities of the Los Alamos National Laboratory itself. And then because of its importance as we perceive it and because of a particular crusade that Dick has, I guess, we have a function which is associated exclusively with software QA.

We do not really bring in all of the features that you may have heard described already. That is the study plan, scientific investigation plans and all kinds of things. What we are trying to do is use the Los Alamos Quality Assurance Program plan as the repository for requirements and not to echo or duplicate it through the redundancy or proliferation of requirements that we see in the higher-level documents.

Quality administrative procedures are employed to describe how it is that we comply with those requirements.

They are not in and of themselves supposed to cause requirements.

Detailed technical procedures, it's a little bit of a stretch, if you will, to impute detailed technical procedures to the Quality Program because, in fact, they predate the Quality Program. But the Quality Program does cause us to have some particular features to these so that, in large measure, they are perceived by our staff at this stage of the game as being components of our Quality Program, and they certainly do compliment.

What I'd like to do now is walk very quickly through the history of our program at Los Alamos from 1987 to 1990. This, I think you will find, is going to be a unique story in the annals of Quality Assurance Program implementation as you've heard described here for the last day and a half.

In 1987, Los Alamos was selected because it was perceived by the Department as being the most ready, if you will, in terms of its program and its compliance with what was then understood to be NRC requirements. And we subjected ourselves or volunteered or agreed or selected or elected or whatever the word was to be the test case, if you will, for what is currently described and referred to as a mini-audit by the Nuclear Regulatory Commission.

That was in the mineralogy and petrology area, which I think everybody understands.

This began -- in my mind, it was somewhat of a downward spiral. It was understood at that particular time, based on the NRC audit -- this looks like a very positive statement, if you will, that basically, you know, there's some things we think you ought to fix up, if you will. But if you go ahead and do this, we're confident that the work which Los Alamos is doing will be difficult to challenge in licensing.

Now, once again, if you go backwards to the

mission, this is, after all, what we were trying to accomplish. Correct?

The Government Accounting Office, on the other hand, had a slightly different interpretation to the NRC mini-audit. They undertook an investigation shortly after the audit, and they interpreted the NRC's comments, once again, to compliment Los Alamos' high technical quality. But they concluded that inadequate documentation might prejudice its use in licensing 10 years later.

We have been going through since 1987 a number of iterations in the interest of trying to get more common acceptance of the original position that was identified by the Regulatory Commission.

And in 1990, as many of you may already know, we were subjected to what is the first qualification audit. And while the term "failure" has not been employed by anyone else, I know of no other way to interpret it other than as a failure.

It was concluded by the audit team that the effectiveness of the program at Los Alamos could not be currently determined, and that was a consequence of sort of a preponderance of evidence in connection with our corrective action program, our failure to implement in any satisfactory way a surveillance and audit program.

On the heels of this mounted a rather substantial

effort to repair, if you will, the situation we found ourselves in last November. And even though that data on that is May, the audit was actually November of last year.

And our current situation is described, in my mind, probably most succinctly by this excerpt from a letter from Don to me that says basically, "Until you get your act cleaned up, I cannot request or accept the program or request NRC to accept it." And frankly, that is the current status.

Now, we obviously are cleaning up our act, I hope. But you've got to understand that this is distinctly different than perhaps what you would have heard from the other participants. Our situation is not quite as neat and tidy as perhaps others would describe.

What kind of lessons have we learned? Well, let me tell you we've learned a lot of lessons, and I'm not sure I've picked the very best. But I'm going to talk about three if them, if you will.

We'll talk a little bit about, in the first instance, our organizational problems. When we began this campaign in 1987, we engaged a contractor, and we charged the contractor with responsibility for development, implementation, administration and verification of the program.

It's impossible to go back and try to describe

why we thought that was a prudent course of action, but in fact, that's what we did.

The results of that are at least twofold. The program that resulted turned out to be the contractors. It was no longer Los Alamos'. As a consequence, I think you can see there was no commitment. There was no buy-in, if you will, by Los Alamos staff. It was really somebody else's problem. It was somebody else's program, a very tragic error and one which I would urge strongly that everybody learn from it. It's not the correct way to proceed in this matter.

The other thing which was -- which is interesting and results from this is that the contractor frequently described in the procedures processes that Los Alamos did not employ or that were different from what Los Alamos employed. As a consequence, we were in non-compliance right out of the starting blocks, if you like.

Now again, it seems like in retrospect, that should have been intuitively obvious. But I regret to say it was not. And that was something we learned from trying to employ a contractor in this capacity. The solution was clear, I think. We reduced the scope of the contractor's support. It is primarily concentrated in areas of administration and verification, and by verification we're talking about primarily surveillance and audit. And we

think that is totally appropriate kind of work scope for a contractor since in that capacity, they bring the same kinds of objectivity, if you will, that almost any other external audit team does when it comes to examining Los Alamos' program.

Training. Training continues. We have at Los Alamos -- I'm sure you've read statistics in Time Magazine and everything else about the number of PhDs employed in the Los Alamos or resident to Los Alamos. But we have a population, frankly, which has very high expectations with regards to training and education.

We found ourselves in connection with training in QA. We were frequently, as already mentioned, training them to things which they already knew. We were training them to levels of detail which were, frankly, somewhat insulting. As a consequence, we exacerbated our problems, if you will, in terms of commitment. We failed to win commitment through our training program.

What we have done, of course, is look very critically at that training program. We've modified it significantly. We've used some of the features that you've already heard described. We've also tried to segment the audience, if you will, and not bore the principal investigators with issues which may only be important to technicians or to administrative staff who have to make

these things happen.

We've done some kinds of work with respect to trying to focus exclusively on what is the incremental difference that the Quality Assurance Program has made in this process, which is described by this procedure. I don't know if it's very clear what I'm saying.

But, for example, there is a quality assurance requirement in connection with procurement. It may surprise everybody to learn that Los Alamos has been procuring things for 45 years. This was not discovered with quality assurance. However, in implementing a procurement procedure, as I mentioned before, we failed to take advantage of the fact that we've been doing this for 45 years and wound up describing a procurement procedure that, frankly, nobody used.

And what we have done, of course, in retrospect is gone back and fixed that, and now what we've done is describe the procurement practice which is in place at Los Alamos. And then we have reconciled that with the quality requirements because, in fact, the Quality Program does require some incremental additional work, primarily in the area of documentation in connection with that, and that is the increment that we train to, if you will. That's important.

Employing knowledgeable professionals as

trainers, again, we excused, if you will, our professional staff from the training requirements, and our contractor tried to provide that kind of training. Again, peculiar to our culture, to our audience, if you don't have the tickets, you don't get their attention, if you will. So we had a little bit of difficulty with that by now transferring that back and making our staff responsible for some of the training, if you will. I think we have a much better and much more effective training program.

Commitment. This is a sensitive area. I'm sure that everybody believes that their organization and their management is committed. But I ask that you examine that very carefully.

We detected weak commitment; in fact, on some occasions, even resistance to the Quality Assurance Program. And I think, frankly, it was with good cause because there was very little perceived value added from the investment.

As a consequence, we did not have management commitment. We did not have the commitment of the bench scientists or working scientists, if you will.

What was primarily perceived was an increased cost, was greater time required to accomplish tasks which previously were done rather expeditiously.

I think we haven't -- I'm not sure that we've

fixed this yet. But by switching from compliance, which is addressing this myriad of detail, and concentrating on what, in my mind, are actual product features which are resulting from the implementation of the Quality Assurance Program, such as more comprehensive and systematic work planning, if you like, Measurement and Test Equipment Calibration Program, which is more systematic, and once again, software quality assurance, which I'll return to in some greater detail.

But I would also add to that an element of software or quality assurance, which the National Academy of Science referred to, and that is basically sample management or sample control, if you will.

I think these are features which have immediate value, if you will, which take that benefit horizon which is perceived as being remote, if you will, in terms of this work unassailability in a licensing environment and brings it up close in terms of these kinds of immediate payback from the system. I think the probability of winning commitment is much greater focussing on these kinds of features than a more obscure or distant goal.

I want to take a few minutes and talk about issues, and I will tell you that at the outset that I've chosen perhaps some rather provocative words to expand these statements, and that's for two reasons. Frankly,

it's an expression of the level of frustration -- even anger that's behind some of them, if you will, within the organization. It is also -- as I understand, there's going to be a roundtable discussion that follows this presentation. So I guess one of the other objectives was perhaps to elevate the adrenalin a little bit of that roundtable discussion -- not that that was my charge.

I have lumped these issues, if you will. It's not obvious that they're lumped. But the first three are somewhat programmatic. The last three are not clear. I think they are somewhat programmatic. I think you may conclude that they are personal. They may, in fact, not appear to you to be issues at all. They may be allegations. But I submit that given sufficient time that we could develop either objective or anecdotal evidence, as Dr. Warner has suggested -- or Dr. North -- that would substantiate these.

With respect to changing requirements, we learned something, that basically we began the program in the assumption that requirements were a constant, that somehow in QA one expressed them.

As you've heard described already, that we have this tier of documentation, and we're sitting at the bottom of a base of a pyramid, if you will, and as a consequence, one of our fundamental planning assumptions, as the

requirements were constant, was obliterated in almost a single step.

What we've also learned and which has been referred to by others is that requirements are not simply a function of these consensus standards, if you will, or even the federal regulations. When you come right down to it, their personalities -- and I submit there's probably another element of uncertainty that we haven't even identified yet. It may be such things as non-kinds of requirements documents, such as the NRC Review Program or review plan, et cetera, et cetera. I'm not sure. But I know that the fact of the matter is that requirements are not a constant, that they are changing. They are changing not only in time, but they are changing in magnitude.

And that has produced for us a problem, and this is just a segment of the story, if you like. This is the requirements document, and it's history. It's sort of an awkward kind of presentation, beginning on the right-hand side with NVO-196-17 and Revision 0 in October of 1980. Tracking through a series of revisions, this brings us to the current Quality Assurance requirement document issued in June of 1990.

But each of these -- and this slide in and of itself probably exaggerates the story somewhat. But the fact of the matter is that these sequence of revisions has

occurred, and again, from the tail of the WIPP, this is the story that we've been tried to track.

I think that is a problem. I believe that the workshops that have already been described several times may be a step in the direction of arresting that rate of change, if you will.

You've also heard some reference to auditing for compliance. We think this is a fundamental problem, one in which we are currently evolving.

I heard Mr. Hooks from the Nuclear Regulatory Commission yesterday say that there was little real work going on. That alarms me a little bit because at Los Alamos, we believe we are doing real work. Our work has been ongoing, if you like. It has been, for the most part, laboratory work. It's understood to be laboratory work. And so we would think that we are kind of a laboratory, if you will, for looking beyond or looking at real work.

However, we find that the evolution of the audit process and the emphases has been from really a performance-based audit in 1987 to a greater and greater level of detail and compliance auditing in the current era.

And we think that that trend should be reversed, and those are my suggestions for solutions, even though I said I didn't have any.

Scoping work incorrectly. Again, you've heard

this said kindlier in lost of other instances, I suspect. We do detect some evidence that in the absence of management leadership, while it's perceived to be weak, that the Quality Assurance Program has been employed, frankly with good intentions in many instances, to cause, if you will, decisions, to affect leadership. But we think it's a poor tool for all the reasons you've heard described earlier.

And I might also add that it puts a bum rap on the Quality Assurance organization when it's all over with.

We have a little bit of concern -- I say this is where we're departing probably from a consensus view. We believe there is evidence that we are in this process bureaucratizing, if you like, science and technology. Again, it's been alluded to by many of my colleagues who have addressed you before. We see abundant evidence that not only are we employing more resources to do the same job, but we are employing the sorts of resources which simply have never been a component of the science and technology initiative before.

We have some qualitative information. In fact, the information on the left is quantitative. It is the direct cost of quality assurance. It does not seem to me to be an unreasonable burden, when you consider what the potential benefits of the Quality Assurance Program are.

The indirect effort on the right-hand side is admittedly some kind of an estimate because it's very difficult, as others have alluded to, to describe exactly how much of a scientist's effort or an engineer's effort, for that matter, is, in fact, related to the Quality Assurance Program, and incremental over what he would have done had he not had a quality assurance discipline imposed.

This is my euphemism. I think this is a real phenomena, and I think it is one that we should be concerned with, that we think the Quality Assurance Program -- at least are we implementing it -- is having this effect. That is obviously slowing the rate of our progress. We think, in some instances, it is having the antithesis of the effect that it was intended. We are, in fact, besmirching -- is my word -- our products, and I want to mention that in this context we're feeling a little bit at a disadvantage relative to our competition, and I don't care how you describe that competition, whether it's just academic peers. But the facta of the matter is that we have to work under this system of constraints, which you've heard described which may be internal reviews, which may be a myriad of detail and so forth. It is, in fact, putting us at a disadvantage, and I can assure you with respect to disgrace, when a senior Department of Energy executive goes before the public and announces that \$500-million worth of

work done must be abandoned because the quality program associated with it is deficient in some way, that my staff is insulted and disgraced by that.

The same work was employed and the same standards were employed in producing that \$500-million worth of work, which has stood them in good stead and has acquitted them satisfactorily with virtually every other customer we have.

So in fact, I think there is a component of disgrace which comes with -- and again, these are antithesis. This is exactly the opposite of what our expectations are of the Quality Program. We have to be very sensitive and concerned about that fact.

We'll talk a little bit about assuring software quality. Again, this may be Dick's personal issue. But I have enormous concern about this phenomena called software.

I have said to others -- and I'll say it to this audience -- that I see software as somewhat of a time bomb ticking in science in technology, and it is a product of probably the last 20 to 25 years, if you will. It does not have the heritage, the discipline, perhaps, which applies to more traditional tools and endeavors within the science and technology area. And I think it is imperative that we act to bring some order to this phenomena.

Whether quality assurance is the vehicle for doing that remains an open question. We're using it as Los

Alamos. As a consequence of everything I've said previously, relatively, perhaps negative aspect of quality assurance, this initiative, which every agrees should be undertaken, is probably being received with less enthusiasm than we would like to see.

I think that for all of the reasons that we've described above that quality assurance at Los Alamos has really got to transcend the Yucca Mountain Project. It's got to be perceived as having value beyond making our work unassailable, frankly, in the licensing environment.

And in order to do that, our management as well as our staff have got to recognize that an effective Quality Assurance Program will allow us to differentiate our products, frankly, will assure us, if you like, a market niche. I think we do have a unique function to provide customers a unique product, and I believe that Quality Assurance -- an effective Quality Assurance Program can avoid some of these perhaps negative aspects to which I have referred, will move us substantively in that direction, and it is that which is going to make a difference in my mind.

Now, I just want to briefly comment on two things. Dr. North has referred to a cultural revolution and believes that that's an accurate description of what's described. I've contemplated that at some considerable

length, and I don't think it's a very good one -- at least as I understand that phenomena.

I think such revolutions are born, if you will, in the grassroots of the proletariat. And what's required here, frankly, in my mind is a revolution, admittedly. But it's one that's probably going to be led by the booshwazee, if you will.

(Laughter)

I do not presently sense that there is a grassroots revolution in this sense, and I think it may be a tactical error on our part to be expecting that revolution to occur at that level. It really has got to occur at the management level, and we must lead the revolution, if you will.

The other thing I wanted to mention, perhaps a little more substantively, is there was some discussion of the use of natural analogues for computer program validation. I would like to comment that our staff has the following concerns with the use of natural analogues. They're probably intuitively obvious, but I'll state it anyway. And that is most natural analogues are extremely difficult to identify the source term, if you will, and then there is a large element of uncertainty associated with the process or processes that occurred by which we make the current observations or processes by which the

system evolved to where we make the current observations.

As a consequence, they have some considerable, if you will, anxiety or skepticism about the use or utility of natural analogues in the validation sense.

And then finally, I would like to respond to Dr. Carter, who has asked us about the reasonableness of the effort associated with quality assurance. And again, I think it is extremely difficult to answer your question now because we do not yet know what the benefit is, frankly. So we cannot make a judgment about the reasonableness because we only have the cost right now, and the benefit is frankly over the horizon. And until we have some feeling for what the benefit is in terms other than generalities, I'm afraid I'm not clear or able to answer whether or not the effort we currently have employed in connection with quality assurance is reasonable. It is necessary.

And if -- I think in closing, I would just like to say I'm not sure that what we say here today is probably going to have -- or even yesterday -- is going to have a great deal of effect on the conduct of science or maybe even in the disposable of waste when you come right down to it. And if that's kind of disturbing to you or if you're discouraged by that future, let me console you with the thought that this opportunity will at least have saved one technical project officer the cost of psychiatric therapy,

and I thank you.

(Laughter)

CHAIRMAN CANTLON: Well, perhaps the way to take this on would be to move into the roundtable right now, and since you've set the right tone for the discussion -- and what we would like to do would be to move behind so that we're looking out at the audience. Let's just take about a five-minute break here and then start.

(A break was taken.)

CHAIRMAN CANTLON: We're reconvening our session for the roundtable, and perhaps by way of getting started, we can start with questions of Mr. Herbst.

Mel?

DR. CARTER: A couple of things that I might mention -- by the way, the Environment and Public Health Panel met in Reno a week or so ago. Dick was talking about the revolution. We were informed by one of our witnesses there that when the total revolution occurred, this was going to be led by the oracle, by the way, that we -- namely the panel and the board -- were going to be put in the strikes and put away for good.

(Laughter)

DR. NORTH: The speaker was wearing a T-shirt with a picture. Was it --

DR. CARTER: It was some oriental leader.

A couple of other observations I might make -- and then I did have a couple of questions for Dick. But with his tale of horrors about QA, we might make the observation that he only missed Halloween by two days.

(Laughter)

The other thing though, seriously, Dick, if Los Alamos survived matrix management -- and I think they did -- I would think they could survive QA.

(Laughter)

It's sort of a minor rolling stone.

Anyway, I appreciate very much your thoughtful and I think considerate candid presentation.

Two things I did want to ask you, one pertains not only to Los Alamos, but the other labs. But if you look back historically, I suppose one of the fundamental strengths and things that have supported the national labs is the fact that they have been historically, if you will, and in some cases fundamentally different. They've been fiercely independent, and I could give several examples.

Those associated with the Weapons Program realize that there are major differences between, say, Los Alamos National Lab and Livermore National Lab in terms of whether or not they have used casing in the past, steel casing versus no steel casing. The cable used in the programs are entirely different. They also had a deference whether they

used a hard wire to fire a device or not. So there were, like I say, fierce and fundamental differences, and these, as far as I'm concerned -- at least a lot of them -- have contributed to the effectiveness into the productivity, the accomplishments and the contributions of the national labs.

So the question is -- with that much setting to it -- how in the world if you have these fundamental differences in technology, practices, procedures and whatnot is anyone going to ever going to conform the labs to something that's rigorous in a procedural thing named "quality assurance"? That's one question I would like to pose to the group.

CHAIRMAN CANTLON: Would you respond so that we can get it on the record, please?

MR. HERBST: Dick Herbst of Los Alamos.

Now, I think that I appreciate your kind comments about the fierce independence and contributions of the laboratory environment.

You provided an interesting segment because there is something else I wanted to say, and I will respond to your question. It is the use of the term "participant."

In fact, we employ that term in this project because we do think we have a particular and a unique role, and it is to provide that sort of objective opinion on these technical matters. What we are trying to do is

provide an objective basis for information upon which that decision will be made, if you will. And that distinguishes us, and we're a little bit nervous about things like TQM, which had a terrible customer orientation, which we fear may compromise that.

In answer to your question, I think, to get these diverse organizations to sort of march to the same drum, at least in some respects, in my mind, it's to abandon all of these intermediate levels of requirements documents and to agree with the community that NQA-1 is the standard and that all of the participants must implement a program which satisfies the requirements of NQA-1 and to eliminate this intervening tiers of documents. Moving away, I should say also from the compliance auditing to performance.

DR. NORTH: Let me echo Dr. Carter's thoughts.

I want to respond to a couple of points that Dick Herbst made. I think they're very important, and I'm not sure that we have any basic disagreements between us. But I think what we're seeing is a new era with a new set of problems that have to be distinguished from some of the problems that the labs have been so successful with in dealing with in the past and for which Dr. Carter was, I think, very appropriately commending you.

Let me start with the issue of natural analogues in which Dick responded to me, and I'm not really sure we

have a disagreement on this. But I think the larger setting for that issue is very, very important, both for quality assurance and for broader objectives of the whole program.

I raise this issue as something that I think needs to be considered as an opportunity. One possible way that one might get some checks on the results to be obtained and the trustworthiness, if I can use that word, of large and complex models for geohydrology and geochemistry, the problem with many of these codes, like climate change codes, is they get to be so big and there are so much data in them, some of it may be dating back decades, as the example Les was giving us. It's very, very hard for anybody to feel convinced that what's in that model is really correct. And yet, we probably have no choice but to use such models when we're considering how we can put together all of these elements of very, very complicated problems.

Now, checking against -- I'll call it nature's experiments -- it may be the very limited of our ability to get a source term, for example. But I think we are remiss if we don't use these opportunities as fully as we can to get some cross-linkage between data that we may be able to go out and get by studying perhaps some mountains with tough -- in Nevada that have some uranium in them, and we

can determine perhaps very imperfectly how much migration of radioisotopes may have occurred in the past by taking some measurements.

Now, where that hasn't been done and we can do it, we ought to consider doing so because this is a way that we can reduce some of the uncertainties. I think in the graph that Tom showed us, the importance of model uncertainty and parameter uncertainty as opposed to checking the calculations.

So my point is not that natural analogues are the solution, but rather it is one more aspect that we might pursue.

Now, from the point of view of some of the national lab people in Los Alamos or elsewhere, they may feel, "Well, I've already done that, and I understand there's nothing more that's valuable that can be done in that area. Last year or five years ago, I went out and I got this data, and I made the calculations, and I assured myself that this aspect was right." That may be completely true. That individual may understand the problem, have explored that opportunity, had drawn the appropriate conclusion, that the information hasn't reached me on the Technical Review Board. It hasn't reached a lot of other people in the community, and it hasn't reached those in NRC that are going to be responsible for the license decision

and those in the public who are concerned about this whole problem and watch all of us and decide how much they can trust this process to assure their health and safety.

That's a very different problem from fixing something in the way of one of the examples Mel was just giving about a technical problem concerned with weapons development, the cable wasn't right or some other problem.

But basically, what you have to do is understand what the technical problem is, come up with an improvement, a way of fixing it, and then you have to sell it to the project manager. And once that individual is sold, then the problem can be fixed, and we're over and done with it, and we go on to the next one.

In this program, we are ultimately talking about selling first and foremost a very complex regulatory process, and then you are talking about selling it out in the public.

The public in the State of Nevada, I have had the opportunity to be there a number of times during the month of October. What Dr. Carter was describing, that was an extreme position. But we have lots of concerned people that showed up to talk to us about their concerns on the repository, and it seems to me if natural analogues or some other ways of investigating provide us with better ways that we can explain the uncertainty, maybe even reduce the

uncertainty and increase the level of trust in these complicated analytical tools, which the problem forces us to use, that that is a very, very good investment in improving not just the quality of the product viewed by the technically trained people within the lab structure, but the quality as perceived by those that are going to be involved in the decision process or who are very concerned about the decision process.

So I think we ought to take seriously the idea that there is some communication about quality in addition to quality assurance viewed just within the organizations.

And I have some concerns about the words on the 1990 QA Mission Statement that you gave us on the last slide, "to render our products unassailable in a regulatory environment."

Well, I can assure you based on the meeting that I attended in Reno that that fellow who wore the T-shirt with the oriental leader, he's going to assail regardless.

His mind is made up, and there may be a number of other people.

In EPA's experience over the last several decades, 80 percent of their decisions result in litigation. I think being assailed is a fact of life in this kind of a program.

I think the issue is: How well can you

communicate the basis for your decisions by having the appropriate level of accuracy in your information and be able to describe where your information and assure the trustworthiness of the process? So the issue is not being unassailable, but rather being able to resist the assaults that are likely to occur in the best way.

And I think that communication becomes an essential part of it. It's not just the ability to understand it. It is the ability to communicate that understanding when the challenge occurs, and I think if you do that well, the chances of being able to resist the assault -- whereas, if you're working in the old mode of "all we have to do is provide a technical fix," you're going to find the program is very deficient.

CHAIRMAN CANTLON: I'd like to open it up now to questions from the audience, participants that would like to have this group -- we have a group of people -- participants, experts in a number of fields. Any issues that we haven't brought up or that we brought up and that you feel a little uncomfortable about, ambiguous -- yes.

MR. HAYES: Larry Hayes, Technical Project Officer, USGS.

I hope we've all agreed that while the patient is quite sick that we found some medicine, and there is optimism for recovery.

I think we've also agreed that a big part of the medicine is input from the very high caliber of scientists that are working in this program, that they do want to help, they will help. They're a big part of the medicine.

I think we've left out though a part of the medicine that we need, also, an acknowledgement that we need to make. The QA folks in this program also are talented and wanted to help, and I think they must be part of the medicine also.

Thank you.

CHAIRMAN CANTLON: Let me just make one rejoinder. I can't help -- but our institution, sort of like the University of Hell, has two medical schools.

(Laughter)

When you use a medical analog, you've got to recognize that witch doctors do have certain kinds of success because part of illness is psychosomatic. And if a patient feels well or feels something is happening -- irregardless of whether there is any fundamental change or modification -- you can get the illusion and a perception that things are better. So I think it's extremely important here.

And when you look at quality assurance, that this initial euphoria that somebody, by God, at last listened to the bitching that science legitimately had -- somebody

listened. That's sort of the witch doctor's situation. You don't know yet that there is any real therapy under way. And I think it's incumbent on Don here and the people that are involved in the QA operations now to delivery an honest-to-God therapy and not simply rely on the psychosomatic reaction that we've been listening to.

There is a second step, and it's extremely important that that second step really begins to show progress. And I have some assurance that that is understood.

One other kind of general observation. I've been Science Manager at a university where we have bureaucratic BS out the kazoo --

(Laughter)

-- and have dealt with it on many, many levels. And I would say this about auditors. Auditors get their Brownie points from sane people. That is the reward structure for auditors, and you shouldn't essentially be panicked because you get cited. It's in the nature of things.

What is devastating is the political use of audit data to pan high quality science performance and essentially to make a public spectacle of it. And I think, again, this is part of the maturation of the science community that has to toughen up because we've worked for

250 years in a setting in which we were each other's critics. We didn't care a hell of a lot about what the public thought.

Now, we're dealing with a type of science that affects so pervasively large segments of the population that what the public thinks about it is absolutely crucial.

But today, the planet itself can be put at risk with a number of technologies.

And so it isn't incumbent on the scientific community and especially the science managers to really make that transition of science and its role in public affairs. That's tough.

And when I chaired the EPA Science Advisory Board, it used to be a real struggle to get the scientific community to recognize that the ultimate decision is made politically. And this decision will be made politically -- and Carl is hoping to God --

(Laughter)

But that is going to be what prevails if it goes his way.

Scientists cannot in the last analysis override the society in this country. And interestingly, we had at our Reno hearing a Kazakhstani from Russia and a Russian physician telling us about the problems that they're having in Kazakhstan because of the fall-out and --

DR. NORTH: This, incidentally, was covered in an article in yesterday's Washington Post that I happened to read last night.

CHAIRMAN CANTLON: And they're making the point that it is essentially the revolt of the people that turned around the Russian government -- the central Russian government.

So the point -- the final thing we have to recognize is that the scientific community is no longer talking to itself. It is engaged in a set of actions that will pervasively impact broad segments of the public, and we have to mature to the point where we have to be Caesar's wife, essentially.

DR. CARTER: John, could I interrupt you a moment? I have one thing, and then I've got a couple of questions I'd like to ask this morning's participants.

But I think that all the BS you mentioned in the university affiliation, you better identify the school. Otherwise, some of the audience --

(Laughter)

-- may think you're talking about Georgia Tech.

(Laughter)

What I would like to do is ask a couple of questions to the various participants in this morning's program and see if we could get a response.

Dick Herbst responded to one of the questions I had, but I'd like to ask the other participants. And I'll give the two questions, and then maybe we could hear their response to the first one and then the second one.

The first question is: What level of QA is reasonable and appropriate? And like I say, Dick responded to that. But I'd like the response of the other participants in this morning's program.

The second question: Under a repository program now, what should be excluded from QA, if anything? I'd like to ask each of the participants those two questions.

MR. HAYES: You want to respond?

I have to give you some rather flip answers. I don't know, number one. What is needed is what will work.

That's how much QA we need, whatever is needed to make our work acceptable. And while not unassailable, but successful in however that work turns out, whether supporting suitability or not supporting suitability. And right now, I don't know how much is enough.

Because of that -- in answering your second question -- I have to say I don't know either. I don't think our program is mature enough that I could look at it and say this is not needed, this is not adding any value, we should be without it.

DR. CARTER: You're going to give USGS double

time?

(Laughter)

MR. DUDLEY: There's a couple of things. I'm Bill Dudley with the USGS.

I think that the answers are not completely identifiable. But first of all, as to what is needed, I think that will fall naturally out of the careful analysis of the impact -- potential impact of any activity on the ultimate determination of the safety waste isolation capability of the site. So it is evident that many things will be much closer to the decision than will other things.

An aeromagnetic map that allows us to draw up any judgments regarding what the geology of the site may be is important, but it is so far removed from that ultimate decision. Normal scientific practice is quite adequate just by inspection.

As far as the second aspect of what is not needed, I think that, again, falls out from that.

I think one thing that all the scientists agree on is that those things are crucial to the actual performance of the repository. Indeed, there has to be QA to some reasonable level.

The second thing they ought to agree on that we do have to produce the documentation as to what was done and why decisions were made. Those will be essential

components of the licensing process.

DR. CARTER: Okay. Because these questions are part of a set that you could ask, how can you improve the Quality Assurance Program?

Les?

MR. JARDINE: If we don't get double time, I'll defer to David.

DR. CARTER: All right.

(Laughter)

MR. SHORT: The first question, what's reasonable and appropriate, this is a difficult question, and all of us have been trying to identify the appropriate levels, performance and controls necessary to assure quality of what we produce. (Off mike).

I'm sure that there will always be differences of opinion on the part of the people involved, whether it's management, QA or the technical staff. But I think our technical staff have expressed to me that when they produce something and it's supposedly has quality in the scientific sense, first and foremost, it also has to be acceptable to their peers. And they consider that one of the primary things.

They also see that the documentation that goes along with that is going to be needed for the licensing process. That is another group of people. And of course,

the confidence that management has in their quality, what they produce, the process that they're using -- it is going to determine what really becomes acceptable and reasonable. And it will be entered into the process.

And at this time, we're starting our first series of gradings at the lowest level for the scientist himself to recognize -- with review from peers -- what's an acceptable level of quality and the controls involved in producing them.

What should be excluded from the quality assurance, we'll go along with that in the grading process.

Some things have been mentioned earlier in terms of management controls and management requirements.

Up front from the scientific viewpoint, they would say so many things are independent of quality framework -- you know, the scheduling, the costs involved.

Others would say, "Oh, but if you want to look at whether this is being done effectively," they could say, "Well, that's part of quality assurance." But we have to come to some compromise with the technical people and the management and the QA people and those opposing total quality management before we can start excluding things.

And it would be an interactive thing. DOE recognizes it, and it will go on.

CHAIRMAN CANTLON: Sandia?

MR. BLEJWAS: Well, as everyone else has said, it's an extremely difficult set of questions to give a short answer to. But in terms of what level of QA is reasonable and appropriate, I think we must always keep in mind what's the ultimate use for the work that we're doing.

And I know that we're aiming -- eventually, at least many of us are aiming, hopefully, for a license application, although we recognize we first have to do an evaluation of suitability with respect to the site. And ultimately, much of our information would have to be used in a legal arena.

I'd like to at least raise a concern that I have in this area, and that is that every piece of information that we gather from Yucca Mountain or information that we gather elsewhere on this project, it doesn't have to be viewed as the smoking gun that's used in a court of law when someone has been shot. But the state would like to think that everything we find might indeed prove to be a smoking gun, and maybe there are a lot of them out there.

I think really whether the site is suitable or not and whether it's licensable or not is going to rely on just a wealth of information -- perhaps millions and millions of pieces of information, many interpretations of that information. And for us to feel that the quality of each one of those pieces of information has to be perfect

in order for us to reach a correct decision about Yucca Mountain, I think, may be putting our resources too much into that type of information.

Your second question dealing with what should be left out of the program, the only thing I'd like to say in that regard is that I'd like to reiterate something I had in one of my viewgraphs -- in my mind, overly conservative management decisions need to be left out of the Quality Assurance Program. Other than that, I really don't have an answer.

DR. CARTER: Well, of course, that question has a corollary what should be included in the program. So you need to look at it positively or the other way.

Dick, we'd like to get your response to the second question at least, and you might have some additional thoughts about the first one.

MR. HERBST: No additional thoughts about the first one. But I'll take advantage of the occasion to respond to Dr. North just a moment.

I didn't mean to imply by my comments that we thought that natural analogues was not a useful tool. I was just trying to describe some of the limitations as we see them.

In fact, we have an interest in Alligator River in Australia. We've got Cigar Lake in Canada. (Off mike).

I don't want you to go away with the impression that we're not favorable or disposed to applying natural analogues this way.

In fact, we've tried to champion that within this program without a great deal of success. Perhaps your enforcement will help.

I will not respond to the first question. However, I would like to go to the second one. I have a very specific area of exclusion I would like to suggest, and that is prior data.

I think the way in which we are trying to deal with the prior data could be interpreted or perceived as somewhat of a retroactive quality assurance. My personal feeling is that the only thing that we have got to do with respect to prior data is make it absolutely clear to the decisionmaker that it was not developed under a Quality Assurance Program. And then the decisionmaker must weigh what that means in terms of how he implies that in arriving at a decision.

But I don't think it makes any sense at all to look backwards and try to retroactively quality assure, as we now understand it, prior data.

DR. CARTER: Okay. Let me try to summarize what's been said. But I gather at least that you could draw the inference or maybe a conclusion that the QA

Program as it relates to the Repository Program is not a full-grown, nurtured program. If you can't answer some fundamental question about it -- you need more data, more time or whatever -- it's obviously -- I had to use the word "immature." But it's certainly not a mature, full-blown program in that sense of the word. I think I'm hearing that essentially from all the participants.

Now, that's not bad. That's maybe just a historical statement.

CHAIRMAN CANTLON: If you could exclude from the QA process those things that are going to be cited by the auditor in a kind of mechanistic way, but has very little real impact on the quality of what comes out, in other words, that's the screen that one needs to look at. Is the audit citation non-useful in arriving at a good set of data? And that may be a kind of approach to looking at what goes in and what goes out.

Other questions or observations?

Don?

MR. HORTON: Don Horton, DOE.

I'd like to basically summarize and also respond to a comment that you made about auditors.

(Laughter)

They don't get points with me for identifying deficiencies. But they certainly become chastised if there

is a problem that they don't identify that sometime later is going to come up and bite us.

So I would certainly hope that they identify the problems. And when I say "problems," I mean real problems in the program. And at the same time, I would hope that on those problems that they identify that they also take into account how big are these problems, how much do they affect the end product, and that's what I'm looking for, and we're trying to develop not only the program, but the personnel performing the audits, to really take into account how much does this affect the end product.

In summary, I'd like to say that our program currently is in a state of change. We recognize that the upper tier requirements, while they have not changed that much, how we interpret those requirements is in the process of change, and it will continue to be as we see ways to improve the program. There are going to be continual changes in these interpretations of these requirements and how we implement them.

And when I say the total program, I'm not just speaking of the QARD or the QAPD, I'm talking about all the implementing procedures, the technical procedures, et cetera.

So I think that DOE has taken a step in listening to the concerns and problems that have been identified to

us, and we're talking action on a resolution of those, and we'll continue to enhance our overall program to address these problems and problems that we identify ourselves.

MR. SHORT: David Short, Lawrence Livermore Laboratory.

I'd like to add another comment concerning auditors. There are many fine professional auditors in the industry and in support of our programs. Some of them go a little bit too far sometimes in looking at word-for-word deviations. Some of them are very good at looking at the intent of management when they wrote that procedure or that instruction.

I think that we've been fortunate to have some very good ones, and our direction to them is to talk about the findings that we have in addition to the adverse findings so that management gets a better view, not of just the non-compliance or compliance, but the positive things that go on.

And Les and I consider both of those things when we use that source to see how well our people are doing in the program. So a lot of times things are emphasized as negative. We consider the whole report.

CHAIRMAN CANTLON: Yes, sir.

MR. COLANDREA: Tom Colandrea, Edison Electric Institute.

Just a couple of thoughts. We talked before about the cultural revolution and the need or lack of need for such a thing, and it might be better to look instead of a revolution as this process as an evolutionary process. This is not something that takes place in a flash. It is continuous improvement, and it is a process that looks at doing things on a continuous basis, not immediately, not in one big step.

Looking back over the last couple of years and going back particularly to the August '88 colloquium where a number of concerns by the scientists were expressed and what has been taking place since then, we see continuous improvement. We do see some rather advanced changes from that point in time.

I think if you were to try to put your finger on one thing you've heard, time and time again by the folks this morning and then again yesterday was the fact that the scientists had something to say, and management and certainly the QA people weren't always listening to what they had to say. And if there's been a major shortcoming, it's been in that area.

The scientists have been heard. The workshops that were conducted in October clearly demonstrate the capturing of those concerns, and they started off with the 33 or so that came out of the Lakewood, Colorado meeting in

August. But added to that by the scientists, by the QA and by the management folks at those October meetings were other concerns. Those have been captures. And from what Don Horton has said, there will be a continual ongoing approach to egress that.

So one other thought. You asked about what is needed and what is not needed. I think one of the shortcomings of this project in this past -- and it goes back to not necessarily communicating with the scientists -- is a lack of building upon what he or she -- the scientist is already doing. And there are a number of key examples where the scientist was doing something very meaningful, but that wasn't captured by the QA person.

There is a recognition now of the need to do that, and I think you'll see in the coming months a continuous improvement in that regard.

CHAIRMAN CANTLON: Let me call on Ken Hooks to kind of give us an NRC view now that you've listened to all of this. What have we missed? What should the panel be thinking about as it prepares its report for Congress and DOE?

MR. HOOKS: Ken Hooks.

I'll try not to disagree with myself anymore than I have to.

(Laughter)

As I said yesterday, I think that clearly in the two years I've been associated with the program, it has made great strides. There's a lot of improvement. I know there are a lot of people associated with the program. Particularly the working-level scientists are still very unhappy with a lot of things, and I can understand that.

I have specifically had experiences when I've been observing audits where I have had scientists tell me that their technical procedures aren't theirs. They're really QA procedures. And upon questioning, they say, "Well, we never had to do these things before, and we have to do them now because we have a QA Program, and therefore, these are QA procedures, and they're not really mine, and I don't feel ownership." That bothered me considerably because those were the procedures that that scientists was actually going to have to go out and do work to. So that's certainly an education process that has to get through and probably is attributable to insufficient communication between the scientists and the QA people.

I've also had people at the labs and the other contractors, including even Los Alamos expressed to me that they were unhappy at the progress of the program, not so much that no work is being done, but that the work they felt like they were hired and assigned to do couldn't be done because they either couldn't get out in the field or

they couldn't get samples from out in the field. And clearly, developing procedures, learning how to use them is real work. But it's not the real work these people want to do.

There's clearly a lot of overshoot from the side of the auditor. But let me give you a couple of viewpoints that are associated with the auditors. One is that auditors are all trained to write against deficiencies in the program. They have to be able to quote a requirement in order to write it down in their report. Now, some of the auditors that DOE has are truly excellent auditors with a good understanding of the scientific requirements of the program and also a very good ability to translate that into real terms of what their findings mean. But they are frustrated by at least their perception of the system that if they can't quote a deficiency to go with what they see, they think that management will not pay attention. There have been past instances where at least the perception of the auditors is that if it isn't written down as a deficiency in the report, when we come back next year we don't see any change. And so the auditors will go to great lengths to cite a deficiency as the basis of a general discussion of things they'd like to see change in order to force that into the report and force the management of the place that they're auditing to respond to it.

It gives the impression perhaps of a compliance-based audit. But I truly do not believe that that is what is going on -- with some singular exceptions, of course.

A basis for some of those singular exceptions is that these poor auditors have the NRC and the State of Nevada and Hart County and my county and who knows who else all watching over their shoulders, and every time they find a deficiency and there's an observer in the crowd, it has to go through their head, "What is somebody going to say if I find what is clearly a procedural deficiency, admittedly small, and I don't write it up because everybody knows that's what QA people are trained to do?"

I don't know how to attack that directly. If I'm doing the audit myself, I can make my own judgment call and ignore if it I want to. It's much harder for these people to do it because they're being watched by so many folks, and they don't represent the ultimate authority. Okay?

I think that the workshops are an excellent thing. I wish they had started sooner. I hope that we have enough of them so that all of the scientists on the program that feel like there is a problem get a chance to express themselves. I don't think that we're going to be able to solve all of them in a hurry. I think there's going to be a number of more recycles before we get to

where we want to be.

Overall, I think that the NRC and DOE and all the participants appreciate anything anyone can do -- even including yourselves -- to highlight the problems and help us focus on them. We know that this program can't be successful unless the public accepts what we're doing. And as much as it may be a bother and seem like a waste of time sometimes to have to go through endless reviews, not only you folks over us, but us over DOE and DOE over the participants and all that sort of thing, I don't see any way under the present way this country is run that we can do anything else with the program.

That's all in my philosophizing, and I don't think I contradicted myself. But if you have a specific question, I'll be glad to try and feel it.

DR. CARTER: No.

CHAIRMAN CANTLON: Any final shots?

DR. CARTER: Yeah. I do have one additional question, I guess, I'd like to ask the roundtable participants from this morning's sessions, if I could. Again, the question is: Do you have enough information and experience to date to differentiate in the process between what's directly related to improvement of quality in terms of scientific information and scientific data and the part of the process that's related to documentation records and

all these sort of things? And I think this is part of the problem of the scientific community, the engineering community. They are sort of rebellious in this area. They look upon the fact that they're doing, indeed, high quality work all the time and so forth.

And of course, they are not that concerned about the fact that they've got to send 10 copies of something by 9 o'clock in the morning or telex something to somebody, meeting deadlines, time checks, notifications and all these kind of things.

And I dare say in the QA Program that these two are woven together very closely. I guess the premise that I have is perhaps that things were separated somewhat. There's a possibility this would improve the process and, certainly, improve the attitude towards the people that are undergoing quality assurance, if you will, in the DOE Program.

So I wonder if I could get any response to that from the participants.

MR. DUDLEY: Bill Dudley, USGS.

I think the way to describing it is a proper separation of administrative and management requirements from aspects that are clearly important to quality.

The degree to which that will foster their acceptance -- the QA Program by the scientists -- is

somewhat dependent on what happens to the part that is segmented off away, the management and administrative things.

If the same philosophy as QA documentation is applied there, but it stays, it could possibly even worsen the situation.

So I think maybe one of Don Horton's biggest tasks is going to help keep management in mind because it may be a damaging quality.

DR. CARTER: Well, I guess, you know, if you think about it, if one of your scientists gets the Nobel Prize, it probably isn't going to matter a hoot in hell whether he sent something in by 8 o'clock in the morning and he had 23 copies, you know. It may be important for other reasons, but not for that. And you know, this is a scientific consideration.

MR. SHORT: Your question, as I understand it -- this is David Short, Lawrence Livermore Lab.

As I understand it, it dealt with experience involving improvement of quality as a result of this process -- involving records and documentation.

I think our scientific staff fully accepts the view that their work must be documented in detail. Their notebooks should be written in such a way that their peers could easily follow their approach to the results. So that

it has a validity in terms of critique.

One of the anecdotes used is in asking one of our senior scientists whether his particular plan that he had to write according to a program helped him in the performance of his research. And his response up front was no. "It was in my head. All I did was write it down."

I could see -- maybe not as competent a scientists -- one of our senior scientists -- going out in the laboratory starting off and doing the work and saying, "Oof, I forgot to order such and such" or "Oh, I forgot about this particular piece of instrumentation that I need."

So I think that for some people it has been helpful, and for others, it's an additional time consumer.

However, the results is the time they put in the writing of the reports, the critique of the reports, the documentation of the reports -- is valued across the board by all of them as being very, very important in the future.

MR. BLEJWAS: I'm not sure I totally understood your question. So let me give you an answer. And if I haven't answered your question, feel free to probe further.

My understanding of what we do at Sandia with documentation -- but I'll also extend it, as Dave did, to preplanning -- is that for the most part, we think that the process is valuable and it's very good. And it's

necessary, and I wouldn't want it to be separated out and said we don't have to worry about this as part of our Quality Assurance Program in total. There are some requirements that indeed shouldn't be in a Quality Assurance Program.

But our scientists, we don't have trouble with our scientists buying into the idea that their work has to be documented. We don't have trouble with the fact that they have to plan their activities and they have to write down their plans and their plans have to be reviewed. I think the difficulty is when their plans have to be written, rewritten, reviewed, re-reviewed, and it gets to be a very lengthy process that doesn't really add any value from their perspective.

But the overall concept is a very good one, and it should be a part of our Quality Assurance Program.

MR. HERBST: Dick Herbst, Los Alamos.

I'm sorry, Mel. I may be even less certain about your questions. Straighten me out.

I think that what we are trying to do at Los Alamos is we're trying to get the document hierarchy sorted out so that requirements appear in only certain kinds of documents. They're not littered all over the paper. I think that's an important step.

Les said Livermore has chosen to sort, if you

will, quality requirements with the administrative requirements and, as I understood him, in two sets of documents. We've been adverse to that because it causes people within who must execute the process to be consulting multiple volumes. That may be a down side, if you will. So we're not disposed to that particular solution, which leaves us with the difficulty of having to try to sort within a single document. What action are you taking relative to quality? What action are you taking relative to some administrative requirement?

And the way in which I think makes most sense for us to deal with that is to make this a component of our procedures when we proceduralize some process. It is to identify unambiguously what is the quality record that will result as a consequence of doing this for the process. That is identifying unambiguously what pieces of objective evidence will be produced and constitute the quality record in connection with that process, and that's the way it works.

MR. JOHNSON: Carl Johnson, State of Nevada.

I think I'd like to, as a closing remark, follow up to some comments that Dr. North made earlier, this roundtable and roundup session.

While it's at least the view here that the technical programs and the scientific efforts will be the

determiner of whether the site is a suitable one or not a suitable one and whether it will go into licensing or not, that seems to be the view. Although what I tried to portray to a question from Dr. Price yesterday is that politics will be the ultimate decider of the repository or not the repository. Politics, particularly in the State of Nevada, and the state's opposition to the repository is driven by the views of the people.

A poll that was taken a few weeks ago and reported in the Las Vegas Review Journal last week indicated almost 80 percent of the people were opposed to the Repository Program. Another question related to that indicated that better than 60 percent of the people were distressful of the Department of Energy.

The point that I'm trying to get to is that this is a public process. Public confidence is the only way this program is going to move forward and move to its ultimate conclusion. Quality Assurance has a lot to do with moving forward and enhancing the quality of public confidence in this program.

One only has to look at examples from the nuclear power industry, that those particular utilities who have good, well-run, efficient Quality Assurance Programs have a lot more -- are supported by a lot higher confidence by the public that they know how to do their job and can get

it done in a safe and efficient manner. Those particular utilities who have quality assurance problems, who have lots of corrective actions and deficiencies that show up on each one of the audits are the ones that have the lowest confidence ratings in the general public. Those are the ones that are constantly faced with problems of the general public making a decision either by a vote or whatever or pressure on their elected officials to close those plants down.

So the point that I'm trying to make is that quality assurance has to do a lot to do with public confidence. That's just the point that I want to end up with.

CHAIRMAN CANTLON: Thank you.

Well, with that, I think we'll declare the panel session adjourned. We certainly appreciate all of you for coming and participating -- especially you people that put together a very fine program for us. We are delighted and think it would be helpful in putting together our own report. Thank you.

(Whereupon, a recess was taken at 1:58 o'clock to be reconvened for the Executive Session.)