

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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BRIEFING BY NUCLEAR WASTE  
TECHNICAL REVIEW BOARD

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PUBLIC MEETING

Nuclear Regulatory Commission  
One White Flint North  
Rockville, Maryland

Tuesday, July 30, 1996

The Commission met in open session, pursuant to notice, at 10:00 a.m., Shirley A. Jackson, Chairman, presiding.

COMMISSIONERS PRESENT:

SHIRLEY A. JACKSON, Chairman of the Commission  
KENNETH C. ROGERS, Member of the Commission  
GRETA J. DICUS, Member of the Commission

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

JOHN C. HOYLE, Secretary  
KAREN D. CYR, General Counsel  
JOHN E. CANTLON, U.S. Nuclear Waste Technical  
Review Board  
JARED L. COHON, U.S. Nuclear Waste Technical  
Review Board

P R O C E E D I N G S

[10:00 a.m.]

CHAIRMAN JACKSON: Good morning, ladies and gentlemen.

This morning, the Commission is pleased to welcome John Cantlon and Jared Cohon from the U.S. Nuclear Waste Technical Review Board, who will brief the Commission on the status of their activities.

Dr. Cantlon, Dr. Cohon, we are very pleased to have you here.

It has been more than two years, since March of 1994, since the Technical Review Board last briefed the Commission about the Board's activities and recommendations and its perspectives on the Department of Energy's program to manage high-level radioactive waste. Much has changed in that period, some of which I won't mention, but in fact the makeup of the Commission itself is quite different in that this will be the first briefing that Commissioner Dicus and I have had with the Nuclear Waste Technical Review Board. We both have been looking forward to this briefing.

Since the last briefing, the National Academy of Sciences, as you know, as directed by the Energy Policy Act of 1992, has issued its report that provides advice to the Environmental Protection Agency for establishing standards for the disposal of high-level waste in a geologic

repository. Based on the National Academy's study, the EPA is now developing standards for Yucca Mountain and the NRC would amend its regulations as appropriate to the revised standards.

Changes have also occurred in the DOE program. The tunneling program at Yucca Mountain has progressed nearly four miles into the mountain, allowing a more detailed assessment of specific site issues. The DOE has issued a viability assessment for determining the technical suitability of the Yucca Mountain site and, as you are all aware, Congress is currently considering legislation that could significantly alter the existing high-level radioactive waste program. So it is clear then that the high-level radioactive waste program has been and continues to be in a state of change, so the Commission believes that this briefing is very timely in that sense and is particularly interested in receiving your views and the views of the Nuclear Waste Technical Review Board on the state of DOE's civilian radioactive waste management program.

Commissioner Rogers, do you have anything you would like to add?

COMMISSIONER ROGERS: No.

CHAIRMAN JACKSON: Commissioner Dicus?

COMMISSIONER DICUS: No.

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CHAIRMAN JACKSON: If not, we look forward to hearing from the two of you.

DR. CANTLON: Chairman Jackson, Commissioners, ladies and gentlemen, good morning. It is a pleasure for us to be here today.

Just by way of background, my background is in environmental biology and Jerry Cohon is the dean of the School of Forestry and Environmental Studies at Yale University.

Since we have not met with you before, let me just begin briefly by summarizing what the Nuclear Waste Technical Review Board does. It is charged, as you know, with evaluating the technical and scientific aspects of the Department of Energy's high-level nuclear waste management program. This includes site characterization and transport of high-level radioactive waste and spent nuclear fuel.

Today, in our prepared remarks, we would like to briefly review some of the key developments of 1995 and the first half of 1996. These have been somewhat turbulent times, as you referred to, but there also has been substantial progress. I would like especially to offer our thoughts on some of the legislative and regulatory changes that were proposed during '95 and which still are under consideration.

Then we will summarize for you the Board's current

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views on the status of the program, including DOE's plans for evaluating the viability of Yucca Mountain site within the next two years. After our prepared remarks, we look forward to a free ranging and candid discussion that has been characteristic of our past meetings with the Commission.

As you are aware, the program funding in recent years has been anything but stable, following the sharp increase in the program's budget. For fiscal '95, it became apparent that funding levels for fiscal '96 and beyond would not support the activities and the milestones that had been laid out in the 1994 program plan.

Faced with a 40 percent reduction in budget, DOE's Office of Civilian Radioactive Management had to reduce the scope of its activities and then set tougher priorities for its efforts for the coming years.

DOE is now pursuing this viability assessment for siting a repository at Yucca Mountain to be completed in 1998. Viability is affirmation of life and the purpose of this assessment seems to be to decide whether or not continued site studies and repository design efforts are warranted. The relationship between the viability assessment and an evaluation of the technical suitability of the Yucca Mountain site is really unclear.

In the Board's view, a recommendation of the site

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to the President should require an assessment that it is technically suitable for development of a repository. The Board has defined suitability to mean a high probability that the site, along with the appropriate engineered barriers, can provide long-term waste isolation. The 1998 viability assessment appears to be a less well documented and less conclusive evaluation of the site's potential.

Slide five shows the general configuration of the exploratory studies facility, including the location of the

test alcoves and the thermal test facility now being constructed off the main tunnel.

Slide six also illustrates the general layout of the ESF but this time shows its relationship to the two blocks where the radioactive waste might be emplaced in the repository.

Recently, one of the most visible parts of the program has been the operation of the TBM to construct the exploratory studies facility. The Board was an early advocate of underground exploration at the Yucca Mountain site and remains so today. The exploration at Yucca Mountain has provided a number of geological insights that would have been difficult to obtain from surface based activities.

Underground exploration has indicated, so far, that the quality of the rock inside Yucca Mountain is better

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than anticipated from surface mapping. The discovery, however, of elevated levels of chlorine 36 at a few locations suggests that pathways exist along which occasional pulses of precipitation can penetrate very rapidly to the repository level.

One of the most important tasks ahead for the DOE, as it evaluates the suitability of the Yucca Mountain site, will be to determine how widespread, how numerous and how fast these paths are, how much water they carry and how often that water flows to the repository level. It would also be very useful to know whether they continue downward to the water table.

While somewhat less visible, substantial progress also has been made in developing a technically credible waste isolation strategy for a potential repository at Yucca Mountain's site. As this slide indicates, the strategy is based on two primary goals: Near complete containment of radionuclides within the waste packages for several thousand years and acceptably low annual doses to members of the public living near the site.

The strategy contemplates achieving these goals by relying on five engineered and geologic barriers which the DOE refers to as attributes to isolate the waste from the accessible human environment.

The Board believes that the strategy must be

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soundly grounded in credible and testable hypotheses concerning the interactions between the engineered and the natural components of the repository over long periods that accommodate change in climate, in geology, hydrologic, geochemical and ecological processes occurring at the site.

If soundly developed, demonstration of probable performance of the strategy will provide a technically supportable basis for setting the priorities for future activities at Yucca Mountain and for the repository design efforts.

Another area of progress for the DOE during 1995 was completion of a more detailed, total system performance assessment for the Yucca Mountain repository. This analysis projects, based on current knowledge, how well and over what period a repository would be able to isolate waste. Equally important, it helps identify the most important parameters affecting performance, again allowing the DOE to better focus its future studies of those parameters.

Changes in the legislative and regulatory environment have affected the U.S. high-level nuclear waste program from its inception. As you know, changes in the basic health and safety standards for a Yucca Mountain repository are now under consideration as directed by Congress in the Energy Policy Act of 1992.

For some time, the Board has believed that current

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regulations and perhaps the health and safety standards governing spent fuel disposal needed to be updated. Current EPA health and safety standard and the NRC and the DOE regulations were really too detailed and probably enacted too early in the process of searching for a permanent repository site.

Scientific and technical knowledge, particularly when applied to a first-of-a-kind undertaking, take time to evolve. In retrospect, a wiser course may have been to collect that knowledge and to use it in developing a regulatory framework.

In the absence of such an approach, the Board believes that the NAS report and the current scientific and technical understanding of the conditions at the Yucca

Mountain site should provide a basis for revising safety standards and regulations. However, the standards in the proposed regulations are well above risk levels and well below the time periods for assuring safety that are being considered by other nations.

In response to a request from the EPA, the Board expressed its view on several key issues raised by the NAS report. The Board stated its belief that if the EPA's standards for a Yucca Mountain repository are to apply for more than 10,000 years, appropriate language should be included in the standards to accommodate the increasing

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levels of uncertainty in projected human health risks over a very long period.

The Board noted that the stringency of the standards for the long-term performance of a repository at Yucca Mountain also will depend on the definition of the critical group. The Board endorsed the general concept of a probabilistic critical group but the alternatives suggested in the NAS report, a subsistence farmer critical group, seems overly conservative for a site like Yucca Mountain which has a harsh climate and lacks arable land.

A reasonable analysis using a probabilistic approach should consider alternative lifestyles by which individuals could be exposed to releases from a repository. The Board stated its belief that incremental risk, if any, associated with the gaseous carbon 14 releases from Yucca Mountain repository should be considered negligible and beyond regulatory concern. The Board also stated that it agreed with the NAS that there is no scientific basis for predicting the probability of inadvertent human intrusion over the long time periods of interest for a Yucca Mountain repository and, accordingly, intrusion analysis should not be required and should not be used during the licensing to determine the acceptability of the candidate repository.

In its letter to EPA, the board noted that the form the standards eventually take could have significant

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implications for repository design.

For example, if the repository standards apply out to a million years, this may serve as a disincentive to spend money to develop more robust engineered barriers or to seek a better quantitative assessment of retardation in the natural barriers. The board believes that wherever practical releases should be delayed through the use of repository design and engineered barriers.

Above all, the board has urged the EPA to keep the standards simple. In the board's view there are limits to what scientific knowledge can accomplish and the standards should recognize and be consistent with those limits.

The board also thinks it may be time to look at the overall process that the U.S. uses in siting, building and licensing a permanent repository. The time may have come to establish a process that acknowledges the need to adapt to changing information. There are a variety of ways of accomplishing this from changing the program's organizational structure to changing the manner in which the repository is licensed.

For example, a more realistic approach to developing a repository may be to license and construct it in increments, say, of 10,000 to 20,000 metric tons while maintaining assured retrievability instead of developing a final design and securing a license for the full 70,000 or

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more metric tons.

Plans for continued testing and monitoring during a repository's initial operation phase also seems to be a very prudent step.

On March 20th, 1996, the board submitted to Congress a report summarizing its views on the disposal of storage spent fuel. The board recommended that the focus of the U.S. policy should continue to be on permanent disposal of spent fuel and high level waste. The board observes, however, that centralized storage capacity which currently is not available in the United States will surely be needed in the future, especially when the reactors begin to shut down in larger numbers.

A large, centralized storage facility will be necessary, one, to facilitate repository operations and waste handling, and two, to address storage needs which will increase markedly around 2010, as the slide illustrates.

The board concluded that storing spent fuel at or near Yucca Mountain now, before the site has been determined

suitable for repository development, risks prejudicing the decision about the site suitability and may also threaten the credibility of the waste management program.

It also would exacerbate the problem of limited resources for the site characterization program.

The board concluded that there are no compelling

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technical or safety reasons to move the spent fuel to a centralized storage facility for the next several years.

Now there are some other developments which have gone ahead, and Dr. Cohon will summarize these for the board.

DR. COHON: Thank you, Dr. Cantlon.

I, too, am very pleased to be here, Chairman Jackson. This is also a first for me.

Progress in assessing the Yucca Mountain appears encouraging. The program is beginning to collect geologic and hydrologic information from the repository horizon. This will be crucial in determining the suitability of the site.

If TBM excavation rates can be improved and if management improvements are made and sustained in other areas the program should be able to proceed more efficiently toward a site suitability decision.

It is obvious that efficient progress cannot be achieved, however, without adequate and stable program funding. To determine the required level of funding, a sound technical justification for the planned activities should be developed.

To a large extent, this justification should flow naturally from the evolving waste isolation strategy and the results of total system performance assessment.

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The board is pleased with the progress that was made in 1995 in the formulation of a waste isolation strategy and in the use of that strategy to help set priorities for the activities of the Yucca Mountain project.

During 1996, however, further development of the waste isolation strategy seems to have slowed. Additional efforts are needed to continue development of the strategy and to use it to develop a technical basis for planning program activities.

Some of the problems that have caused continuing frustration with the program have yet to be resolved. Perhaps the most important of these is the perception of program inefficiency.

The DOE's tardiness in articulating a technical basis for its program activities has contributed to these perceptions.

This sense of inefficiency is heightened by the DOE's inadequate integration among the various activities in the program. At times, as we have seen our board meetings, some program participants seem to have little knowledge of the activities of other participants.

The program also continues to be schedule-driven. Despite the sharp reduction in funding for fiscal year '96 there seems to be an effort within the program to maintain nearly the same schedules for repository development and

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licensing.

For example, the DOE says that projected funding will not permit a technical site suitability decision in 1998. The DOE's response has been to maintain a 1998 milestone nevertheless but to give the decision a new name, a "viability assessment."

The technical basis for the viability assessment will be less complete than had been anticipated for the technical site suitability decision.

The board believes it would be better to establish a strong technical basis derived from the waste isolation strategy and total system performance assessments to determine the scope of work required, then more technically defensible schedules and decision points could be established.

Perhaps the single most important technical decision facing this program is evaluating the suitability of the Yucca Mountain candidate site. For the next two years the program will focus on a viability assessment of the site, however. As we understand it, this decision of viability is not a finding that the site is suitable for development as a repository. It is instead merely a determination that the site continues to be a live candidate that requires additional studies leading to a site

suitability decision in 2001 and completion of a license

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application in 2002.

Senate Bill 1936, as we understand it, currently to stand would move the site recommendation forward in time to 1998 with a much diminished technical basis for that decision.

The board believes that additional studies beyond those planned for the viability assessment will be needed to evaluate the site suitability, most notably an east-west excavation across the candidate repository block.

Years of underground construction worldwide show that no amount of surface-based testing can eliminate the necessity for underground exploration and testing. It is the board's position that a technically defensible evaluation of the site cannot be made without exploration that would eliminate or greatly decrease existing hydrologic uncertainties.

The board continues to believe that an east-west crossing of the geologic block west of the Ghost Dance fault, i.e., in the upper waste emplacement block, is necessary prior to any technically defensible decision on site suitability and in evaluation of the adequacy of its disposal capacity.

The current desire for the repository has all or almost all waste emplacement in the upper waste emplacement block west of the existing tunnel. This block, which is 4

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kilometers long and 1.2 kilometers wide, has not been explored by drilling or by subsurface exploration.

Without the east-west exploration the geologic and hydrologic uncertainties of the unexplored portion of the repository block must be extrapolated -- the geologic and hydrologic characteristics, I'm sorry, of the unexplored portion of the repository block would have to be extrapolated from those found in the portal-to-portal loop, the current tunnel.

Exploration of such a long distance would be difficult to justify technically.

The 1996 revision of the DOE's program plan shows completion of an East-West excavation if deemed necessary. However, even if undertaken, this excavation would not be completed before the 1998 viability assessment.

In the board's view a technically supportable decision about the suitability of the site for a repository of adequate capacity simply cannot be made without the information that would be obtained from an east-west excavation across the block.

Initial results from underground tunnel scale heater experiments also will be needed to predict better the movement of water in the rocks surrounding the hot waste packages. The DOE is now excavating facilities for these tests but the tests cannot be completed and the results

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evaluated before the 1998 viability assessment.

The board cautions against making more of the viability assessment than it merits. Additional information will be needed beyond that which will be available for the viability assessment before a technically-supportable decision can be made about the suitability of the Yucca Mountain site.

The board believes that adequate information can be acquired within four to five years to support a suitability decision about the Yucca Mountain site but adequate and stable program funding will be needed if this goal is to be achieved.

This concludes our prepared presentation. We will be happy to answer any questions you may have. Thank you.

CHAIRMAN JACKSON: Okay, thank you.

Let me start by asking you a couple of questions.

Let's talk explicitly for a moment about the east-west crossing that you talked about and the words I guess in your report indicated that the DOE's program plan shows completion of that east-west excavation if deemed necessary.

Has there been any movement with respect to renormalization of DOE's program plan with respect to contemplation of that?

DR. CANTLON: Not that we are aware of. They are aware of our concern about it. I think they concede that at

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some point it would be necessary but they doubt that they are going to have the funding to get it done before the viability assessment.

CHAIRMAN JACKSON: Another question was in the view of your board to what extent is the DOE program even in this renamed or renormalized program focused on, still focused on the most important issues perhaps without the depth you would like to see, or is it in any way likely to be compromising of the ultimate suitability evaluation that you feel is necessary in order to determine the significant attributes?

DR. COHON: Well, let me give you my opinion on that.

I don't believe they've lost their way. I don't believe that they are moving in directions that are inconsistent with the suitability determination.

We would like to believe that a viability determination is a step along the way towards suitability and in fact we believe that to be the case.

What concerns us is the pressures on the program, both funding and otherwise, which may lead the program to renormalize -- that's a good word, Chairman Jackson -- so that viability assessment becomes equated with suitability determination.

As our statement indicated, we believe that simply

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is not true. That is going farther than viability assessment can take you.

CHAIRMAN JACKSON: Let me switch it over.

Assuming that you have a familiarity with what the NRC has been doing, and you know that the NRC Staff has been focusing on these key technical issues, to what extent do you feel that they are in fact the appropriate issues to focus on for evaluating repository performance or the safety performance thereof?

DR. CANTLON: Well, clearly if one wants to put spent fuel in that site for a very long period of time the real challenge is to have that material retained above the water table in such a substantial way that the small pulses that get there over the longer period of time will then be diluted out before it gets out to where people will have access to it.

We think that if you now look at that challenge, the geo-hydrology of the site is really the critical set of issues and the finding of Chlorine 36 enriched waters at the repository level tells you that bomb-affected water has gotten there in 50 years, which isn't in an of itself a veto of the site because if those occasions and if those places are both very dispersed -- in other words, only a rare event, one of the big thunderstorms that occurs, a 100 year type flood -- and if it occurs in only a very few places,

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then the emplacement process which repository around the world have conceded that you are not going to be able to randomly place waste packages in the earth. You have to pay attention to what the geology is, and by avoiding those places.

So that is the one challenge -- to really document -- and that is why we are so fixed on the idea that until one knows in an east-west crossing that the bulk of the area that is needed for waste emplacement isn't even more permeated with Chlorine 36 pathways, it's very difficult to assume that that site will have the capacity to handle the spent fuel so it's the capacity issue.

Then one needs to look at the rigor, the robustness of the engineered barriers and obviously this is a conflict between the economics of doing the job and the security that in the long range the transuranics are actually going to be contained long enough and so the question of what the backfill should be like and whether or not there should be fillers in the package.

I personally -- I don't know how widely this is shared in our board -- but my own personal view is that any time you have large void spaces in a waste package, eventually as that package crumbles, its strength deteriorates, you are going to end up with little pockets as those void spaces essentially create little pockets over

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each waste package. Well, that is an invitation to mobility, and so I think the idea of putting fillers in the package is good.

Now what that does is to give you a real headache. Who's going to do it? The utilities? Or are you going to do it centrally out at the site? What are you going to use?

There are a lot of economic and safety issues that relate from that, but if you really want to look at long-

range safety, I think you need fillers and you need backfill.

DR. COHON: With regard to the question of whether we, both our Board and your Commission, are looking at the right issues, I think the big unknown here is what you started your remarks with. That is, what is the pending standard that we expect to be coming out from the Environmental Protection Agency. That will have profound implications on what we need to look at and, depending on how that comes out, it will be interesting to see how both the program and NRC respond to that. This is further complicated and made uncertain by pending legislation.

CHAIRMAN JACKSON: Let me do one last question. I keep saying they are "last." You have to beware of people who have five last questions.

DR. COHON: Can we hold you to five?  
[Laughter.]

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CHAIRMAN JACKSON: I am going to read from your prepared statement here. It says the Board believes it would be better to establish a strong technical basis derived from the waste isolation strategy which you have just been speaking to and total performance assessments to determine the scope of work required and, of course, referenced to the appropriate standards. And then I do note that you made a comment that, at times, some of the DOE program participants seemed to have little knowledge of the activities of the other participants.

Why am I bringing these two up in the same paragraph? I had made some note of something like that when I visited Yucca Mountain last year but I guess the question becomes does that not have impact on being able to make a total system performance assessment if all the pieces are not communicating?

DR. COHON: Absolutely. The approach that the DOE has developed to deal with that particular issue is the creation of working groups around specific pieces of the total system performance assessment. These working groups include both technical managers and the modelers of the performance assessment activity, as well as the scientists who are doing the data collection. These working groups, then, are intended to develop a single coordinated, integrated component of the total system performance

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assessment. This is just now happening so we can't comment yet on how effective this is.

We are keenly aware from our sense of history with this program that the program has made a very significant transition from a science-based program without a great deal of focus or direction in terms of trying to integrate or coordinate to one where the design, the waste isolation strategy and total system performance assessment are the dominant activities. It is not easy for a program this large to make such a dramatic transition and that is what they are struggling with.

CHAIRMAN JACKSON: I am told that your Board doesn't consider vulcanism to be a significant issue, although it has been something that our staff has focused on. Can you speak a little bit to that?

DR. CANTLON: Yes. I am a biologist and Jerry is an engineer, so we are clearly out of our technical depth here. But the geologists that have looked at and examined the whole set of issues, it has to do basically with the orientation of the past areas of vulcanism and whether one projects that orientation, avoiding that block or not avoiding the block. That is really the basic issue.

You know, it is extremely low probability, even assuming an orientation toward Yucca Mountain. So we don't think that that is going to be a project killer.

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CHAIRMAN JACKSON: Commissioner Rogers?

COMMISSIONER ROGERS: Well, maybe I can ask something that is in your field and that is the definition of the critical group. I wonder if you could comment a little bit on how you see that issue, which really still is getting quite a bit of attention outside of the National Academy study, particularly because the one dissenting opinion was offered by a very distinguished leader in the field, Professor Pickeford, in which he took the maximally exposed individual approach and was very comfortable with the subsistence farmer as a definition of that for a number of different reasons that I think he explained in his dissenting opinion.

How do you see that controversy? I am not quite sure how to interpret your comments here with respect to the definition of the critical group following a probabilistic definition or concept. Would you elaborate on that a little bit?

DR. COHON: Chairman Cantlon has designated me the expert on this, so I will try to give you an intelligent response.

This issue, as you point out, is a general one that doesn't just, of course, affect the standard for the Yucca Mountain repository but in fact is a key issue in risk assessment generally. I think that -- well, let me first

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explain the Board's position and try to explain the philosophy, if you will, that is behind it.

The Board's position was to subscribe to the notion that we don't know and can't know what population will live in or near -- in the vicinity of Yucca Mountain. Therefore, let's take an approach which assigns probabilities to various kinds of populations, to various critical groups. That is what we meant by that. That is what the report recommended.

Why would we recommend that and not support the notion of the maximally exposed critical group? I think the argument here goes like this. Our colleagues on the Board who are expert on this could probably give you a better discussion. When you are talking about a situation like this where we are trying to look out so far into the future and where it is impossible to know or even, I would claim, even to characterize the populations that will be there, on what basis do you choose a maximally exposed critical group? I mean, one has to fabricate it. In the spirit of probabilistic risk assessment, it seems only appropriate then that you should apply probabilities to those critical groups rather than choosing one and designing and planning for that one when you can't know what that one is.

This problem, being one of a kind and so far in the future with so much uncertainty, is distinctive, I

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think. There are other risk assessment situations where you can't know in advance that a person or a group will be exposed but at least the group exists and you know that they do something or live in a place so that they have a reasonable probability of being exposed. That's not so in this case. I am sure Professor Pickeford could give a wonderful and very rapid response to what I just said to support his position, but I think I have explained the rationale.

DR. CANTLON: One additional element in that discussion, I am a native of Nevada so I grew up in the desert and know that country and it is a little difficult to visualize a subsistence farmer anywhere near Yucca Mountain in today's climate so now one has to project ahead to pluvial periods. If you project ahead to pluvial periods in that area, the data that we have from pack rat middens and other kinds of data to identify what vegetation and so on was there, gets you up to about sagebrush level, which is also the kind of vegetation that you have in the northern reaches of the Nevada test site.

If you now project that around the state of Nevada, there are very -- there are almost no subsistence farmers in that environment. You have ranches, people living off of ranches, but they use surface water. You don't drill a well 1,000 feet deep and try to haul water up

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to do a subsistence farm. It is just not a credible thing for that environment today and it is even of shaky credibility projecting it to the pluvial period, you know, consistent with the Ice Age environment.

COMMISSIONER ROGERS: Just one other question.

How do you feel about the communication between the Technical Review Board and NRC staff? How do you feel that has gone and how do you see that in the future?

DR. CANTLON: Our communication is excellent. We have raided you for two of our outstanding professional staff.

[Laughter.]

COMMISSIONER ROGERS: Oh, you did? I am not sure that was quite what I was getting at.

[Laughter.]

DR. CANTLON: So these individuals, Dan Fehringer and Leon Reiter, have substantial NRC experience and have colleagues here and so I don't think we have felt at any

time away from your technical people. Now, obviously, as the Commission has come into its own conditions you, like any organization, have to protect your information and there are periods in which credibility is counterproductive.

CHAIRMAN JACKSON: Commissioner Dicus?

COMMISSIONER DICUS: I have no questions. Thank you.

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CHAIRMAN JACKSON: Let me ask you one more question here.

I note that you do make a point about the standards in the proposed legislation in the Congress being well above risk levels and below the time periods being considered in other nations. Is that in your prepared statement from the point of view of diplomatic or political difficulty or because you feel the standards being contemplated are moving away from what would have a reasonable technical foundation?

DR. CANTLON: Let me take a crack at that, Chairman Jackson.

I am particularly troubled with the 1,000 year standard proposed in the legislation. Now, obviously, when you write a standard, you are writing a law and, since very few governments have survived 1,000 years, I can understand a kind of legal rationale for that. But it does seem to me that if one looks at responsible intergenerational and now we are talking multigenerational relationships, 1,000 years is really an inadequate time.

Now, as I understand that language, it is the obligation of the NRC to characterize if not to establish the regulation so I think if it is sharply characterized out to 10,000 years, that would not -- I think that is, in simply recognizing the fact that laws don't exist for

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multiples of thousands of years, as far as we know.

Now, as far as the 100 millirem standard is concerned, that is substantially above international things and while I personally believe that the basic data for radiation effects at levels below 100 millirem are almost nonexistent really in terms of solid data, it doesn't trouble me as a level but it is an international problem in that other nuclear nations have adopted much more stringent levels of protection. Since you have a great deal of public concern about it, that is going to give us a problem, I think.

CHAIRMAN JACKSON: Dr. Cohon, did you have a comment you wanted to make?

DR. COHON: Nothing, thank you.

CHAIRMAN JACKSON: Okay. The last last question.

In what sense do you believe, and this is just for my technical edification, that the quality of the rock is better than anticipated? And this is based on the surface data.

DR. CANTLON: It simply means that there are bigger areas in which the fracturing is not as profound and that the quality of the fracture surfaces are such that it doesn't indicate a great deal of water movement.

CHAIRMAN JACKSON: Okay.

Well, thank you very much. I appreciate your

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coming for an excellent session. You have raised, in fact, many of the same concerns that the NRC has had with the high-level waste radioactive program and many others that we will consider, you know, as we move along through this precicensing phase.

We appreciate your taking the time to come here and brief us. We won't wait another two years. There is too much that changes in the interim.

Commissioner Rogers, do you have any additional comments?

COMMISSIONER ROGERS: No.

CHAIRMAN JACKSON: Commissioner Dicus?

COMMISSIONER DICUS: No.

CHAIRMAN JACKSON: Thank you.

This meeting is adjourned.

[Whereupon, at 10:48 a.m., the briefing was concluded.]