STATUS OF THE DEPARTMENT OF ENERGY PROGRAM TO DEVELOP A PERMANENT GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND POWER

OF THE

COMMITTEE ON COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED SIXTH CONGRESS

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CONTENTS

Page

Testimony of:

Berkley, Hon. Shelley, a Representative in Congress from the State of Nevada 10

Crowley, Kevin D., Staff Director, Board on Radioactive Waste Management 41

Gibbons, Hon. Jim, a Representative in Congress from the State of Nevada 8

Itkin, Ivan, Director of Office of Civilian Radioactive Waste Management, U.S. Department of Energy 24

Knopman, Debra S., Board Member, U.S. Nuclear Waste Technical Review 29

Page, Stephen D., Director, Office of Radiation, U.S. Environmental Protection Agency 34

Paperiello, Carl, Deputy Executive Director, Materials Research and State Programs, Nuclear Regulatory Commission 20

Material submitted for the record by:

Cohon, Jared L., Chairman, United States Nuclear Waste Technical Review Board, letter dated August 31, 2000, enclosing response for the record 121

Colvin, Joe F., President and Chief Executive Officer, Nuclear Energy Institute, prepared statement of 106

Crowley, Kevin D., Director, Board on Radioactive Waste Management, letter dated August 18, 2000, enclosing response for the record 103

Page, Stephen D., Director, Office of Radiation, U.S. Environmental Protection Agency, letter dated September 18, 2000, enclosing response for the record 127

Rathbun, Dennis K., Director, Office of Congressional Affairs, Nuclear Regulatory Commission, letter dated August 28, 2000, enclosing response for the record 115

STATUS OF THE DEPARTMENT OF ENERGY PROGRAM TO DEVELOP A PERMANENT GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA

FRIDAY, JUNE 23, 2000

HOUSE OF REPRESENTATIVES,
COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON ENERGY AND POWER,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:15 a.m., in room 2123, Rayburn House Office Building, Hon. Joe Barton (chairman) presiding.

Members present: Representatives Barton, Bilirakis, Largent, Burr, Shimkus, Bryant, and Boucher.

Staff present: Kevin Cook, science advisor; Elizabeth Brennan, legislative clerk; and Sue Sheridan, minority counsel.

Mr. BARTON. The Subcommittee on Energy and Power of the Commerce Committee hearing on the status of the Department of Energy programs to develop a permanent geologic repository at Yucca Mountain, Nevada, is underway.

Today's hearing will address the Department of Energy's program to develop an underground repository for the permanent disposal of nuclear spent fuel and high level radioactive waste. Solving the disposal question is absolutely essential if we are to maintain our existing nuclear generating capacity to meet the Nation's present and future energy needs. Members of the subcommittee are all too aware of how much time and energy has been spent wrestling with this issue in recent years. The Department of Energy has a clear statutory and contractual responsibility to begin accepting spent fuel beginning in January 1998, which is a year and a half ago.

The government's failure to meet that obligation has resulted in a growing financial liability that may eventually cost the taxpayers tens of billions of dollars. But the Department tells us that the earliest the repository will actually be ready for operations is in the year 2010. We must find a way to take acceptance of spent fuel from the utilities and move it to the repository some time sooner than 2010 if at all possible. Yet the Clinton administration has resisted all efforts to accelerate the acceptance date giving us veto threats rather than constructive solutions.

The focus of today's hearing is not on interim storage nor on a take title option or any of the other areas of contention. Today, we want to talk about the Department's plan to get the repository

ready for operation by 2010. We have to find out whether that schedule, even though it is 12 years too late, is realistic and achievable. To meet that schedule, the Department must first complete several near-term milestones.

Late this year, the Department is to issue a site recommendation consideration report followed by final site recommendation and a final environmental impact statement next summer. These documents are essential, and I want to repeat, these documents are essential to support the final selection of the Yucca Mountain site; and in turn, the license application to the Nuclear Regulatory Commission in the fiscal year 2002.

All of these steps are on the critical path if the repository is to open in 2010. Yet, there are grave concerns about the ability of the Department to meet this near-term schedule, and therefore, doubts about whether 2010 date is, in fact, feasible.

The first of these concerns deals with the adequacy of funding. Secretary Richardson finally admitted to this subcommittee last year that the repository will not be built by 2010 unless there are major changes as to how the program is funded. Unfortunately, that admission was followed by a veto threat regarding our committee's bill to take the repository program off budget to ensure adequate future funding. We are still waiting for the administration and the Department to send us a constructive proposal on how it intends to resolve the long-term funding profile problem.

Today, however, we also have to address the short-term funding situation. The Department did not receive all of the funds it has requested for the fiscal year 2000. And it looks like the fiscal year 2001 budget appropriation that is pending also will be less than the Department's request. We need to understand the impact of these near-term funding constraints on the ability of the Department to meet its milestones for the final environmental impact statement, site recommendation requirement, the licensing, and the licensing application, all of which are critical steps if the repository is to open on time in 2010.

As chairman of this subcommittee, I am very concerned about the Department's recent decision to recompete the management operation contract for the civilian radioactive waste management program. The contracts that the Department should be recompeting, such as the one for the management of the Los Alamos National Laboratory, the Department has never completed in over 50 years, despite the University of California's appalling mismanagement of security matters. But where the contractor appears to be performing well, and the program is coming up on several key milestones, this Department of Energy decides that recompetition is absolutely essential. Go figure.

I need to be persuaded that the recompetition of the Yucca Mountain contract at this juncture is really in the best interest of the program. I don't see how the committee can tolerate the Department claiming that the transition to a new contractor is an excuse for any schedule slippages. Mark my words, if they do recompete the contract, I will almost guarantee you there is going to be a slippage, and I will also guarantee you the Department is going to claim it because of the new contractor coming online. I hope that

I am not a prophet and am proved wrong on that, but I just feel it in my bones as I sit here.

The Nuclear Waste Technical Review Board was established to provide independent technical oversight of DOE's work on the repository. As DOE approaches these critical program milestones in the near future, I would expect that the role of the Technical Review Board will become more important than ever before. The Board has already surfaced a number of technical concerns about the Department's planning and design work. We need to understand these concerns better and find out if DOE is paying proper attention to the scientific advice that it receives from this review board.

The most complex, but possibly the most important issue that we have to address today, is an appropriate radiation standard for the repository. The Environmental Protection Agency was directed in the Energy Policy Act of 1992 to promulgate public health and safety standards to protect against release of radioactive materials from the Yucca Mountain site. Such standards are to be based on and consistent with the findings and recommendations of the National Academy of Sciences. Last summer, the EPA finally circulated a draft rule which proposed, in addition to an all-pathways individual protection standard of 15 millirems, a separate standard for the protection of groundwater.

It is my understanding that the Department of Energy, the Nuclear Regulatory Commission, the National Academy of Sciences Board on Radioactive Waste Management, all have significant disagreements with the EPA over this proposed stand-alone separate standard for the protection of groundwater.

Hopefully, we will be able, after today's hearing, to understand the scientific rationale for the need for the separate EPA groundwater standard, if there is such a need, and specifically, whether the proposed standard is consistent with the legislative mandate in the 1992 Act. We also need to understand the basis for the concerns that have been expressed by the Department of Energy, the Nuclear Regulatory Commission, and the National Academy of Sciences about the EPA's proposed standard. Selecting the proper standard and doing it in a timely manner is essential for the repository project to move forward.

[The prepared statement of Hon. Joe Barton follows:]

PREPARED STATEMENT OF HON. JOE BARTON, CHAIRMAN, SUBCOMMITTEE ON ENERGY AND POWER

Today's hearing will address the Department of Energy's program to develop an underground repository for the permanent disposal of spent nuclear fuel and high-level radioactive waste. Solving the disposal question is absolutely essential if we are to maintain our existing nuclear generating capacity to meet the Nation's present and future energy needs. The Members of this Subcommittee are all too aware of how much time and energy we have all spent wrestling with this issue in recent years.

The Department has a clear statutory and contractual responsibility to begin accepting spent fuel starting in January of 1998. The Government's failure to meet that obligation has resulted in a growing financial liability that may eventually cost the taxpayers tens of billions of dollars. But DOE tells us that the earliest the repository will be ready for operations is the year 2010. I continue to believe that we must find a way to take acceptance of spent fuel from the utilities and move it to the repository site sometime sooner than 2010. Yet the Administration has resisted

all of our efforts to accelerate the acceptance date, giving us veto threats rather than constructive solutions.

However, the focus of today's hearing is not on interim storage, nor on take title, nor any of those other areas of contention. Rather, we are here today to talk about the Department's plan to get the repository ready for operation by 2010. We have to find out whether that schedule, even though it is twelve years too late, is realistic and achievable. To meet that schedule, the Department must first complete several near-term milestones. Late this year, the Department is to issue a Site Recommendation Consideration Report, followed by a final Site Recommendation and final Environmental Impact Statement next summer. These documents are essential to support the final selection of the Yucca Mountain site and, in turn, the License Application to the Nuclear Regulatory Commission in Fiscal Year 2002.

All of these steps are on the critical path if the repository is to open in 2010. Yet I have concerns about the ability of the Department to meet this near-term schedule, and therefore doubts about whether the 2010 date is feasible.

The first of these concerns deals with the adequacy of funding. Secretary Richardson finally admitted to this Committee last year that the repository will not be built by 2010 unless there are major changes to how the program is funded. Unfortunately, that was followed by a veto threat regarding our Committee's bill to take the repository program off-budget to ensure adequate future funding. We are still waiting for the Administration and the Department to send us a constructive proposal on how it intends to resolve that long-term funding shortfall. Today, however, we also have to address the short-term funding situation. The Department did not receive all of the funds it requested in Fiscal Year 2000, and it looks like FY2001 appropriations will also be less than the Department's request. We need to understand the impact of these near-term funding constraints on the ability of DOE to meet its milestones for the final EIS, the site recommendation, and the license application, all of which are critical steps if the repository is to open on time in 2010.

I am very concerned about the Department's recent decision to re-compete the M&O contract for the Civilian Radioactive Waste Management program. The contracts that DOE should be competing, such as the one for the management of Los Alamos National Laboratory, the Department has never competed in over 50 years, despite the University of California's appalling mismanagement of security matters. But where the contractor is performing well and the program is coming up on several key milestones, then the Department decides that recompetition is absolutely essential. I need to be persuaded that re-competition of the Yucca Mountain contract, at this critical juncture, is really in the best interests of the program. We absolutely will not tolerate DOE claiming that the transition to a new contractor as an excuse for any schedule slippages.

The Nuclear Waste Technical Review Board was established to provide independent technical oversight of DOE's work on the repository. As DOE approaches these critical program milestones in the near future, I would expect that the role of the Technical Review Board will become more important than ever before. The Board has already surfaced a number of technical concerns with DOE's planning and design work to date. We need to understand these concerns better and also find out whether DOE is paying proper attention to the scientific advice it receives from the Technical Review Board.

The most complex but possibly the most important issue we have to address today is the appropriate radiation standard for the repository. The Environmental Protection Agency was directed in the Energy Policy Act of 1992 to promulgate public health and safety standards to protect against the release of radioactive materials from the Yucca Mountain site. Such standards are to be based on and consistent with the findings and recommendations of the National Academy of Sciences.

Last summer, the EPA finally circulated a draft rule last summer which proposed, in addition to an "all-pathways" individual protection standard of 15 millirems, a separate standard for the protection of groundwater. I understand that the Department of Energy, the Nuclear Regulatory Commission, and the National Academy's Board on Radioactive Waste Management all have significant disagreements with EPA over this proposed standard. We need to understand the scientific rationale for the EPA standard, and specifically whether the proposed standard is consistent with the legislative mandate in the 1992 Act. We also need to understand the basis for the concerns expressed by the DOE, NRC, and the National Academy about EPA's proposed standard. Selecting the proper standard, and doing so in a timely manner, is essential for the repository project to move forward.

I welcome my colleagues from the Nevada Congressional delegation here today, as well as our distinguished witnesses from the federal agencies and independent technical boards. Today's hearing should answer the question of whether DOE is on

the proper "glide path" to meet its milestones and open the repository in 2010, or whether the Department is flying along on a mere "wing and a prayer."

Mr. BARTON. I see that my other colleague from the Nevada Congressional delegation is here and I think I am right that we have got the entire House delegation.

Ms. BERKLEY. Yes.

Mr. BARTON. That is great. I want to welcome Mrs. Berkley in addition to Mr. Gibbons. We look forward to their testimony as soon as we have our finished opening statements. This is a very important oversight hearing for the Yucca Mountain site. And it would not be appropriate to do it without having the input of our colleagues that represent the great State of Nevada in the Congress.

With that, I would like to turn to my ranking member, Congressman Boucher, and for an opening statement.

Mr. BOUCHER. Thank you very much, Mr. Chairman. I want to commend you for conducting the hearing this morning on the status of the Yucca Mountain repository for the disposal of spent nuclear fuel and high level radioactive waste. The Energy and Power Subcommittee has a long tradition of working on a bipartisan basis to address our Nation's energy security in a manner that is both serious and thoughtful. Nowhere has that bipartisan spirit been more in evidence than in our efforts to solve our Nation's nuclear waste problems. And in that tradition, I want to say a word of welcome this morning to our colleagues from Nevada, Shelly Berkley and Jim Gibbons, who are appearing as our first witnesses.

In the Nuclear Waste Policy Act of 1982, Congress assigned to the Federal Government a responsibility for the permanent disposal of spent nuclear fuel that is generated as a result of commercial research or defense processes. And amendments that we adopted to that Act in 1987, the Congress identified Yucca Mountain in Nevada as the site to focus upon for the construction of the disposal facility.

Since 1987, the Department of Energy has been conducting the site and technical studies that were necessary for the design and the construction of the repository. The Yucca Mountain facility is scheduled to begin accepting shipments in the year 2010. In order for the facility to meet that goal, and to be prepared for the acceptance of shipments, the Department of Energy must meet two important deadlines next year. The first of these is the issuance of the final environmental impact statement, and the second is the final site recommendation.

I am highly concerned that recent decreases in the funding appropriated by the Congress for DOE's Yucca project will have a material adverse affect on the Department's ability to meet both the short goal of insuring these important reports, and the long-term goal of having the facility ready to accept shipments by the year 2010.

I look forward to hearing this morning from witnesses on the status of the project and on the projected ability of the Department of Energy to meet both the near-term goal of having these reports issued next year and the long-term goal of having the facility ready by the year 2010.

Of even greater concern, although it is not precisely the focus of today's hearing, is the adequacy of funding for seeing the repository through the construction phase. H.R. 45, which the chairman mentioned in his remarks, was reported by this committee last year by our full Commerce Committee on a broad bipartisan vote of 40 to 6. And it would have taken the nuclear waste fund off budget to ensure that that fund, like the Highway Trust Fund, can be used for its intended purpose and for no other purpose. The Department of Energy has indicated that unless Congress restores access to the roughly $9 billion in the fund, the program will face major shortfalls within the next 3 or 4 years. While it is unlikely that Congress will enact legislation addressing the matter this year, I think it is imperative that we take up this cause early during the course of the next Congress.

I also want to thank Chairman Barton for inviting the Environmental Protection Agency to testify about its pending rulemaking on environmental standards for the repository. I recognize that the agency is somewhat constrained in the degree to which it can answer questions about the direction that the final rule is likely to take, since that matter is still under active consideration at the EPA. Nevertheless, I think it would be useful to hear from EPA about the status of the rule and those matters which the agency can address with respect to progress toward its completion.

Mr. Chairman, I commend you for this timely discussion and I join with you in looking forward to our witnesses' testimony.

Mr. BARTON. Thank you, Congressman Boucher.

Mr. Bryant of Tennessee is recognized for an opening statement.

Mr. BRYANT. Thank you, Mr. Chairman. I will be very brief in recognition of our two outstanding members. Having roomed for a couple of years with a former member in your State and one who whom I expect will return shortly as a Senator, I learned very quickly that the correct pronunciation of the State is Nevada. And they are probably too nice to point that out to us today.

Mr. SHIMKUS. But you are not.

Mr. BRYANT. But I am not. I would point out it is Nevada, I believe.

Mr. BARTON. Well, it ain't Texas, so I am not too worried about it.

Mr. BRYANT. I would say, again, in deference to our panel, and this, our outstanding second panel also, I simply agree with what has been said already. I have concerns with this idea of rebidding the operation and management recompeting for that as well as other issues. I'd like to see us stay on track. And with that, I would apologize too. I know we are going to be in and out today, many of us have other competing committees and appointments. So please, don't take that personally as we come and go and with that, I will yield back the balance of my time.

Mr. BARTON. Okay. The gentleman from Illinois, Mr. Shimkus, for an opening statement.

Mr. SHIMKUS. Thank you, Mr. Chairman. In lieu of time and having gone over this now in my 4th year of talking about Yucca Mountain and understanding both sides of the issue, I will just yield back my time and wait for the panelists.

Mr. BARTON. The ranking member and the chairman have great sympathy, since we have been doing this for 14 to 16 years. You are a novice, if you have only had to do it for 4 years.

Mr. SHIMKUS. But I stop talking and you continue.

Mr. BARTON. Well, that may be the last time you get the microphone.

The gentleman from North Carolina.

Mr. BURR. I will also say ditto, only to add to it, Mr. Chairman, if we don't succeed now, Texas will be the target site for this facility. I yield back.

Ms. BERKLEY. Perfect.

Mr. BARTON. Give us enough money, we may think about it.

Mr. BURR. Isn't there a hole already in the ground down there?

Mr. BARTON. There is in my district, actually.

[Additional statements submitted for the record follow:]

PREPARED STATEMENT OF HON. JOHN B. SHADEGG, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Chairman Barton, I commend you for continuing the Subcommittee's oversight into the issues of nuclear power and waste disposal. Nuclear power is a safe and efficient source of energy production which allows the generation of vast amounts of electricity while avoiding the air quality concerns raised by many other sources of power. Electricity consumption is expected to increase at the rate of one to two percent per year for the next twenty years and nuclear energy is needed to meet this growth without increasing air pollution.

To ensure the continued viability of nuclear energy in the future while dealing with existing waste, it is absolutely essential that we put the permanent repository for this waste into operation as soon as possible. This is not optional: nuclear waste is currently stored at dozens of power plants throughout the United States, and many of these plants are running out of storage room.

The permanent waste repository at Yucca Mountain has been under intensive study since 1987 and, by July, 2001, a final recommendation on whether to proceed with construction will be delivered to the President. Key to the President's decision is the use of sound, unbiased science to determine the parameters of the repository.

Unfortunately, the importance of sound science appears to have escaped the Environmental Protection Agency (EPA) in their attempts to set radiation standards. There are numerous crucial aspects of these standards on which the EPA has failed to follow the science, including setting a standard which is lower than national and international standards and far below the amount of radiation which the average person receives in the course of normal, everyday life.

Let us examine in greater detail one of the aspects in which the EPA has failed to use sound science: the EPA proposal to set a dose-based standard for radiation exposure. This proposal is in direct contradiction to the risk-based standard recommended by the National Research Council, an independent, unbiased scientific institution affiliated with the National Academy of Sciences. As the National Research Council enunciates in its November 26, 1999 letter to EPA Administrator Carol Browner:

> "The Board believes that EPA's rationale for proposing a dose-based standard is flawed for the following reasons. EPA's statement in its reason 93 that a 'risk-based standard . . . depends upon current knowledge and assumptions about the chance of developing a fatal cancer from a particular exposure level' is incorrect. A risk based standard is *not* based on scientific assumptions. Instead, it is based on a public-policy determination of acceptable risk levels to individuals or populations . . ." (Emphasis in original)

There is a public policy dispute over what role nuclear energy should play in the nation's future mix of generation assets. This is a legitimate dispute and should proceed openly. What are not legitimate are backdoor attempts to foreclose the option of increasing nuclear capacity by blocking the safe disposal of existing waste. Permanent storage of nuclear waste is an issue which must be decided on the basis of sound science, not emotion or a desire to derail debate on the larger issue of nuclear power. The EPA should concentrate on the job which Congress gave it to perform, the setting of scientifically-based standards to allow the safe permanent storage of nuclear waste.

PREPARED STATEMENT OF HON. TOM BLILEY, CHAIRMAN, COMMITTEE ON COMMERCE

Thank you, Mr. Chairman.

Just two weeks ago, this Subcommittee held a hearing that addressed the future of nuclear power. It was clear from that hearing that one of the key impediments to nuclear power in this country is the lack of a safe, centralized facility for the disposal of spent nuclear fuel.

DOE was explicitly directed by Congress back in 1982 to develop a permanent underground repository and to begin accepting spent nuclear fuel by January 31, 1998. In 1987, Congress further directed DOE to focus its attention on Yucca Mountain in Nevada as the most promising site for the repository. Yet DOE tells us that it is still at least 10 years away from having a repository.

The hearing today is to investigate whether DOE is truly on track, as it claims it is, to open the repository in 2010. There are technical challenges, financial challenges, and contracting challenges that call into question DOE's ability to meet this schedule. We also must address the fundamental question of the appropriate radiation standard for the repository, which the Environmental Protection Agency is preparing to issue as a final rule later this summer. The Department of Energy, the Nuclear Regulatory Commission, and the National Academy of Sciences all have significant disagreements with the standard that EPA is proposing. We need to understand the scientific and policy basis for EPA's proposed standard and the effect of that standard on the repository program.

Today's hearing will help the Committee understand whether DOE really is on the right track to open the repository in 2010, and whether all the technical, financial, contracting, and environmental pieces are in place to support that schedule. I look forward to the testimony of our distinguished witnesses today.

Thank you, Mr. Chairman. I yield back.

Mr. BARTON. Let's hear from our senior member, Mr. Gibbons, for 7 minutes and then we will hear from the junior member, Mrs. Berkley, for 7 minutes. Welcome to the subcommittee.

STATEMENT OF HON. JIM GIBBONS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

Mr. GIBBONS. Thank you, Mr. Chairman. And I realize this is simply an oversight hearing on the status of Yucca Mountain, but I do appreciate the cordial and congenial welcome of the committee as well as the interest of the chairman in hearing from us on this issue as well. And Mr. Chairman, I would like to have a full and complete written copy of my statement entered into the record.

Mr. BARTON. Without objection.

Mr. GIBBONS. Mr. Chairman, as you well know, I have, all along, adamantly and consistently, opposed any legislation or concept that would create or further develop Yucca Mountain as areas for nuclear waste in Nevada. Ever since I have been elected to Congress, I have consistently voted against the annual Energy and Water Development Appropriation Act, which annually funds the studies, development and construction of Yucca Mountain. And this repository is a travesty and an injustice to the citizens and residents of Nevada. It has a great potential to destroy the economy and the environmental future of our State.

And long before I came to this House, as you have heard already, Yucca Mountain was chosen by Congress to store America's high level nuclear waste with the 1987 "Screw Nevada Bill," as it was titled and the only issue left, Mr. Chairman, today is science. It makes sense that factual standards based upon sound science and reason, along with protection and welfare of this Nation's citizens, should not be drawn upon when we address nuclear waste storage.

Secretary Richardson himself stated that Yucca Mountain site, "will be based on science, pure science, not politics."

I would question the Secretary's statement because of a $1.4 million study he commissioned wherein it appears that we are attempting to put the square peg in a round hole. A team of experts are using this money to determine if tiny fluid inclusions which are bubbles in mineral deposits within the mountain are the result of hot, rising water which flooded the repository in previous eras. If this is the case, Yucca Mountain should be disqualified because it will happen again and release potentially deadly nuclear waste into the environment and cause great harm to the area as well as to any base water or aquifer system in the area as well that the region and the people depend upon. It now appears, however, that Secretary Richardson, in his haste to complete Yucca Mountain, will not even wait for his study to be completed before he makes his recommendation.

In February he states, and I quote again, "I have got a lot of good science, I will have sufficient information." I would ask this committee to talk to the Secretary and ask him to take this vital information on fluid inclusion studies into his account if we are to truly and factually base Yucca Mountain on sound science. Yucca Mountain should be disqualified, Mr. Chairman, for at least two other very important reasons, one being that rainwater containing the isotope chlorine 36, which is less than 50 years old, have been detected far below the surface in the underground site. Chlorine 36 comes from above-ground nuclear tests that Nevada endured during the post-World War II and that timeframe era. The Nuclear Waste Policy Act does mandate that because of this extremely fast-surface-water-travel-time to the repository, the Yucca Mountain site should be disqualified. I am not an engineer or a mathematician, but I think you and the members of this committee can see the point.

The second reason for disqualification is the geologic barriers of Yucca Mountain will not limit radionuclide releases, thereby polluting groundwater supplies that are currently used for human consumption and crop irrigation. This again meets the condition for disqualification and is a true show stopper. It is important, in fact, it is very important to ensure that the Department of Energy does not ignore these facts or attempt to alter their regulations. This scientific approach dictates that DOE disqualified the site, not the regulations.

Members of Congress also need to recognize the fact that these studies are credible, and future legislation must address these fatal findings. The art of political persuasion has no place in this fight. Members of Congress and the DOE must look to the hard scientific evidence that proves the site is unsuitable.

Mr. Chairman, I and the rest of Nevada will never relinquish our fight against Yucca Mountain. We didn't ask for it, and we don't want it, no matter how much money you offer us. I will continue to be adamantly opposed to the Energy and Water Appropriations Act, which further funds construction and study of Yucca Mountain. Recently, the President vetoed Senate bill 1287, the Nuclear Waste Policy Amendments Act of 2000, and I congratulate him. I plan to contact the President and encourage him to further his commitment to protecting the citizens of Nevada by vetoing this year's Energy and Water Development Appropriations Act.

With that, Mr. Chairman, I will thank you for your time here today, and with the indulgence of the chairman in letting our views and the views of Nevada to be aired before your committee, I would ask that in light of the fact that I have an additional appointment, I know there may be questions of the committee, but ask to be excused at this point in time.

Mr. BARTON. Obviously, since we have such power over you, if we said no, you could get up and walk out of this room a free man.

Mr. GIBBONS. Out of the courtesy of the chairman, I would stay if it were requested.

Mr. BARTON. We understand the constraints of the time. We are glad for you to be here and put your views on the record, because it is a very important issue for your district.

We'd now like to hear from the gentlelady from Nevada.

Nevada. That sounds like yankee to me.

STATEMENT OF HON. SHELLEY BERKLEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

Ms. BERKLEY. Well, there are a lot of Yankees now in Nevada.

Mr. BARTON. Making a lot of money. Your complete statement is in the record in its entirety. We would recognize you for 7 minutes to elaborate on it.

Ms. BERKLEY. Thank you, Mr. Chairman, and I'd like to thank you and the rest of the members of the committee for affording me the opportunity to speak about an issue that affects every single person in my district and the entire State of Nevada. Oversight of the Department of Energy's Yucca Mountain project is crucial to the continued growth and development of my State, crucial to the health and well-being of all Nevada families, and crucial to the health of our environment. And that is why I testify before you today, to share with you my concerns and the concerns of my constituents about the status of the Yucca Mountain project.

I understand that the purpose of this hearing today is to address the oversight concerns surrounding the Yucca Mountain project. I realize the subcommittee is discussing the time line, engineering and regulatory aspects of the project, but when discussing oversight issues, we must also look at the scientific evidence and problems that have been raised regarding the suitability of the Yucca Mountain to hold radioactive waste.

On three separate occasions, the State of Nevada has demonstrated using DOE's own data that the site should be disqualified under both the EPA standard and DOE's own internal site screening regulation, and each time the DOE or Congress has changed the regulations to ensure that Yucca Mountain would not be disqualified, regardless of the health and safety consequences to Nevadans. In fact, DOE has found that geology at Yucca Mountain is so poor that over 95 percent of the waste isolation capability of the proposed site would have to be provided by metal waste containers and other so-called engineering barriers around the waste with only about 5 percent of the site's waste isolation performance, depending on the natural conditions. When this project started, the idea was to find a place with natural geologic features to contain the radiation. Clearly, that standard cannot be met at Yucca Mountain.

Yucca Mountain is located in the young, geologically, area with four volcanos within 7 miles of the site. Yucca Mountain is surrounded by 34 known earthquake fault lines and has experienced over 620 earthquakes in the last 20 years. One of these earthquakes measured 5.9 on the Richter scale, and caused over a million dollars in damage to DOE's own surface support facilities. An aquifer flows beneath Yucca Mountain with water moving so rapidly that even with all the engineering barriers, radiation will unavoidably escape from the repository and contaminate the water flow. As recently as yesterday, it was reported again that scientists have found strong evidence that the Yucca Mountain repository floor was once flooded with hot water and feared that water could rise again. These are the real oversight concerns.

I urge my colleagues to take into consideration the alarming scientific evidence when determining the status of the Yucca Mountain project. The real question here, are we going to continue allowing political expediency to determine our Nation's nuclear waste policy or will we listen to the science? The Yucca Mountain project is a failed one. We need to invest in our future and the future of generations to come, and work together to find a responsible and safe solution. And I would echo what my distinguished colleague from northern Nevada said, not only are there Yucca Mountain appropriations in the Energy and Water bill and applaud him for his efforts there, but there is also a great deal of Yucca money in the Defense appropriation bill as well.

I thank you for allowing me to testify before the subcommittee on this important issue. I would also like to submit as part of my testimony a recent article that has appeared in the Las Vegas Review Journal and the Las Vegas Sun that further detailed the scientific findings that disprove Yucca Mountain as a suitable site to hold radioactive waste. And I thank the committee very much for their cordial acceptance of my testimony.

[The prepared statement of Hon. Shelley Berkley follows:]

PREPARED STATEMENT OF HON. SHELLEY BERKLEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

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That is why I testify before you today—to share with you my concerns, and the concerns of my constituents, about the status of the Yucca Mountain Project.

I understand the purpose of this hearing today is to address the oversight concerns surrounding the Yucca Mountain Project. I realize the subcommittee is discussing the time line, engineering, and regulatory aspects of the project.

But when discussing oversight issues, *we must also look* at the scientific evidence and problems that have been raised regarding the suitability of Yucca Mountain to hold radioactive waste.

On *three* separate occasions the State of Nevada has demonstrated, using DOE's own data, that the site should be disqualified under both the EPA standard and DOE's own internal site screening regulation. And each time, the DOE or Congress has changed the regulations to ensure that Yucca Mountain would not be disqualified, regardless of the health and safety consequences to Nevadans.

In fact, DOE has found the geology at Yucca Mountain so poor that over 95% of the waste isolation capability of the proposed repository would have to be provided by metal waste container and other so-called engineered barriers around the waste, with only about 5% of the site's waste isolation performance depending on the nat-

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These are the *real* oversight concerns. I urge my colleagues to take into consideration the alarming scientific evidence when determining the status of the Yucca Mountain Project.

The *real* question is, are we going to continue allowing political expediency to determine our nation's nuclear waste policy—*Or*, will we listen to science.

The Yucca Mountain Project is a failed one. We need to invest in our future, and the future of generations to come, and work together to find a responsible and safe solution.

I thank you for allowing me to testify before the subcommittee on this important issue. I would also like to submit as part of my testimony recent articles that appeared in the Las Vegas Review Journal and the Las Vegas Sun that further detail the scientific findings that disprove Yucca Mountain as a suitable site to hold radioactive waste.

[December 1, 1999—Las Vegas Sun]

CRITICS: DOE HAS CHANGED YUCCA RULES

By Mary Manning

The Department of Energy offered new rules on the approval of a proposed high-level nuclear waste repository site at Yucca Mountain Tuesday—rules that were greeted with howls by national and local critics who accused the DOE of changing the guidelines to ensure that the repository will be built.

The DOE wants to change siting guidelines issued in 1996 that spelled out certain findings that would stop a Yucca Mountain repository, such as ground water moving too fast, an earthquake or volcanic activity at the mountain.

Yucca Mountain, 90 miles northwest of Las Vegas, is the sole site under study by the DOE for the world's first high-level nuclear waste repository. The mountain has not yet passed scientific muster and will not be ready to accept 77,000 tons of highly radioactive waste until 2010 at the earliest.

The DOE proposes to use complex computer models with whatever scientific information it has in hand to prove a repository will work, but no single fact should disqualify Yucca Mountain, the new rules say. The proposal was published in the Federal Register on Tuesday.

The DOE's proposal would eliminate individual problems such as rapid ground water flow from stopping the DOE from building the repository, Nevada's technical coordinator Steve Frishman said.

"What they're trying to do is change the law by regulation," Frishman said. "It's a simple attempt to avoid the law."

Both Sens. Harry Reid and Richard Bryan, D-Nev., denounced the DOE guideline.

In a letter sent to President Clinton today, Bryan said, "As it has become increasingly clear that the Yucca Mountain site cannot meet the existing siting guidelines, the DOE has attempted to . . . evaluate the suitability of Yucca Mountain based on a single, and far less stringent, total system performance assessment."

"Such a change," the letter stated, "would destroy and remaining public confidence in the site characterization process and place the health and safety of over 1 million Nevadans in serious jeopardy."

"It's more of the same old game-playing," Bryan's chief of staff, Jan Neal, said this morning. "The site doesn't meet the criteria so instead of disqualifying the site they change the criteria."

Reid said he had "crave concern" with the DOE's proposal. He noted that atomic weapons fallout from Pacific Island nuclear tests reached the repository's level 1,000 feet deep inside Yucca in less than 40 years.

"That characteristic surely violated the earlier criterion that such water migration must take more than 1,000 years," Reid said.

"Generally, the changes cited in your proposed rulemaking do very little to dispel the perception that earlier guidelines are being abandoned because they would disqualify Yucca Mountain from any further consideration as a permanent disposal site," Reid wrote in a letter to Energy Secretary Bill Richardson.

"This is a transparent effort to change the rules of the game in the third quarter," Reid said. "It's a rule change that could threaten the health and safety of the people of Nevada."

Reid and Sen. Richard Bryan, D-Nev., were successful this year in forcing Senate Republicans to abandon efforts to store nuclear waste temporarily at the Nevada Test Site, a former proving ground for nuclear weapons experiments.

Public Citizen's Mass Energy Project senior policy analyst Amy Schollenberger called the DOE proposal "another blatant attempt to ensure that Yucca Mountain is approved as a geologic repository for radioactive waste, even though all of the evidence suggests that it will endanger the public, the environment and future generations."

Public citizen, a nonprofit consumer advocacy group launched by Ralph Nader, has been a leading critic of the DOE's attempt to weaken safeguards at the site. Shollenberger said if DOE is successful and the Nuclear Regulatory Commission, which must license the site, can eliminate a ground water radiation limit, the region's aquifer could be destroyed.

[June 22, 2000—Las Vegas Review-Journal]

YUCCA HOT WATER REPORT COULD BURN RICHARDSON

By Keith Rogers

While Energy Secretary Bill Richardson was treading political hot water Wednesday over his agency's handling of a nuclear secrets security lapse, scientists studying what some believe is ancient evidence of hot water rising within the proposed Yucca Mountain nuclear waste site were still at odds over their observations.

The team of scientists who met Wednesday at the University of Nevada, Las Vegas are in the midst of a two-year, $1.4 million study led by associate professor Jean Cline. The study should be completed in April, she said.

The team of experts from federal agencies, universities and the state—including Yuri Dublyansky, Nevada's consulting geologist from the Siberian Branch of the Russian Academy of Sciences—probably won't have their conclusions ready for an agency report this year. Richardson will use the report when considering whether to recommend Yucca Mountain as the place to entomb the nation's high-level radioactive wastes.

Some 77,000 tons of waste—mostly spent fuel pellets encased in metal rods from nuclear power reactors—will be destined for a repository in the mountain, 100 miles northwest of Las Vegas, by 2010 if the site is deemed suitable and a repository can be licensed by the Nuclear Regulatory Commission.

Richardson, who called for the UNLV study in 1998, said then that his recommendation for the Yucca Mountain site "will be based on science, pure science, not politics."

More recently, on a Feb. 11 trip to the agency's Nevada Operations Office in Las Vegas, Richardson said he will remain on course to make his recommendation this year even though the findings from Cline's group probably won't be part of the report he will consider.

"I've got a lot of good science. I'll have sufficient information," he said in February.

But Nevada officials say Richardson should wait until questions about the rising thermal water theory are answered—if they can be answered conclusively. Richardson could face legal action from the state if he makes a recommendation without knowing the answers.

At issue are tiny bubbles in mineral deposits from deep within the mountain. Scientists want to know whether those bubbles hold fluids that show hot water rose in the recent geologic past—1.6 million to 2 million years ago—and flooded what would be the repository floor.

If that's the case, state scientists fear it could happen again, after waste packages have been put in the mountain, risking a potential release of deadly nuclear remnants into the environment.

Joseph Whelan, a geochemist from the U.S. Geological Survey's Denver office, said his associates believe the calcite mineral features stem from rain or snowmelt that percolated downward from the rocks above the proposed repository site.

"If this calcite formed from upwelling water flooding these rocks, as has been proposed, then that water would have entirely filled all of those fractures and cavities and it would have deposited calcite in them all. This is not what we observe," he said during a briefing at UNLV.

Dublyansky, who has been gathering samples from the mountain independent of the team, said he disagrees with Whelan's statements.

Cline, however, said the group's results concerning the temperatures of the fluids trapped in the minerals "are very consistent with Yuri's. They're also very consistent with Joe Whelan's. All three parallel studies are consistent," she said.

The temperatures that were measured average about 122 degrees, but a few of the 40 samples that have been analyzed contained fluid that was about 176 degrees, or 36 degrees less than the boiling point of water.

Dublyansky believes this bolsters his theory that hot water came from below the repository site and not above, as the federal scientists contend. But a key element in proving the theory is to determine when the minerals were deposited in relation to the mountain's formation 13 million years ago.

Cline said the scientists will attempt to age-date the minerals through uranium-decay methods using equipment at Canada's Royal Ontario Museum Laboratory.

"We cannot say whether fluids went up or down, and we probably won't be able to say that with any surety at the end of the study," she said.

Mr. BARTON. Thank you. The Chair is going to recognize himself for 5 minutes. We are going to try to get through the question period fairly quickly so we can get to our other panels. But I think we should ask a few questions. All of the problems that you just highlighted in your testimony, those are well known to the scientific community and to the technical experts. Haven't they all, in various reports, passed the scrutiny? I mean, I didn't hear anything new. I understand where you are coming from. Look, I am not at all surprised to hear what you just said, but haven't all of those been analyzed and passed muster in terms of it being safe to put the material in Yucca Mountain?

Ms. BERKLEY. With all due respect, Chairman Barton, as late as yesterday, it was reported in the Las Vegas newspapers that the scientists that are continuing these studies have just come up with the finding of hot water having flowed under Yucca Mountain, not that many years ago in geological years, and have a tremendous concern that that water may rise again. So this is yet another scientific finding that is as new as 24 hours. So I think until the scientific studies are completed, that we should not be shipping or even thinking about Yucca Mountain as a potential site. But I do think that hole in the ground in your district might be a suitable location if they studied that as well.

Mr. BARTON. I wouldn't have a problem with that, to be honest about it, if it underwent the scrutiny that Yucca Mountain has.

Ms. BERKLEY. Perhaps we could work on a dual-track scientific study.

Mr. BARTON. Well, I could take 10 casinos and a billion dollars a year and give you, you know, some old rubber tires or something that might be a fair trade.

Ms. BERKLEY. My concern, of course, representing Las Vegas, which is the major population center in the State of Nevada, located only 90 miles away from Yucca Mountain, that if, God forbid, there was an accident, there is no amount of money that Congress could have given the State of Nevada to compensate for the loss of

health, loss of health in the environment and the loss of our economy and continued growth and prosperity.

Mr. BARTON. I understand your concern. I am not at all being frivolous about that. But there has been more scientific review of this particular site, and it is under more scrutiny by the environmental groups so that, you know, at some point in time, at least I think that you do have to make a decision. And it certainly appears to me, based on the evidence that the decision to build it there, if, in fact, that is what it is, is a safe decision. I am not going to say it is a non controversial decision.

The gentleman from Virginia, Mr. Boucher.

Mr. BOUCHER. I don't have any questions.

Mr. BARTON. Okay. In order of appearance, the gentleman from Illinois.

Mr. SHIMKUS. I would just make a point that I have young children 7, 5, and 8 months. And there was a very popular show that I think about a lot these days, called The Magic School Bus. And in one show the Magic School Bus goes from, if you believe in evolution, goes back through time through the millennium, it really stays in one location, but it goes through deserts, through swamplands, through ice age, through, you know, through the billions of years that—I am a creationist, but if you go to the extent there probably was water flowing there a few millennia ago. You know that there probably will be water flowing there again a few millennia from now.

But I agree with the chairman, one site is better than over 60 sites for nuclear storage and the desert is better than the temperate zone. Underneath a mountain is better than above ground, and a location where there has been nuclear activity is better than a place where there has never been. I applaud the defense of your constituents. I think the science will bear out that this is the best hope for us to move this issue forward. And I thank you for your defense of your State and your citizens. I really, if you want to add——

Ms. BERKLEY. To my distinguished colleague, I had the wonderful opportunity to meet your family when they visited Las Vegas, and they are worth protecting and defending, just as the children that live in any district are. But if I thought for 1 minute making Yucca Mountain the national repository for nuclear waste would solve the nuclear waste problem in this country, I would probably be for it. All you are going to be doing is create yet another waste site, and once the 100,000 tons of nuclear waste that is deposited across this country gets trucked or taken by rail to Yucca Mountain, it will not solve the problem, because nuclear waste will continue to be produced as long as we have this type of technology.

And I would recommend to this Congress that rather than spending the billions and billions and billions of dollars that it is going to take to ready Yucca Mountain in order to accept this nuclear garbage, that we start working on a scientific way of solving this problem so that the nuclear waste we produce is less toxic, less radioactive, and we have less of a problem in this country. Yucca Mountain is not going to make this problem go away. It is going to exacerbate it because it is going to give me the problem.

Mr. SHIMKUS. Just reclaiming my time, we already transport high level nuclear waste all over this country, and we have done it safely for many, many years. And I think we will continue to do so. Having nuclear waste in some of the major metropolitan areas of our country, Chicago, Illinois, being an example, is more catastrophic than, again, underneath a mountain in the desert.

Now, if we could ship this to Vieques Island and we could use Yucca Mountain as a naval training assault area, I may support that. But you understand that we have our concerns of our constituents as much as you do. And I think Congress has spoken and the science will prove it out and we will eventually move that. I yield back my time to the chairman.

Mr. BARTON. Thank the gentleman from Illinois. The gentleman from North Carolina, Mr. Burr.

Mr. BURR. Mr. Chairman, I haven't got a question of the gentlewoman, I would only make this statement. That this issue and probably more than anything else that we have dealt with at least in the 6 years that I have been here, displays the great difference that exists in the definition of good science. Your argument, Mr. Gibbons' argument is very compelling and the test that is the State of Nevada does in response to the test that the Department of Energy has done and nuclear regulatory—and others, we see it again with the EPA's current study and the questions that have been raised about that. If we get nothing else out of this, then the right definition that everybody can use for good science so that we can have an environmental policy that produces an outcome versus a continuation of complaints about the process, then I believe today we will have accomplished a tremendous amount. In the meantime, I think what Mr. Shimkus was trying to say is that every State in this country, somewhere in that State we have nuclear waste stored. Sometimes we make a decision based on what's good for the entire country and consolidation of that storage. In this particular case seems to be the will of Congress, and my hope is though I believe that you will vigorously fight it, and you should, that we can have some finality to this and soon.

Ms. BERKLEY. Mr. Burr, if I could correct one thing you said. There is one State that doesn't have nuclear waste and that is the State of Nevada.

Mr. BURR. The gentlewoman's point is made. I am sure that we could find some radioactive areas out there, though. Thank you.

Ms. BERKLEY. I think what my colleague who spoke before me said, the people of the State of Nevada don't want this. They have spoken loud and clearly to their representatives in Congress and we have an obligation to those families to protect them to the best of our ability. And because other Members of Congress have a problem regarding nuclear waste in their district near their population centers doesn't make it any better or easier for us to accept it to alleviate your problem in order to exacerbate my own.

Mr. BARTON. Would the gentleman yield? I just want to ask when we had an active military testing program for our nuclear weapons, wasn't that done in Nevada?

Ms. BERKLEY. Of course that was long before I was born.

Mr. BARTON. I understand that. Actually, some tests were done as late as the 1980's underground.

Ms. BERKLEY. That is correct. No, if I could answer and I don't mean this to sound sharp or——

Mr. BARTON. You can be sharp. You have got the right to be sharp. I have to be polite, but witnesses can be sharp.

Ms. BERKLEY. Well, I would hope to match your politeness, and this is said with all due deference and respect, but I grew up in Las Vegas, a lot of my friends had pains, particularly dads in those days that worked at the Nevada test site. When they were told by this Federal Government that it was perfectly safe not only to be at the Nevada test site but to participate in the both above-ground and underground tests, and all they had to do was go home and take a shower and they would be fine. Well, I just attended a hearing a couple of months ago in my district, where all the Nevada test site workers that are dying of cancers and some of the most hideous, heinous cancers that you and I have ever seen and hope to God none of us ever experience. And this is the same government that is now telling the State of Nevada that it is perfectly safe to store 100,000 tons of nuclear waste under Yucca Mountain. They misled the Nevada public and the American public back in the 1950's and the 1960's, 1970's and 1980's; I believe the Federal Government is misleading us now.

Mr. BARTON. Well, I can't comment on the 1960's and 1970's and 1980's, but I can assure the gentlelady from Nevada that nobody is misleading anybody in any State of the Union right now. That is why we have the technical review board. That is why we are doing the environmental impact statement. That is why this subcommittee has done a half a dozen hearings on this. That is why I met with the county commissioners from your district. That is why I met with State representatives and the State senators, why I have been out there twice. I think it ought to be located at Yucca Mountain. But I don't think we ought to mislead anybody. And I don't think that the Clinton administration or the Bush administration or the Reagan administration or any of the administrations that have been in office since the Nuclear Waste Policy Act was passed in 1982 have done anything but try to be above board, so that there is informed consent, at least informed discussion and debate.

Obviously, there is going to be a difference of opinion in democracy about some of these issues, that is why this hearing is being held today. This subcommittee is not in the business of misleading anybody in the United States of America, any constituent of any Congressional district about what the true facts are.

Ms. BERKLEY. I appreciate that. And I have seen you, I know that you have come to Las Vegas because we once shared a plane ride together, and I knew that you were going to Las Vegas on behalf of Yucca Mountain. I don't think it is an intentional misleading, but I don't think anybody, scientists or government officials, could guarantee to the people of the State of Nevada that this nuclear waste will never have a problem, there will be no groundwater problems, there will be no volcanic activity, there will be no earthquake activity that would disturb the nuclear waste and create a problem.

And if I thought that anyone could give me that guarantee, I would feel a whole lot better about this. But I am not talking about

the short run, 5, 10, 15, 20 years from now, in my lifetime, talking about what may happen 100 years from now, and that is a blink of an eye. I don't think I could rest well in any grave knowing that I have created this problem for my constituents and my children and my children's children if we didn't vigorously defend against putting nuclear waste at Yucca Mountain. And I know that you understand my position.

Mr. BARTON. I understand that. The gentleman from Oklahoma.

Mr. LARGENT. Ms. Berkley, I'd just like to ask you, can you give us some examples of guarantees that you could make for 100 years from today?

Ms. BERKLEY. That is exactly my point, Mr. Largent. Exactly my point.

Mr. LARGENT. So we should do nothing ever, because you can't guarantee anything.

Ms. BERKLEY. No, of course not. What I think we should be doing——

Mr. LARGENT. That is my point. My point is you can't guarantee anything 100 years from now. But that doesn't mean that we should do nothing today because we can't guarantee something 100 or 1,000 years from now. I'd like to ask you this question, and that is this, simply, a not-in-my-back-yard, or do you just totally oppose all nuclear activity?

Ms. BERKLEY. Oh, no, not at all.

Mr. LARGENT. We should have nuclear activity in terms of generation of electricity?

Ms. BERKLEY. What I think the solution is——

Mr. LARGENT. Let me ask this question first. Do you support nuclear energy production of electricity?

Ms. BERKLEY. If, in fact, we could find a way of disposing with the by-product of nuclear energy, I would not be opposed to its creation. Prior to Congress, in a past life I was in-house counsel for Southwest Gas Corporation. I have an energy law background. So this is an area that I know a little bit about. Now, I am not opposed to nuclear. What I am opposed to is this country hasn't come up with a policy of dealing with the nuclear waste other than dumping it in the ground. What I would—I mean, this is a great country. This is an extraordinary country. And we are at the beginning of a new millennium and the dawning of the 21st century. Certainly there will be scientific breakthroughs in the next several years that will afford us an opportunity of handling this very dangerous by-product of nuclear energy in a more efficient safer way. I don't believe dumping it in the Nevada Desert is going to be the ultimate solution. Let us take the billions of dollars, extend the areas that the nuclear waste is being stored at at the nuclear repositories now, do dry-cask storing, which is adequate for the next century, and during that time, let us use these billions and billions of dollars and come up with a scientific way of rendering this stuff less toxic, less harmful, less dangerous. I would be all in favor of that, because we still don't have a good nuclear energy policy in this country.

Mr. LARGENT. First of all, if you do know anything about this issue, and I assume you do, then you know that we don't have the capacity to go another century with storing it in onsite facilities.

I mean, that just simply cannot happen. What I would say to you is that do you believe that there is a scientific solution that is out there that would guarantee us 100 years from now that there won't be a problem with it? Is there a scientific solution that would meet the demands and the hurdles that you are placing on Yucca Mountain?

Ms. BERKLEY. I am a great optimist, and I believe in this country. If we could put a man on the moon with a concerted effort of a 10-year plan, then if we put our minds together and put the scientific minds working on this and make this a national priority, we could come up with a solution of rendering the toxic weight less dangerous, less toxic and more safe so that we wouldn't have to keep relying on burying it under the ground.

What happens when Yucca Mountain is full and we keep producing this nuclear waste? What is the next State that is going to be assaulted with this? And how many more years are you, Congress, going to be considering the next national repository? Yucca Mountain is another temporary solution. We still will not have gotten to the major problem. And what happens when it is filled up? Where do we go from there? Is it Texas next? Is it Oregon, Washington? I mean, which one of us wants to accept this stuff? None of us.

So let's roll up our sleeves, work together in a bipartisan way, and figure out what we are going to do to render this stuff less toxic and dangerous for all of us, for my sake as well as yours. I don't want to leave it in anybody's district. And I don't want to take it in mine.

Mr. LARGENT. You can filibuster in the Senate. My question was do you believe that there is a technological solution out there?

Ms. BERKLEY. Yes, I do.

Mr. LARGENT. That will guarantee us that 100 years after implementing this solution, that they can guarantee you that there won't be any problems whatsoever?

Ms. BERKLEY. The scientific solution may not be discovered at this moment, but I believe it can be.

Mr. LARGENT. It is just a yes-or-no question.

Ms. BERKLEY. I think it is more complicated than a yes or no. If you ask me does a scientist have a solution today as of June 23, that I cannot answer. Do I think that if we spend—take the billions of dollars that we are using now to ready Yucca Mountain and invest it in scientific studies, I do believe that we can come up with an answer. I do believe in our scientists and I do believe in America.

Mr. LARGENT. Mr. Chairman, I yield back. I will just say that I think that some of our best and brightest have come up with a solution. It is Yucca Mountain. I hope we can do better in the future as well. But at this point in time, I think we have invested a lot of time. This committee has spent a lot of time, and I yield back.

Mr. BARTON. Well, before we let the gentlewoman go, we want her to know that the subcommittee goes on record as we support America also. Let's end this on a positive note that we can agree on that.

Ms. BERKLEY. Well, I have to thank all of you. This is the first time in the entire 18 months that I have served in Congress that

I have ever had the pleasure of being grilled by an entire subcommittee.

Mr. BARTON. Grilled? You haven't seen grilled. Wait until next week when Secretary Richardson is here. You will see grilled.

Ms. BERKLEY. I look forward to the opportunity of watching somebody else in this seat. Thank you very much.

Mr. BARTON. Come back next week. Thank you.

Let's hear from our second panel now, if they will come forward. We have Dr. Ivan Itkin, who is the director of the Office of Civilian Radioactive Waste Management at the Department of Energy, and I have had the privilege of meeting Dr. Itkin in my office. He is a distinguished gentleman who volunteered for that job, which shows how much he loves his country that he took that position.

We have Mr. Carl Paperiello, who is the deputy executive director for Materials Research and State Programs for the Nuclear Regulatory Commission. We have Mr. Steve Page, director of the Office of Radiation for the Environmental Protection Agency. We have Dr. Debra Knopman, who is a board member of the Nuclear Waste Technical Review Board.

Last but not least, we have Dr. Kevin Crowley, who is the staff director of the Board of Radioactive Waste Management for the National Research Council. Welcome, lady and gentlemen. Your testimony is in the record in its entirety. We will start with Mr. Paperiello and ask you to summarize in 7 minutes, and we will go right on down the line. Welcome to the subcommittee.

STATEMENTS OF CARL PAPERIELLO, DEPUTY EXECUTIVE DIRECTOR, MATERIALS RESEARCH AND STATE PROGRAMS, NUCLEAR REGULATORY COMMISSION; IVAN ITKIN, DIRECTOR OF OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, U.S. DEPARTMENT OF ENERGY; DEBRA S. KNOPMAN, BOARD MEMBER, U.S. NUCLEAR WASTE TECHNICAL REVIEW; STEPHEN D. PAGE, DIRECTOR, OFFICE OF RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY; AND KEVIN D. CROWLEY, STAFF DIRECTOR, BOARD ON RADIOACTIVE WASTE MANAGEMENT

Mr. PAPERIELLO. Mr. Chairman, members of the committee, the staff of the NRC is pleased to testify about our regulatory oversight of the management and disposal of high level radioactive waste and spent nuclear fuel. Among the subjects I will discuss today is the status of our review of DOE's program to characterize the Yucca Mountain site as a potential geological repository and our progress in establishing site-specific licensing requirements for the proposed repository.

The Commission continues to believe that a permanent geologic depository is the appropriate mechanism for the United States to ultimately manage spent fuel and other highly radioactive wastes.

The program remains on course consistent with our responsibilities under the Nuclear Waste Policy Act of 1982 and the Energy Policy Act of 1992. We are in the middle of an important transition. The staff is moving from the prelicense consultative role defined for the NRC in the statute to its role as regulator and licensing authority as we prepare for possible submittal of a DOE license appli-

cation. And I will note a number of the important milestones and activities that comprise our program during this transition.

On February 22nd of last year, the commission published a proposed regulation 10 CFR part 63 for public comment. This is a site-specific—we have a high-level waste rule. This is a site-specific rule for Yucca Mountain based on our experiences to that date on studying the mountain.

As soon as we proposed our regulations, we embarked on a series of public meetings to encourage involvement by members of the public most affected by the decisions we face in establishing our final rule for Yucca Mountain. From these meetings, together with written submittals, we received more than 900 comments for proposed criteria. The NRC staff has carefully considered and analyzed these comments and has incorporated many of them in a draft final rule that the commissioners now have before them.

Later last year, after the comment period for the NRC's proposed regulations closed, the EPA proposed standards in 40 CFR 197 for Yucca Mountain. The NRC has provided extensive comments on the EPA proposal. The NRC has identified serious concerns with the proposed standards that if unchanged in the final standards, will increase significantly the complexity of the NRC's licensing process without commensurate increase in the protection of public health and safety in the environment.

That being said, however, we have made clear in our proposed rules that once final EPA standards for Yucca Mountain are in place, the NRC will amend its regulations as needed to confirm to the final standards as required by law.

In July of last year, the DOE published for public comment its draft environmental impact statement for proposed Yucca Mountain repository, and the NRC provided detailed comments on the DEIS in February of this year. On May 4 of this year, DOE forwarded its revised siting guidelines at 10 CFR 963 to NRC for concurrence. We expect that the Commission will reach concurrence finding on DOE's draft guidelines later this year. We suspect that DOE will prepare to issue a site recommendation in July of 2001.

Before then, the NRC expected to review a proposed DOE recommendation and provide comments as required by statute on sufficiency of DOE site characterization and waste form proposal.

If DOE makes a recommendation on the Yucca Mountain site, and if the President and the Congress affirm that recommendation, the DOE will then apply to the NRC for a license to construct a repository. The NRC has 3 years to determine whether to approve or deny the application, except that the Commission may extend the deadline by not more than 1 year. Through early NRC staff identification and clarification of key technical safety issues, we are optimistic that we will be prepared to complete this demanding and first-of-a-kind review in the time allotted. Consistent with this objective, we have completed rulemaking to establish a licensing support network using Web-based technology to promote access to documents and thereby hasten review of the license application.

I would like now to turn to the subject of DOE's quality assurance activities involving Yucca Mountain. DOE has experienced problems in the past in carrying out its QA program. In general, DOE has done an acceptable job in uncovering its own quality as-

surance problems, but has been less successful in taking prompt corrective action and preventing recurring problems. I am pleased to be able to say that recent DOE actions have improved the picture considerably in this area. However, the task is not complete and reflecting the need for continued vigilance, we have strengthened our oversight of DOE's quality assurance activities.

In conclusion, it is important to stress that DOE bears the responsibility for demonstrating that licensing and certification requirements are met to protect public health and safety and the environment. The Commission independently must assess and find that such a demonstration has been made before we can issue a license for any geological repository. Among other things, completion of NRC's review of a potential license application depends on the timely establishment of scientifically sound standards and regulations, the receipt of a high quality license application from DOE, and sufficient resources for the agency to maintain its independent technical review capability.

I want to thank you for the opportunity to review the status of the NRC's high level waste regulatory program and will gladly answer any questions that you have.

[The prepared statement of Carl J. Paperiello follows:]

PREPARED STATEMENT OF CARL J. PAPERIELLO, DEPUTY EXECUTIVE DIRECTOR FOR MATERIALS, RESEARCH, AND STATE PROGRAMS, U.S. NUCLEAR REGULATORY COMMISSION

Overview

Mr. Chairman, members of the Subcommittee, the staff of the Nuclear Regulatory Commission (NRC) is pleased to testify about our regulatory oversight of the management and disposal of high-level radioactive waste and spent nuclear fuel. Among the subjects I will discuss today are the status of our review of the Department of Energy's (DOE's) program to characterize the Yucca Mountain Site as a potential geological repository and our progress in establishing site-specific licensing requirements for the proposed repository.

The Commission continues to believe that a permanent geologic repository is the appropriate mechanism for the United States to ultimately manage spent fuel and other high-level radioactive waste. We believe the public health and safety, the environment, and the common defense and security will be protected best by the development of a comprehensive system for the management and disposal of high-level radioactive waste, that includes storage, transportation and deep underground disposal. In our view, a deep geologic repository is a sound and technically feasible solution to the problem of final disposition of spent nuclear fuel and other high-level radioactive wastes.

Status of NRC's HLW Regulatory Program

The NRC's High-level Waste (HLW) regulatory program remains on course, consistent with our responsibilities under the Nuclear Waste Policy Act of 1982, as amended, and the Energy Policy Act of 1992. This legislation specifies an integrated approach and a long-range plan for storage, transport, and disposal of spent nuclear fuel and HLW. It prescribes the respective roles and responsibilities of the NRC, the DOE and the U.S. Environmental Protection Agency (EPA) in the nation's HLW program. The Congress assigned NRC extensive prelicensing responsibilities and the regulatory authority to issue a license, if appropriate, only after deciding whether a DOE license application for a geologic repository at Yucca Mountain, Nevada, complies with applicable standards and regulations.

The NRC staff is in the midst of an important transition—from the prelicensing, consultative role defined for NRC in statute, which has been our emphasis to date, to the role as regulator and licensing authority, as we prepare for a possible submittal of a DOE license application. In my testimony today, I will highlight a number of the important milestones and activities that comprise our program during this important transition. Among these are: (1) establishment of a regulatory framework; (2) comment on the DOE's draft Environmental Impact Statement (EIS) for a proposed repository at Yucca Mountain; (3) review and, if appropriate, concur in

the revised DOE siting guidelines; (4) comment on a DOE site recommendation, should the DOE elect to pursue development of a repository at Yucca Mountain; and (5) if a license application is received, preparation for making a licensing determination in the time allotted by statute. In addition, I would like to say a few words about NRC's oversight of the DOE's quality assurance activities and provide a brief update of our transportation safety activities.

Establishment of a Regulatory Framework

We take seriously our obligations to provide a regulatory framework for the possible licensing of a geologic repository at Yucca Mountain; and to consult with the DOE and other stakeholders, including the Nevada public, in advance of any license application should one be received. We plan to have risk-informed regulations specific for Yucca Mountain in place by the end of this year. Under the Energy Policy Act of 1992, the Commission must modify, if needed, its regulations to be consistent with final EPA standards within a year of their issuance. Because in 1998 we expected only a very short period in which to issue final implementing regulations after final EPA standards are issued, the Commission initiated its own rulemaking in parallel with that of the EPA in formulating its standards. The NRC was concerned about its responsibility to make public, as soon as possible, how we plan to implement the health-based standards called for by the Congress. In our view, prompt, public access to our regulatory intentions was necessary, not only to enable the DOE to begin preparing a possible license application but, just as importantly, to allow for timely and meaningful public involvement in the development of our implementing regulations. After EPA issues final standards, we will act promptly to prepare needed conforming revisions, if any.

On February 22 of last year, the Commission published proposed regulations at 10 CFR Part 63 for public comment. As soon as we proposed our regulations, the NRC staff embarked on a series of public meetings to encourage involvement by members of the public most affected by the decisions we face in publishing final regulations for Yucca Mountain. From these meetings, together with written submittals, we received more than 900 comments on our proposed criteria. The NRC staff has carefully considered, and analyzed these comments, and has incorporated many of them in a draft final rule that the Commissioners now have before them.

Later last year, after the comment period for NRC's proposed regulations closed, the EPA proposed standards at 40 CFR 197 for Yucca Mountain. The NRC has provided extensive comments on the EPA proposal. The NRC has identified serious concerns with the proposed standards that, if unchanged in the final standards, will increase significantly the complexity of the NRC's licensing process without commensurate increase in the protection of public health and safety and the environment. That being said, however, we made clear in our proposed rule, that after final EPA standards for Yucca Mountain are in place, the NRC will amend its regulations, as needed, to conform to the final standards, as required by law.

NRC Reviews of DOE's Draft EIS, Siting Guidelines and Site Recommendation

In July of last year, the DOE published, for public comment, its draft Environmental Impact Statement (DEIS) for a proposed Yucca Mountain repository. The NRC provided detailed comments on the DEIS in February 2000. The NRC comments identified several broad issues and a number of specific topical areas that the DOE should address to make the final EIS complete. The DOE is now completing its final EIS which must, eventually, accompany DOE's license application to construct a HLW repository. The NRC is required, by law, to adopt, to the extent practicable, the final DOE EIS. On May 4, 2000, the DOE forwarded its revised siting guidelines at 10 CFR Part 963 for NRC review and concurrence. The DOE proposes to use the revised guidelines to review and evaluate Yucca Mountain for recommendation as a potential repository site. We expect that the Commission will reach a concurrence finding on DOE's draft final guidelines later this year.

If the DOE elects to pursue development of Yucca Mountain as a repository, we expect the DOE will prepare to issue a site recommendation in July of 2001. Before then, the NRC expects to review a proposed DOE recommendation and provide comments, as required by statute, on the sufficiency of DOE's site characterization and waste form proposal. The NRC expects that it will take six months to complete the necessary review of any site recommendation, and provide comments.

Preparation for Making a Licensing Decision

As part of our overall prelicensing strategy, we continue to focus our review on the nine key technical issues that are most important to repository safety and, therefore, to licensing. Since we redirected and streamlined our program several years ago, the NRC staff has completed a number of significant reports on the status of resolution, at the staff level, of each of the nine key issues. Now, we are ap-

plying the experience gained in preparing these reports to the development of a Yucca Mountain review plan that will eventually guide our review of a license application. As this development progresses, we also continue to conduct public technical exchanges between members of the NRC and DOE technical staffs and with NRC's Advisory Committee on Nuclear Waste.

If DOE makes a recommendation on the Yucca Mountain site, and if the President and Congress affirm that recommendation, the DOE will then apply to the NRC for a license to construct a repository. The NRC has three years to determine whether to approve or deny the application, except that the Commission may extend the deadline by not more than one year. Through early NRC staff identification and clarification of key safety issues, we are optimistic that we will be prepared to complete this demanding and first-of-a-kind review in the time allotted. Consistent with this objective, we have completed a rulemaking to establish a Licensing Support Network, using web-based technology to promote access to supporting documents and, thereby, hasten review of the license application. A further rulemaking with regard to the Licensing Support Network is now in preparation.

Quality Assurance

I would now like to turn to the subject of the DOE quality assurance activities involving Yucca Mountain. DOE has experienced problems in carrying out its quality assurance program. In general, the DOE has done an acceptable job in uncovering its own quality assurance problems. However, it has been less successful in taking prompt corrective actions and preventing recurring problems. I am pleased to be able to say that recent DOE actions have improved the picture considerably in this area. However, the task is not complete and, reflecting the need for continued vigilance, we have strengthened our oversight of DOE's quality assurance activities.

Safety of Packages for Spent Fuel and HLW Transport

In addition to our oversight responsibilities for any potential geologic repository, the NRC is charged with certifying the safety of the packages used to transport spent nuclear fuel and high level waste. NRC continues to support the requirement that waste shippers use NRC-certified packages for transport of spent fuel and high-level waste. In the past year, NRC has reviewed and approved three dual-purpose cask systems for storage and transport. We are also reviewing four more dual-purpose cask system designs.

The shipment of spent nuclear fuel in NRC-approved transportation containers continues to have an unparalleled record of success from a safety perspective. To date, there has not been a release of radioactive material from an accident involving an NRC-approved spent fuel transportation container. In March 2000, NRC completed a safety study on spent fuel shipment risks. This study found the risks associated with transport of spent nuclear fuel by truck or train are even lower than earlier risk estimates. NRC held a series of meetings in 1999 to interact with interested stakeholders in a public forum to discuss the issues related to spent fuel transport. The NRC has more meetings planned for later this year.

Conclusion

It is important to stress that the DOE bears the responsibility for demonstrating that licensing and certification requirements are met to protect public health and safety and the environment. The Commission independently must assess and find that such a demonstration has been made before we can issue a license for any geologic repository. Among other things, completion of NRC's review of a potential license application depends upon: the timely establishment of scientifically-sound standards and regulations; the receipt of a high-quality license application from the DOE; and sufficient resources for the NRC to maintain its independent technical review capability. I want to thank you for the opportunity to review the status of NRC's HLW regulatory program, and will gladly answer any questions you may have.

Mr. BARTON. Thank you, Doctor. We would now like to hear from Dr. Itkin, and your statement is in the record. We recognize you for 7 minutes. Welcome to the subcommittee.

STATEMENT OF IVAN ITKIN

Mr. ITKIN. Thank you, Mr. Chairman and members of the subcommittee. I am Ivan Itkin, Director of the Department of Energy's Office of Civilian Radioactive Waste Management.

I appreciate the opportunity to provide an update on the status of our program and to address the issues of concern to the committee. Over the past few years, the Department has made significant progress toward a recommendation on the permanent solution for spent nuclear fuel and high level radioactive waste.

We are on schedule to make a decision in 2001 on whether or not to recommend the Yucca Mountain site as a repository. With sufficient appropriations, and if the site is suitable for recommendation and is designated so by the Congress, we are on schedule to begin emplacement of the waste in 2010.

Let me again emphasize that the overriding goal of the Federal Government's high level radioactive waste management policy is the establishment of a permanent geologic repository. Permanent geologic disposal not only addresses the management of spent nuclear fuel from commercial electric power generation, but is also essential to advancing our nonproliferation goals. The repository will secure highly enriched spent nuclear fuel from foreign and domestic research reactors and surplus plutonium from dismantled nuclear weapons. A repository is necessary to support our nuclear powered Naval fleet.

Finally, a permanent geologic repository is vital for cleaning up the legacy of our past nuclear weapons production at sites throughout the country.

In the next year, we expect to complete the near-term scientific and engineering work for a Secretarial decision on whether or not to recommend the Yucca Mountain site for further development. We are on schedule to complete the documentation required by law.

A Presidential decision to go forward with Yucca Mountain must be based on science, and we are conducting a world class scientific and technical program at Yucca Mountain.

We have had almost 5 years of direct examination of the geology underneath Yucca Mountain, and we completed a 2,000 meter cross-drift tunnel in December 1999 to develop a more complete three-dimensional model of the geologic formation.

We continue to conduct the world's largest thermal tests to assess how long-term exposure to heat from waste packages might affect the hydrology and near-field environment within the tunnels that may be constructed within Yucca Mountain.

Since the release of the viability assessment in December 1998, we have focused on reducing uncertainty in the models we use to predict repository performance.

We have refined our repository design to be flexible and robust. And we can adjust the period of ventilation, vary fuel staging at the waste packages, and adjust waste package spacing.

Let me now turn to the program's current activities. The program's focus for early fiscal year 2001 is to complete the site recommendation consideration report. This report will be made available to the State of Nevada, the Nuclear Regulatory Commission, and the public to inform them of our findings and to facilitate public comment on a possible recommendation.

The program issued the draft environmental impact statement for a geologic repository in July 1999. More than 2,700 individuals attended public hearings on the draft statement and more than 700 provided comments. We are presently analyzing the comments, pre-

paring responses, and continuing the development of the final environmental impact statement.

Under the Nuclear Waste Policy Act, the final environmental impact statement must accompany a recommendation from the Secretary to the President to develop this site. The Department has requested $437.5 million for fiscal year 2001. This funding is necessary to complete the activities needed for an informed policy decision.

The full fiscal year 2001 request is also necessary for critical work related to the preparation of a license application that was deferred in past years due to funding levels below those published in the viability assessment.

Let me address the program's efforts to recompete the current management and operating contract. The program's current M&O contract was awarded in 1991 and will expire in February of 2001. Consistent with the Department's contracting policy, we are recompeting our M&O contract. We received three proposals on June 8, 2000, at the close of the bidding period. We expect to award a follow-on later this year, and after awarding the contract, we expect—no, in fact, we will demand an orderly transition, and have allocated funds for contractor transition in our fiscal year 2001 budget request.

Both the Environmental Protection Agency and the Nuclear Regulatory Commission have proposed regulations for radiation dose limits at Yucca Mountain and to license a repository at the site. To align our site suitability criteria to the proposed regulations, the Department has proposed 10 CFR 963, the Yucca Mountain site suitability guidelines. We are hopeful that the Environmental Protection Agency will establish reasonable standards that are protective of the public health and safety and the environment, and that these standards can be implemented by the Nuclear Regulatory Commission in a rigorous licensing process.

It is our understanding that the Environmental Protection Agency will finalize the radiation protection standard for Yucca Mountain this summer.

Mr. Chairman, members of the committee, we have made significant progress. Since we set out to characterize the Yucca Mountain site after enactment of the Nuclear Waste Policy Act of 1982, we knew we would face many challenges. I believe by the end of next year, we will have met the most difficult of those challenges. There will likely continue to be additional scientific and institutional issues to be addressed during any licensing process, but I believe that the program is well positioned to move forward.

Thank you. I appreciate being allowed to present this testimony, and I will be happy to answer any questions that you may have.

[The prepared statement of Ivan Itkin follows:]

PREPARED STATEMENT OF IVAN ITKIN, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, U.S. DEPARTMENT OF ENERGY

INTRODUCTION

Mr. Chairman and members of the Subcommittee, I am Ivan Itkin, Director of the Department of Energy's Office of Civilian Radioactive Waste Management. I appreciate the opportunity to provide an update on the status of our Program and to address issues of concern to the Committee.

Over the past few years, the Department has made significant progress toward a recommendation on a permanent solution for spent nuclear fuel and high-level radioactive waste. We are on schedule to make a decision in 2001 on whether or not to recommend the Yucca Mountain site as a repository. With sufficient appropriations, and if the site is suitable for recommendation and is designated by Congress, our current schedule is to submit the license application for repository construction to the Nuclear Regulatory Commission in 2002, to begin construction in 2005 upon receipt of construction authorization, and, if the site is licensed, to begin emplacement of the waste in the repository in 2010.

BACKGROUND

The overriding goal of the Federal Government's high-level radioactive waste management policy is the establishment of a permanent geologic repository.

Permanent geologic disposal addresses the management of spent nuclear fuel from commercial electric power generation and from past Government defense activities, and it is essential to advancing our non-proliferation goals. A permanent disposal solution will also secure highly enriched spent nuclear fuel from foreign and domestic research reactors. It will also provide for the disposition of surplus plutonium from dismantled nuclear weapons. A repository is necessary for the disposition of spent nuclear fuel from our nuclear-powered naval vessels. Finally, a permanent geologic repository is vital for cleaning up the legacy of our past nuclear weapons production at sites throughout the country.

PROGRAM STATUS

The near-term scientific and engineering work that will be the foundation for a Secretarial decision on whether or not to recommend the Yucca Mountain site to the President is expected to be completed next year. A Presidential decision to develop a repository must be based on sound science. It must not only be accompanied by the documentation required by law, but also inform our policy makers, our regulatory oversight agencies, and the public regarding the scientific basis for the decision.

We are conducting a world-class scientific and technical program at Yucca Mountain. Through the Exploratory Studies Facility, we have had almost five years of direct examination of the geology underneath Yucca Mountain. From this study, our scientists and engineers, including experts from our nation's universities and our National Laboratories, have advanced our understanding of a potential repository system. This understanding led us to further focus our investigations, responding in part to the Nuclear Waste Technical Review Board and other experts.

In response to requests from the Nuclear Waste Technical Review Board, we completed a 2000-meter cross-drift tunnel in December 1999. This year, we will complete niches and alcoves in the cross-drift tunnel that will assist us in developing a more complete three-dimensional model of that geologic formation. For nearly two years, we have gathered and integrated into our performance models data from the cross-drift tunnel inside the mountain to refine our predictions of repository performance.

Within the Exploratory Studies Facility, we continue to conduct the largest thermal test of a geologic formation in the world. This test, commonly known as the drift-scale test, assesses how long-term exposures to heat from waste packages might affect the hydrology and near-field environment within tunnels that may be constructed within Yucca Mountain. This work will help determine the effects of heat on waste package performance and assist in the further refinement of repository design as we move forward toward licensing a repository, if the site is deemed suitable.

Since the release of the Viability Assessment in December 1998, the primary objective of the program's scientific and technical work has been reducing uncertainty in our predictions of repository performance. Our repository design has been refined to better manage thermal loads and reduce uncertainty. It is a flexible and robust design that can accommodate various operational modes, including adjusting the period of ventilation, varying fuel staging and loading into waste packages, and adjusting waste package spacing to manage thermal loads.

This approach will permit future generations to evaluate actual repository performance, learn from the operations and monitoring, and close the facility when appropriate. A repository that is flexible to accommodate technical advances or future changes in priority is one way to address concerns regarding the need for additional information due to uncertainty.

PLANNED ACTIVITIES

Let me now turn to the Program's current activities, and the major events on the horizon. The culmination of the Program's site characterization efforts is to prepare the documentation required under the Nuclear Waste Policy Act to support a decision on whether or not to submit a site recommendation to the President. The Program's focus for early Fiscal Year 2001 is to complete the Site Recommendation Consideration Report. This report will present background information and descriptions of the site characterization program and the site. It will also include descriptions of the repository design, the waste form, and waste packages; a discussion of data related to the safety of the site; and a description of the performance assessment of the repository. The Site Recommendation Consideration Report and its supporting documents will be made available to the State of Nevada, the Nuclear Regulatory Commission, and the public to inform them and to facilitate public comment on a possible recommendation.

The Nuclear Waste Policy Act requires a final environmental impact statement to accompany a site recommendation to the President, if the Secretary decides to recommend the site for development as a repository. The Department issued the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* in July 1999. The draft environmental impact statement provides information on potential environmental impacts that could result from the construction, operation and monitoring, and eventual closure of a repository at Yucca Mountain.

We conducted a public comment period on the draft environmental impact statement from the end of July 1999 through February 28, 2000. Twenty-one hearings were held, eleven throughout the country and ten in the State of Nevada. More than 2700 individuals attended those hearings and more than 700 provided comments. We are presently analyzing the comments, preparing responses to be documented in the comment response section of the final environmental impact statement, and continuing development of the final environmental impact statement.

Our plan for Fiscal Year 2001 and beyond reflects the evolution of the project emphasis from scientific investigations to data synthesis, model validation, repository and waste package design, safety analysis, and documentation. The Program's near-term priorities upon completion of site characterization will be to enhance and refine repository design features and to develop the remaining information required to continue to a license application if a decision to recommend the site is made by the Secretary and approved by the President and Congress.

FISCAL YEAR 2001 BUDGET

To support our future activities, the Department has requested $437.5 million for Fiscal Year 2001. The funding we have requested is needed to complete the activities that are necessary for an informed policy decision. In addition to compiling the remaining information that is necessary for a possible site recommendation, the full Fiscal Year 2001 request is also necessary for critical work, related to the preparation of a license application, that was deferred in past years due to funding levels below those published in the Viability Assessment. The Program has been able to maintain its schedule for major milestones over the past years despite significant reductions from our request level, but only by deferring critical work that still must be completed.

Regaining momentum with the Fiscal Year 2001 request will enable the Program to be more responsive to emerging scientific issues, such as those raised during our extensive ongoing interactions with the Nuclear Waste Technical Review Board and the Nuclear Regulatory Commission. Now, when we are so close to significant milestones, we should not allow insufficient resources to be a cause for delay.

CONTRACT RECOMPETITION

The Program's current management and operating contract was awarded in 1991 and will expire in February 2001. Consistent with the Department's contracting policy regarding management and operating contracts, and in conformance with direction provided in the enacted Energy and Water Development appropriations, we are recompeting our management and operating contract.

The Department received three proposals on June 8, 2000, which was the close of the bidding period. We have begun to evaluate submittals by the three teams, which are led by MK Nevada LLC, Bechtel SAIC Company LLC, and TRW Parsons Management and Operations LLC. We expect to award a follow-on performance-based contract late this summer or early in the fall. After awarding the contract,

we expect an orderly transition. We have allocated funds for contractor transition in our Fiscal Year 2001 budget request.

REGULATORY ACTIVITIES

We have proposed 10 CFR 963, *Yucca Mountain Site Suitability Guidelines,* for use by the Department in evaluating site suitability. This proposal is intended to align the suitability criteria in the Department's evaluation process with the standards being promulgated by the Environmental Protection Agency and the licensing criteria being promulgated by the Nuclear Regulatory Commission. Specifically, the Environmental Protection Agency and Nuclear Regulatory Commission are each revising the regulatory framework for standards involving radiation dose limits at Yucca Mountain and for licensing this site, respectively.

We are hopeful that the Environmental Protection Agency will establish reasonable standards that are protective of public health and safety and the environment, and that these standards can be implemented by the Nuclear Regulatory Commission in a rigorous licensing environment. It is our understanding that the Environmental Protection Agency will finalize the radiation protection standard for Yucca Mountain this summer. Soon afterwards, we expect the Nuclear Regulatory Commission to modify its licensing criteria to be consistent with the standard.

CONCLUSION

As I noted at the beginning of my testimony, we have made significant progress. Since the enactment of the Nuclear Waste Policy Act in 1982, our nation has made a substantial investment in permanent geologic disposal. Approximately four billion dollars and years of cutting-edge science and engineering have brought us to this point. When we set out to characterize the Yucca Mountain site through an ambitious scientific program, we knew we would be faced with challenges. I believe by the end of next year we will have met the most difficult of those challenges. There will likely continue to be additional scientific and institutional issues to be addressed during any licensing process. But, I believe the Program is well positioned to move forward.

Thank you. I would be pleased to answer any questions you may have.

Mr. BARTON. Thank you, Doctor.

We now would like to hear from another doctor—we are getting overwhelmed with Ph.D.'s today—Dr. Debra Knopman, who is the board member from the Nuclear Waste Technical Review Board, which is tasked with overseeing all the scientific analysis on these decisions. Your statement is in the record in its entirety and we would welcome you to summarize it for 7 minutes.

STATEMENT OF DEBRA S. KNOPMAN

Ms. KNOPMAN. Thank you, Mr. Chairman, and members of the subcommittee. I am a member of the Nuclear Waste Technical Review Board. My full-time job is director of the Center for Innovation and the Environment of the Progressive Policy Institute. As most of you may know, the Board members serve in a part-time capacity. I am pleased to act as the Board's representative today. Our Chairman, Dr. Jared Cohon, President of Carnegie Mellon University, sends his regrets at not being here. I will make summary remarks.

Mr. Chairman, when Congress created the Nuclear Waste Technical Review Board in the 1987 amendments to the Nuclear Waste Policy Act, it gave the Board a very important and unique mandate. That mandate is to conduct an independent review of the technical and scientific validity of activities conducted by the Secretary of Energy in implementing the Act, including characterization of the Yucca Mountain site and packaging and transportation of spent nuclear fuel and high level radioactive waste.

I would like to update the subcommittee this morning briefly on some of the Board's most recent recommendations on the DOE safety strategy for the Yucca Mountain site, methods for predicting repository performance, and scientific studies of Yucca Mountain. I would like to make four points.

Point 1: Representation of uncertainties about the Yucca Mountain site will be an important component of a site recommendation decision document. The Board continues to endorse the use of performance assessment, sometimes called TSPA, supplemented by other lines of evidence for making a site suitability determination. While the numerical models in a performance assessment help us to understand and estimate how a repository might perform at Yucca Mountain, the models are based on many assumptions. For example, underlying the models are assumptions about the natural environment, including climate, water movement, chemistry, et cetera, and about the engineered system, including corrosion and other processes.

The Board believes that explaining the uncertainties inherent in the PA and the underlying assumptions as clearly and fully as possible is essential for technical credibility and sound decision-making. The board is concerned that a performance assessment without such an explanation could deprive policymakers of critical information on possible tradeoffs between projected performance and uncertainty in those projections.

Let me give you an example. One policymaker might be willing to accept development of a repository that would release half of the allowable dose and have only a 1-in-1,000 chance of exceeding that limit. However, that same policymaker might decline to develop a repository that is expected to release only a 10th of the allowable dose but has a 1-in-4 chance of exceeding the limit.

Another policymaker's preferences might be the opposite. Because the uncertainties about repository system performance may be substantial, estimates of uncertainty about doses are at least as important as estimates of performance.

DOE and the Board have had numerous exchanges on this point, and we understand that the program is making an effort to respond to the Board's concerns.

The second point I would like to make: A case for repository safety must be built on multiple lines of evidence, not just a complex computer model. Although we endorse the use of performance assessment modeling, the Board believes that the modeling should not be used as the sole source of guidance about long-term performance of the repository system. The Board supports the DOE's use of multiple and independent lines of argument and evidence, including defense-in-depth, safety margin, natural analogs and performance confirmation testing to supplement the use of TSPA, the total system performance assessment, in its case regarding Yucca Mountain site suitability.

In other words, this is a matter of not putting all the scientific eggs in one basket of computer modeling. The Board believes that the program is making an effort to develop these additional lines of evidence. It is unclear at this time how far along DOE will be in their development at the time of the site recommendation consideration report.

Third point: There are important connections between repository design and uncertainties in the safety case. In other words, evaluation of the site's suitability is dependent, to a considerable degree, on confidence in the technical case made for performance of a proposed repository and waste package design. That is the reason why one way to address uncertainties in the safety case is to reduce them by modifying repository design.

In particular, the Board has suggested that the DOE investigate the effects of heat on the waste packages, repository tunnels, and hydrologic and hydrogeochemical processes at the site. The Board made this suggestion because higher temperatures, especially if water is present in repository tunnels, appear to carry additional uncertainties in estimating repository system performance in comparison to lower temperature below-boiling conditions in the rocks surrounding the tunnels.

In the past, DOE has maintained that above-boiling repository designs have the potential to vaporize water in the rocks surrounding the repository tunnels, thereby keeping the waste packages essentially dry for up to 1,000 years.

The Board is concerned that the performance assessment may not, in its current state of development, capture adequately how the thermal, hydrologic and other processes in the mountain interact. And if this is the case, then the PA model may not be able to accurately represent the uncertainty associated with this above-boiling design.

A below-boiling design may have the potential to reduce concerns about these coupled processes, but more thorough analysis is needed before any judgment is made about the optimal thermal conditions for the repository operation. The Board is very pleased that DOE has begun preliminary work in this area.

Fourth point: Important scientific studies are still going on at Yucca Mountain. The primary focus of the scientific work now in progress at Yucca Mountain is to reduce uncertainties through the acquisition and analysis of additional relevant data. For example, the Board believes on the basis of current knowledge that the DOE has chosen the best materials available for the waste package. However, our experience with the materials extends only over a few decades a short time relative to the tens of thousands of years of their intended life in a repository.

The Board is closely following the DOE's efforts to address questions about stress corrosion cracking and about dissolution of the passive layer around the waste package that would act as a barrier—corrosion barrier in the alloy being proposed for the package. The east-west cross-drift recommended by the Board and completed in October 1998 by DOE continues to yield scientific dividends and will help address some of the current questions about the rock where the proposed repository would actually be located.

In conclusion, Mr. Chairman, the Board believes that the DOE's efforts to develop the site recommendation consideration report have been very useful to identify issues that they would need to resolve or clarify in a final site recommendation report. At this point, the DOE has not encountered any single issue in characterizing the Yucca Mountain site that automatically eliminates it from consideration as the location of a permanent repository for spent nuclear

fuel and high level radioactive waste. However important technical questions remain about Yucca Mountain, especially about the effects of heat on the movement of water in the mountain and on the associated transport of radionuclides.

DOE is taking steps to address these uncertainties, but some uncertainty will inevitably continue about predictions of repository performance. This may be true to some extent at any site. At the time the decision is made onsite recommendation, the Board believes it is critical that DOE not only offer estimates of performance, but also clarify the extent and significance of the scientific uncertainties that are a vital part of decisionmaking.

Thank you very much for this opportunity to provide the Board's views. I would be happy to respond to questions.

[The prepared statement of Debra S. Knopman follows:]

PREPARED STATEMENT OF DEBRA KNOPMAN, U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD

Mr. Chairman and members of the Subcommittee. I am Debra Knopman, a member of the Nuclear Waste Technical Board. My full-time job is Director of the Center for Innovation and the Environment of the Progressive Policy Institute. It is my pleasure to act as the Board's representative this morning and to express the views of the Board on progress in the Yucca Mountain site-characterization program. The Board's Chairman, Dr. Jared L. Cohon, sends his regrets at not being able to be here today.

With your permission, Mr. Chairman, I will make some brief summary remarks and ask that my full statement be entered into the hearing record.

The Board's Mandate

Mr. Chairman, when Congress created the Nuclear Waste Technical Review Board in the 1987 amendments to the Nuclear Waste Policy Act (NWPA), it gave the Board a very important—and unique—mandate. That mandate is to conduct an independent review of the technical and scientific validity of activities conducted by the Secretary of Energy in implementing the NWPA, including characterization of the Yucca Mountain site and packaging and transportation of spent nuclear fuel and high-level radioactive waste. Congress intended the Board to communicate its findings and recommendations to the Secretary and to Congress in a timely fashion before important decisions are made, not after the fact.

The Board takes its charge very seriously, Mr. Chairman, and we are pleased to have this opportunity to update the Subcommittee on the Board's view of the Yucca Mountain program before the release of the Department of Energy's (DOE) site recommendation consideration report, or SRCR, which currently is scheduled for the end of this year. In particular, I would like to update the Subcommittee briefly on some of the Board's most recent recommendations on the DOE's safety strategy for the Yucca Mountain site, methods for predicting repository performance, and scientific studies of Yucca Mountain.

The DOE's Site Recommendation Consideration Report

As I mentioned, Mr. Chairman, the DOE intends to issue a site recommendation consideration report on Yucca Mountain at the end of this calendar year. The DOE plans to update the SRCR and use it along with other information called for in the Nuclear Waste Policy Act as the basis of a site recommendation, currently scheduled for mid-2001.

According to the DOE, the SRCR will include four elements: a comprehensive computer model called the "total system performance assessment," or TSPA; a qualitative description of the attributes of the Yucca Mountain site; a repository design and safety case; and an outline of future research needs. Over the last few months, the Board has commented to the DOE on some of these issues. I will briefly summarize some of our most recent comments.

Representation of uncertainties about the Yucca Mountain site. The Board continues to endorse the use of performance assessment, or PA, supplemented by other lines of evidence, for making a site-suitability determination. While the numerical models in a PA help us understand and estimate how a repository might perform at the Yucca Mountain site, the models are based on many assumptions. For example, underlying the models are assumptions about the natural environment, includ-

ing climate, water movement, chemistry, seismicity, and volcanism, and about the engineered system, including corrosion and other processes. The assumptions may be based on field and laboratory data, on the results of expert judgment, or on detailed conceptual and numerical analyses.

The Board believes that explaining the uncertainties inherent in the PA and the underlying assumptions as clearly and fully as possible is essential for technical credibility and sound decision-making. The Board is concerned that a PA without such an explanation could deprive policy-makers of critical information on possible trade-offs between projected performance and the uncertainty in those projections. For example, one policy-maker might be willing to accept development of a repository that would release half of the permitted dose and have only a 1 in 1,000 chance of exceeding the permitted dose. However, that same policy-maker might decline to develop a repository that is expected to release only a tenth of the permitted dose but that has a 1 in 4 chance of exceeding the permitted dose. Another policy-maker's preferences might be the opposite. Because the uncertainties about repository system performance may be substantial, estimates of uncertainty about doses are at least as important as estimates of performance.

To help decision-makers better understand estimates of repository performance in the PA, the Board recommends that the DOE include in a site recommendation document a description of critical assumptions, an explanation of why particular parameter ranges were chosen, a discussion of data limitations, an explanation of the basis and justification for using expert judgments, and an assessment of confidence in the conceptual models used.

In addition, the Board recommends that the uncertainties associated with the performance estimates be identified and quantified well enough so that the performance estimates can be put in the context of what is well known, what is less well known, and what is unknown (or unknowable) about Yucca Mountain. The DOE and the Board have had numerous exchanges on this point, and we understand that the program is making an effort to respond to the Board's concerns.

Building a case for repository safety. Although we endorse the use of PA, the Board believes that PA modeling should not be used as the sole source of guidance about the features, events, and processes that might affect the long-term performance of the repository system. Therefore, the Board supports the DOE's use of multiple and independent lines of argument and evidence, including defense-in-depth, safety margin, natural analogs, and performance confirmation testing, to supplement the TSPA in its case regarding Yucca Mountain site suitability. These additional elements, combined with a clear description of uncertainty as described above, will present a more technically defensible demonstration of repository safety than would any element by itself. In other words, this is a matter of not putting all the scientific eggs in one basket of computer modeling. The Board believes that the program is making an effort to develop these additional lines of evidence, but it is unclear at this time how far along DOE will be in their development at the time of the SRCR.

Connections between repository design and uncertainties in the safety case. One way to address uncertainties is to reduce them by modifying repository design. In early1999, the Board recommended to the DOE that it analyze alternatives to the repository and waste package designs included in the DOE's 1998 viability assessment. In particular, the Board suggested that the DOE investigate the effects of heat on the waste packages, repository tunnels, and hydrologic and hydrogeochemical processes at the site. The Board made this suggestion because higher temperatures, especially if water is present in repository tunnels, appear to carry additional uncertainties in estimating repository system performance in comparison to lower-temperature, below-boiling conditions in the rock surrounding the tunnels. In the past, the DOE has maintained that above-boiling repository designs have the potential to vaporize water in the rock surrounding the repository tunnels, thereby keeping the waste packages essentially dry for up to a thousand years.

Understanding the differences in estimated performance and associated uncertainties under different temperature conditions is an important component of our overall understanding of potential repository performance at the Yucca Mountain site. However, the Board is concerned that PA may not in its current state of development capture adequately how the thermal, hydrologic, mechanical, and chemical processes in the mountain interact. If this is the case, then the PA model may not accurately represent the uncertainty associated with above-boiling designs. A below-boiling design may have the potential to reduce concerns about these "coupled processes." Nonetheless, more thorough analysis is needed before any judgment is made about the optimal thermal conditions for repository operation.

In any case, Mr. Chairman, the Board believes that an analysis of the tradeoffs between estimates of performance and the uncertainties in those estimates is essen-

tial before a technically-defensible decision can be made on repository design. The Board is pleased that the DOE has begun preliminary work in this area.

Important scientific studies continue at Yucca Mountain. An important aspect of reducing uncertainties is obtaining relevant data. For example, the Board believes, on the basis of current knowledge, that the DOE has chosen the best materials available for the waste package. However, experience with the materials extends over only a few decades—a short time relative to the tens of thousands of years in their intended life in a repository. The Board is closely following the DOE's efforts to address questions about stress corrosion cracking and about dissolution of the passive layer that acts as a corrosion barrier in the alloy that has been selected for the exterior of the waste package. Answering these questions should help reduce uncertainties and increase confidence in predictions of waste package performance that are extrapolated from present-day experience.

The east-west cross drift recommended by the Board and completed in October 1998 by the DOE continues to yield dividends in scientific information that help to address some of the current questions about the properties of the layer of rock where most of the waste would be placed and about how liquid water and water vapor will move within that layer. In addition, the ongoing drift-scale heater test, now in its third year, should provide important information on the general effects of heat on the mountain.

Conclusion

In conclusion, Mr. Chairman, on the basis of what we know at this time, the SRCR will provide an important analysis of key issues that are likely to be included in a final technical document accompanying a site recommendation. Although the Board cannot say whether the SRCR itself will be sufficient for determining site suitability, the Board believes that the DOE's efforts to develop the SRCR have been very useful in helping the DOE identify issues that would have to be resolved or clarified in a final site recommendation report.

At this point, the DOE has not encountered any issue in characterizing the Yucca Mountain site that automatically eliminates it from consideration as the location of a permanent repository for spent nuclear fuel and high-level radioactive waste. However, important technical questions remain about Yucca Mountain, especially about the effects of heat on the movement of water in the mountain and on the associated transport of radionuclides. The DOE is taking steps to address these questions, but some uncertainty will inevitably continue about predictions of the performance of a potential repository system. This may be true to some extent at any site.

At the time a decision is made on site recommendation, the Board and the scientific community are likely to be asked at least two questions: (1) Is the underlying science broadly regarded as technically credible and sound? and (2) Are the uncertainties in estimates of performance displayed clearly and openly, especially about the major factors that may lead to a potential radioactive release? A major question for policy-makers at that point may be whether the site is suitable, given the level of uncertainty associated with the DOE's site-suitability determination. The Board believes it is critical that the DOE not only offer estimates of performance but also clarify the extent and significance of the technical and scientific uncertainties. Understanding uncertainties is vital for sound decision-making.

Thank you very much for this opportunity to provide the Board's views. I will be happy to respond to questions.

Mr. BARTON. Thank you, Doctor. We now would like to hear from the director of the Office of Radiation at the U.S. Environmental Protection Agency, Mr. Steven Page. Your statement is in the record in its entirety and we ask you to summarize it in 7 minutes.

STATEMENT OF STEPHEN D. PAGE

Mr. PAGE. Thank you, Mr. Chairman, and members of the subcommittee. I will focus my brief remarks on the issues that I understand are of particular interest to you and the subcommittee this morning. The Energy Policy Act of 1992 directed EPA to set site specific public health and safety standards for Yucca Mountain. That legislation also required the National Academy of Sciences to conduct an analysis of the scientific basis for the standards to be applied to Yucca Mountain.

Since then, EPA has finalized its generic high level waste standards and certified a deep geological repository that complies with those standards. During the past 10 years, EPA has been working closely with DOE, NRC, OSTP, and the National Academy of Science to apply these standards and to develop site specific standards for Yucca Mountain that are technically sound and achievable, legally defensible, and above all, are protective of public health and the environment.

In August 1999, we published our proposed Yucca Mountain standards. We received approximately 800 public comments from 70 groups or individuals which we will be responding to in writing at the time we issue our final standards. We received extensive comments from DOE and NRC as well as other government entities, the National Academy of Sciences, industry, and environmental groups, tribal organizations, scientific associations, and members of the general public.

Now, I would like to turn to the three main elements in our proposed disposal standards: Individual protection, human intrusion, and groundwater protection.

We received more comments on these three issues than on any other aspect of the proposed rule. The individual protection standard focuses on exposures to an individual whose lifestyle is similar to people living today in the Yucca Mountain region and who obtains drinking water and food from local sources. The human intrusion standard focuses on evaluating the ability of the repository to withstand a single intrusion event. And third, the groundwater standard protects important natural resources by focusing on the quality of the aquifer supplying water to downgradient communities.

As directed by the Energy Policy Act, our proposed Yucca Mountain standards are based on and generally consistent with the recommendations of the National Academy of Sciences. The NAS commented that the individual protection standard of 15 millirem is within the risk range they recommended, and that the human intrusion standard very closely follows their recommendations.

However, there were some differences on the proposed groundwater protection standard, which I would like to address briefly.

The NAS said that a separate groundwater standard is unnecessary and that it lacks a sound scientific basis. However, the NAS also recognized that EPA does have the authority to consider policy issues in setting a separate groundwater protection standard. They recommended that we clearly identify the standard as an implementation of policy.

Historically, this administration as well as previous administrations have had a policy of protecting groundwater resources that currently are being used, or that potentially could be used as a source of drinking water. More than 50 percent of the U.S. population draws on groundwater for its potable water supply. Proper cleanup of contaminated groundwater is often difficult, if not impossible, to achieve and it is very expensive if it can be done at all.

It is important to remember that the aquifer under Yucca Mountain currently is used as source of drinking water. Therefore, we proposed protection of groundwater at Yucca Mountain to the same level as the maximum contaminant levels, or the MCLs, for radio-

nuclides that we established under the authority of the Safe Drinking Water Act. As you may be aware, virtually every State has taken steps to comprehensive groundwater protection. Forty-one States have numeric or narrative groundwater standards to protect their groundwater currently. Groundwater protection is also applied to every hazardous waste facility in this country.

The citizens of Nevada, particularly in a region growing as rapidly as the Las Vegas metropolitan area should be extended the similar type of protection for the disposal of spent nuclear fuel and high-level radioactive waste in the Yucca Mountain repository.

An important question that some commenters raise is the need for a separate groundwater protection standard in addition to at all-pathways individual protection standard. Our proposed rule contains two complementary standards: A 15 millirem all-pathways individual protection standard and a 4 millirem groundwater protection standard. While the 15 millirem proposed standard directly protects individuals who may receive exposure from radionuclides released from the repository, the 4 millirem level protects the groundwater resource, as we mentioned earlier. This level of protection is derived from the MCLs that are used to define acceptable supplies of drinking water. Similarly, should groundwater that is or could be used for drinking water be a significant pathway, present and future users of the groundwater resource are adequately protected. By extension, it provides protection to individuals who now live, or may live in the future, in the vicinity of Yucca Mountain.

We understand that DOE still has to undergo the NRC licensing process. However, to date, DOE's ongoing studies show compliance with the proposed groundwater standard, although EPA is still considering options and alternatives for the final rule. DOE's costs for the facilities are driven by many external influences, including EPA's proposed standard, all of which strive to enhance repository safety. Other more notable influences include the recommendations of the Nuclear Waste Technical Review Board and the rigorous NRC licensing process.

Further, EPA's current schedule to issue the final standard this summer does not adversely impact DOE's ability to make a site recommendation as planned. Thank you again for inviting me to testify before the subcommittee today, and I am happy to answer any questions that you may have.

[The prepared statement of Stephen D. Page follows:]

PREPARED STATEMENT OF STEPHEN D. PAGE, DIRECTOR, OFFICE OF RADIATION AND INDOOR AIR, U.S. ENVIRONMENTAL PROTECTION AGENCY

INTRODUCTION

Good morning Chairman Barton and Members of the Subcommittee. It is my pleasure to appear before you today to provide you with an update on the Environmental Protection Agency's (EPA) environmental protection standards for the proposed geologic repository at Yucca Mountain, Nevada. I will update you on the status of our final standards and focus on issues of interest to the Subcommittee.

I would like to begin by reviewing EPA's statutory authority for issuing the Yucca Mountain standards and the process that we are following in developing the standards. I also will discuss the National Academy of Science's (NAS) technical recommendations, and some important elements of our proposed standards, including the proposed ground water protection standard for Yucca Mountain. Finally, I will

generally address the expected impact of our proposed standards on the cost of the repository.

We believe that, as a matter of policy, the environmental protection standards that EPA ultimately issues should consider four primary principles: good science, cost-effectiveness, equity, and pollution prevention.

STATUTORY AUTHORITY

The Energy Policy Act of 1992 [Pub. Law No. 102-486, 106 Stat. 2776, 42 U.S.C. § 10141 n. (1994)] gives EPA the authority to establish public health and safety standards for Yucca Mountain. This Act states that EPA shall promulgate "public health and safety standards for protection of the public from releases from radioactive materials stored or disposed of in the Yucca Mountain repository" [§ 801(a)(1) of the Energy Policy Act]. The Act further states that EPA's standards "shall be the only such standards applicable to the Yucca Mountain site."

Prior to the enactment of the Energy Policy Act, EPA developed generic radioactive waste disposal regulations that applied to all radioactive waste disposal sites, including Yucca Mountain, which was currently under consideration as the Nation's first geologic repository for commercial nuclear waste. These regulations are found at 40 CFR Part 191 (50 FR 38066, September 19, 1985). These generic disposal regulations were applied to the Waste Isolation Pilot Plant (WIPP) in New Mexico, which EPA certified in 1998, and is currently operating as the Nation's first geologic disposal facility for transuranic radioactive waste produced as a result of our Nation's defense programs.

In 1987, EPA's generic disposal regulations were remanded by the U.S. Court of Appeals for the First Circuit [NRDC v. EPA, 824 F 2d 1258 (1st Cir. 1987)], because, among other things, we had not properly considered ground water protection. Also in 1987, the Nuclear Waste Policy Act was amended (NWPAA, Pub. L. 100-203), selecting Yucca Mountain as the sole site to be characterized for high-level radioactive waste and spent nuclear fuel disposal. Then, in 1992, the WIPP Land Withdrawal Act (WIPP LWA, Pub L. 102-579) was enacted, which directed EPA to finalize the generic disposal regulations at 40 CFR Part 191 and certify whether WIPP was a suitable site for transuranic waste disposal. The WIPP Land Withdrawal Act also exempted Yucca Mountain from the 40 CFR Part 191 generic radioactive disposal standards.

So, in 1992, with the enactment of the Energy Policy Act, EPA was directed by Congress to set site-specific environmental protection standards for Yucca Mountain. In doing so, EPA was to consider technical recommendations from the National Academy of Sciences (NAS). The NAS issued its Yucca Mountain report in 1995. Between 1995 and 1999, when EPA issued our proposed environmental protection standards for Yucca Mountain, we held technical discussions with the NAS, as well as numerous interagency discussions with DOE, the Nuclear Regulatory Commission (NRC), the Office of Management and Budget, the Office of Science and Technology Policy, and other federal agencies to discuss important technical and policy issues associated with the development of the standards.

STANDARDS DEVELOPMENT PROCESS

EPA published its proposed standards in the Federal Register on August 27, 1999 (64 FR 46976). We are working on developing the final rule, and we anticipate promulgating the final rule this Summer. We received extensive comments from DOE and NRC, as well as other government entities, NAS, industrial and environmental advocacy groups,Tribal organizations, scientific associations, and members of the general public. We received approximately 800 public comments from 70 groups or individuals which we will be responding to in writing at the time we issue our final standards.

We have made every effort to consider all sides of the issues that have come to our attention. This includes meetings with interested parties and discussions within the Administration. A significant amount of this time has been spent addressing scientific issues in coordination with NAS, the Office of Science and Technology Policy, DOE and NRC. EPA has worked diligently with these organizations to resolve the many complex issues. We are currently in the final stages of drafting the final rule and supporting documents for our internal Agency review process. These documents include the preamble and rule, extensive technical background information document, economic impact analysis, and detailed response to comments document. Once these documents have been reviewed within EPA, we will begin the inter-agency review process administered by the Office of Management and Budget, in which DOE and NRC will participate.

We are taking the necessary time to ensure that we prepare standards that are technically sound, legally defensible, can be implemented reasonably, and are protective of public health and safety from potential releases from Yucca Mountain. During the public comment period, and thereafter, EPA staff traveled to local communities to hold public hearings and meetings to discuss the standards, EPA's role with respect to the other agencies' roles, and to answer general questions about the Agency's process for setting the standards. These meetings were held with community and Tribal leaders, as well as with state and county representatives.

NATIONAL ACADEMY OF SCIENCE'S RECOMMENDATIONS AND COMMENTS

The Energy Policy Act required us to contract with the NAS to conduct a study to provide findings and recommendations on reasonable standards for protection of the public health and safety. On August 1, 1995, the NAS released its report ("the NAS Report"), titled *Technical Bases for Yucca Mountain Standards.* Since 1995, EPA has thoroughly studied the NAS report and the public comments received on the report in order to propose the standards for Yucca Mountain. The EPA's proposed Yucca Mountain standards are based on and consistent with the recommendations of the NAS. Where our proposed rule departed from a strict reading of the NAS report, we made a special effort to explain our reasoning.

The development of the proposed rule for Yucca Mountain was guided by the findings and recommendations of the NAS because of the special role Congress gave the NAS and because of the NAS's scientific expertise. We worked very hard to incorporate NAS's comments into our proposed rule; and, in some cases we have used NAS's recommendations to inform our policy decisions. In its comments on our proposed standards for Yucca Mountain, the NAS is supportive of many aspects of our proposed rule and provides recommendations for improvement in areas where we disagree.

IMPORTANT ASPECTS OF EPA'S ENVIRONMENTAL PROTECTION STANDARDS

The three main elements proposed in our proposed standards are the individual-protection standard, the ground water protection standard, and the human intrusion standard. Each standard must be met for DOE to be in compliance with our rule. Provided below are some of the issues on which NAS and others had important comments.

The individual-protection standard focuses on exposures to an individual whose lifestyle is similar to people living today in the Yucca Mountain region, and who obtains drinking water and food from local sources. The ground water protection standard protects important natural resources by focusing on the quality of the aquifer supplying water to downgradient communities. The human intrusion standard focuses on evaluating the ability of the repository to withstand a single intrusion event.

Individual Protection

In its proposal, EPA adopted an annual dose of 15 millirem from all exposure pathways as protective. This is equivalent to the NAS-recommended annual risk range of 1×10^{-6} to 1×10^{-5}, which translates to a dose range of 2 to 20 millirem/year. The annual risk associated with EPA's proposed 15 millirem standard and 4 millirem standard for ground water fall within this range. In its comments on the proposed rule, NAS determined that the individual protection standard proposed by EPA fell within the range of values it suggested. In those comments, the NAS stated that, "EPA appears to recognize that its standard must be written in a way that provides appropriate protection to the individuals who have the highest potential for exposure . . . while avoiding unrealistic and unnecessarily conservative assumptions for individual exposure."

Human Intrusion

In our proposed rule, EPA followed the NAS recommendations on human intrusion. We did this by including a scenario for inadvertent human intrusion that is analyzed using similar methods as the undisturbed case (i.e., without intrusion). We were prescriptive in specifying the intrusion event in order to make implementation a more reasonable process for DOE and NRC.

Regulatory Time Frame

We proposed that DOE meet numerical standards for 10,000 years after repository closure. The 10,000-year limitation was set to reduce speculation about the application of a regulation beyond 10,000 years and to be consistent with previous regulation of the WIPP geologic repository. In its report, NAS recommended that the period of compliance should extend to a time when the potential peak risks may

occur (this could be several tens of thousands years for Yucca Mountain). NAS determined that there is likely little difference between its recommendation and EPA's proposed standard because although EPA's standard applies for only 10,000 years, EPA also proposed to require DOE to consider the performance of the disposal system at the time of peak dose, whenever that occurs, as part of the environmental review process.

GROUND WATER PROTECTION

The NAS report concluded that an individual protection standard is sufficient for the protection of public health from radiation releases from the Yucca Mountain repository. The NAS did, however, state that, under the Energy Policy Act, EPA has the authority to set a separate ground water standard as a matter of policy. EPA has proposed the ground water standard as an implementation of policy which we plan to articulate more clearly in the final rule.

Ground Water Protection

Ground water is one of our Nation's most precious resources; more than 50 percent of the U.S. population draws on ground water for its potable water supply. If radionuclides migrate into this valuable resource, there are multiple routes of exposure. In addition to serving as a source of drinking water, ground water may be used for irrigation, stock watering, food preparation, showering, and various industrial processes. Ground water contamination is also of concern to us because of potential adverse impacts upon ecosystems, particularly sensitive or endangered ecosystems. For these reasons, we believe it is a resource that needs special protection. Therefore, we proposed a level of protection of ground water at Yucca Mountain at the same level as the maximum contaminant levels (MCLs) for radionuclides that we established previously under the authority of the Safe Drinking Water Act (SDWA).

As you know, EPA has a long-standing policy of emphasizing the protection of ground water resources in other contexts from all sources of pollution. We developed a formal Agency strategy in 1990. Key elements of our ground water protection and cleanup strategy in other contexts are the overall goals of preventing adverse effects on human health and the environment and protecting the environmental integrity of the Nation's ground water resources. Ground water should be protected to ensure that the Nation's currently used and reasonably expected drinking water supplies do not present adverse health risks and are preserved to present and future generations. It should also be protected to ensure that ground water does not interfere with the attainment of surface-water-quality standards that are necessary to protect the integrity of associated ecosystems.

The pollution prevention approach to protecting ground water resources avoids requiring present or future communities to implement expensive cleanup or treatment procedures. This approach also protects individual ground water users. Moreover, absent the protections in our proposed rule, EPA believes the ground water in aquifers around the repository itself could be subject to expensive cleanup by future generations if releases from the repository contaminate the surrounding ground waters at levels that exceed the drinking water standards. A guiding philosophy in radioactive waste management, as well as waste disposal in general, has been to avoid polluting resources that reasonably could be used in the future rather than imposing cleanup burden on future generations.

Virtually every state has taken steps toward comprehensive ground water protection. Forty-nine states have developed programs to protect current ground water sources of drinking water through the Wellhead Protection Program. Forty-one states have numeric or narrative ground water standards to protect their ground water supplies. As EPA has said in testimony to this Subcommittee before, the people of Nevada should not be exposed to higher risks than the people in any other state in the U.S. EPA believes that ground water in a region growing as rapidly as the Las Vegas metropolitan area should be protected from pollution "up front," rather than becoming polluted, and then forcing the residents to bear the cost of the environmental cleanup afterwards.

An important question that has been raised by some commenters is the need for the separate ground water protection standard, in addition to the all pathways individual protection standard. Our proposed rule contains two standards for disposal of spent fuel and high-level radioactive waste in the Yucca Mountain repository: a 15 millirem all-pathways individual protection standard, and a 4 millirem ground water protection standard. It is critical to understand the relationship between these two separate, but complementary, standards. We proposed an all-pathways individual protection standard and a separate ground water protection standard because it was our view that it was appropriate to do so in order to comply with our

statutory mandate to promulgate "public health and safety standards for protection of the public from releases from radioactive materials stored or disposed of" in the Yucca Mountain repository [§ 801(a)(1) of the Energy Policy Act].

The 15 millirem standard is an all-pathways standard that directly protects individuals who may receive exposure (through any pathway) from radionuclides released from the repository. The 15 millirem all pathways standard is the same standard that we included previously in our generic standards for geologic repositories (40 CFR Part 191). Should any pathways including a ground water pathway prove to be significant, the all-pathways standard serves to limit radiation exposures to affected individuals. However, should the ground water pathway be the most significant source of exposure, then an all pathways standard would allow groundwater concentrations that exceed 4 millirem/year.

The 4 millirem standard is the MCL, promulgated pursuant to the Safe Drinking Water Act, and is used to define the allowable level in drinking water. If ground water that is or could be used for drinking water, among other uses, is a significant pathway, present and future users of the ground water resource would be protected at the level of the current drinking water standard by a ground water standard. By extension, a ground water standard would provide this protection (albeit indirectly) to the individuals who now live, or who may live in the future, in the vicinity of Yucca Mountain. In its report on the technical bases for Yucca Mountain standards, NAS identified ground water as the pathway likely to lead to the greatest exposure of the public and the environment to releases from the Yucca Mountain repository.

With respect to radioactive waste disposal, we believe the fundamental principle of inter-generational equity is important. We should not knowingly impose burdens on future generations that we ourselves are not willing to assume. Disposal technologies and regulatory requirements are developed with the aim of preventing pollution from disposal operations, rather than assuming that cleanup in the future is an unavoidable cost of disposal operations today. Designing a disposal system, and imposing performance requirements that avoid polluting resources that reasonably could be used in the future, therefore is a more appropriate choice than imposing cleanup burdens on future generations. The approach to ground water protection in our proposed regulation is consistent with our overall approach to ground water protection: it limits the contamination of current and potential sources of drinking water in the vicinity of Yucca Mountain.

In designing our proposed ground water protection standard, EPA offered as much flexibility as possible, while still ensuring adequate environmental protection. For example, to facilitate implementation of the standard, we proposed the concept of a "representative volume" of ground water in which DOE and NRC would project the concentration of radionuclides released from Yucca Mountain for comparison against the MCLs. In addition, we proposed the concept of a "point of compliance" whereby EPA would establish the area where the concentration of radionuclides would be measured. Our proposed standards offered several options and explained the rationale for each in detail.

Our proposed standard requires that DOE provide a reasonable expectation that, for 10,000 years of undisturbed performance after disposal, releases of radionuclides from the disposal system will not cause the level of radioactivity from combined beta and photon emitting radionuclides in the representative volume at the point of compliance to exceed 4 millirem per year to the whole body or to any organ. Put simply, under our proposal, DOE must provide a reasonable expectation that the Yucca Mountain disposal system will meet the same levels as the current MCLs for radionuclides under the Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26). We frequently require compliance with the MCLs in our regulations.

When we developed the current MCLs in 1975, we based them on the best scientific knowledge regarding the relationship between radiation exposure and risk that existed at that time. In the near future, we intend to update the existing MCLs based on a number of factors, including the current understanding of the risk of developing a fatal cancer from exposure to radiation; pertinent risk management factors (such as information about treatment technologies and analytical methods); and applicable statutory requirements. Particularly relevant statutory requirements, in this context, are the requirements (1) that MCLs be set as close as feasible to the Maximum Contaminant Level Goal (MCLG) [42 U.S.C. § 300g-1(b)(4)(B)] and (2) that revised drinking water regulations provide for equivalent or greater human health protection than the regulations they replace [42 U.S.C. § 300g-1(b)(9)].

Our preliminary analysis of the current MCLs, which are being revised under a separate Agency rulemaking, indicates that, when updated for the latest scientific understanding, the radionuclide concentrations to meet the current MCLs mostly fall within the Agency's range of acceptable risks of 10^{-4} to 10^{-6}. This means that there will be no more than one in 10,000 to one in 1,000,000 chance of excess cancer

deaths. This is not unique to Yucca Mountain, as it is the risk range that has governed the Nation's drinking water regulations for the last 25 years. Based on the statutory requirements and the factors identified above, we proposed allowable concentrations for the radionuclides of concern at Yucca Mountain at levels that are comparable to current standards.

EFFECTS OF OUR RULE ON THE REPOSITORY'S COSTS AND DOE'S SCHEDULE

An EPA draft study (which will be available when the final rule is issued) indicates that EPA's proposed standards will not have a significant impact on the cost of the repository. We support DOE's efforts to design the repository in such a way as to prevent or to the extent possible limit any releases from the repository in order to avoid passing on the costs of clean up to future generations. We understand that DOE still has to undergo the NRC licensing process; however, to date, DOE's ongoing studies show compliance with the proposed ground water standard, although EPA is still considering options and alternatives for the final rule.

As our economic impact analysis for our final standards will illustrate, DOE's costs for the facility are driven by many external influences, including EPA's proposed standards, the recommendations of the Nuclear Waste Technical Review Board and the rigorous NRC licensing process, all striving to enhance repository safety. A primary concern relates to minimizing the technical uncertainties of modeling and enhancing repository performance through certain engineered enhancements to the repository design (e.g., an improved canister, drip shields).

CONCLUSION

Thank you again for inviting me to testify before the Subcommittee today. I would be happy to answer any questions that you may have.

Mr. BARTON. Thank you, Mr. Page.

We now would like to hear from Dr. Crowley. Your statement is in the record in its entirety and you are recognized for 7 minutes.

STATEMENT OF KEVIN D. CROWLEY

Mr. CROWLEY. Thank you very much, Mr. Chairman. Thanks for the invitation to testify.

For the record, my name is Kevin Crowley. I am the director of the National Research Council's Board on Radioactive Waste Management.

BRWM was established by the National Academy of Sciences in 1958 to provide scientific and technical advice to the Federal Government on the safe and responsible management of radioactive waste. The BRWM recognizes the importance of the Yucca Mountain radiation protection standards and has been interacting in a cooperative spirit with EPA and the other Federal agencies at this table to help ensure that these standards are based on sound science.

As Mr. Page mentioned in his statement, the Energy Policy Act of 1992 directed the EPA administrator to obtain advice from the NAS on the technical basis for Yucca Mountain standards. The NAS's advice to EPA was provided in the 1995 National Research Council report entitled "Technical Basis for Yucca Mountain Standards." That is this report which I will refer to as the TYMS report in the remainder of my testimony.

After EPA issued its draft standards in August 1999, the BRWM wrote another report to the EPA administrator that compared those standards with the recommendations in the TYMS report. The purpose of the comparison was to determine whether EPA followed the recommendations in the TYMS report and if not to suggest how EPA could modify its draft standards to make them consistent.

The 1999 BRWM report concluded that EPA's draft standards were consistent with the TYMS report in several important respects, and I have reviewed those in my full written testimony. The BRWM also identified several points of disagreement, and I would like to focus the remainder of my oral testimony on those three points.

The first significant point of disagreement concerns the form of the standard. EPA proposes a standard that is based on the dose that an individual may receive from repository releases. The TYMS report specifically recommended against basing the standard on dose, but instead recommended the establishment of what it calls a risk-based standard. A risk-based standard, a standard that is based on the likelihood of a health effect; in this case, the likelihood of contracting a fatal cancer from radiation releases from the repository.

The TYMS report noted that the question, what is an acceptable risk, is a societal judgment to be established through the rulemaking process. Once a risk level is established, then a dose value can be derived using existing scientific knowledge.

The adoption of a risk-based standard as recommended by the TYMS report would have several benefits, and I would like to list those. First, there would be clear traceability between the numerical value of that standard and the public policy decision on what is an acceptable risk.

Second, the standard would be more readily understood by nonexperts, which could help promote more meaningful public input to rulemaking and greater public confidence in the final standards and recommendations for Yucca Mountain.

Third, this approach would promote consistency between the Yucca Mountain standards and regulation for other hazards such as toxic chemicals. And fourth, a risk-based standard would not have to be revised by subsequent rulemaking as advances in scientific knowledge improve our understanding of radiation effects on human health.

The second point of disagreement concerns EPA's inclusion of a groundwater standard in addition to an all-pathway standard. The all-pathway standard, of course, also applies to groundwater. The TYMS report recognized that groundwater is likely to be the primary source of individual exposure to any radioactive materials that escape from Yucca Mountain. And the report found that an adequate set-all-pathways standard could protect both individuals living near the repository and populations distant from the repository, including those populations that would use the groundwater.

Therefore, the report did not recommend a separate groundwater standard. The 1999 BRWM report concluded that the imposition of a separate groundwater standard may greatly complicate the licensing process for Yucca Mountain and have a negative impact on the protection of the public. I have provided more extensive comments on this in my written testimony. I hope we have a chance during the Q and A session to talk about the groundwater standard in a little more detail.

The third and last point of disagreement concerns the time period over which the standard should be applied. The main concern identified in the BRWM report is an EPA requirement that reposi-

tory performance be examined beyond 10,000 years to see if dramatic changes could be anticipated.

EPA provides no guidance as to what qualifies as a "dramatic change," nor does it state the purpose of this examination. The BRWM report notes that this aspect of the standard will provide no real benefit to protection of the public.

Yucca Mountain repository must isolate waste from the environment for many millennia. It is essential that the standard for this repository be scientifically sound. The overall conclusion of the 1999 BRWM report is that the current EPA draft standards fall short of this goal in some important respects. The BRWM hopes that EPA will accept the suggestions it has made for improvements in the proposed standards. That concludes my oral remarks. Again, thank you very much for the opportunity to testify.

[The prepared statement of Kevin D. Crowley follows:]

PREPARED STATEMENT OF KEVIN D. CROWLEY, DIRECTOR, BOARD ON RADIOACTIVE WASTE MANAGEMENT, NATIONAL RESEARCH COUNCIL

Chairman Barton and subcommittee members, thank you for the opportunity to appear before the Energy and Power Subcommittee to testify on the Environmental Protection Agency's (EPA's) draft radiation protection standards for Yucca Mountain. I am the director of the National Research Council's Board on Radioactive Waste Management (BRWM), which was established by the National Academy of Sciences (NAS) in 1958 to provide scientific and technical advice to the federal government on the safe and responsible management of radioactive waste. My testimony to the subcommittee today will focus on recent reports from the BRWM and committees under its oversight that bear directly on the question of radiation protection standards for Yucca Mountain. In particular, I will discuss the findings and recommendations from two reports: *Technical Bases for Yucca Mountain Standards,* also known as the "TYMS report," which was published in 1995, and a 1999 BRWM report entitled *Comments on Proposed Radiation Protection Standards for Yucca Mountain, Nevada by the Board on Radioactive Waste Management.*

As you know Mr. Chairman, the Energy Policy Act of 1992 directed EPA to promulgate radiation protection standards specifically for a potential repository at Yucca Mountain, Nevada. The Act directed the EPA Administrator to obtain advice from the NAS on the technical bases for radiation protection standards, and the Act further mandated that EPA base its standards on the NAS recommendations.

To respond to this request, the National Research Council, the operating arm of the NAS and National Academy of Engineering, appointed a BRWM committee in early 1993 to provide advice to EPA on the standards. The committee held a series of information-gathering and deliberation meetings (many in Nevada) over a period of about two years and issued its recommendations in the 1995 TYMS report.

In developing its recommendations, the TYMS committee was very careful to distinguish between scientific and policy judgments. The committee recognized that some elements of the standards could be addressed using scientific data and understanding, whereas other elements required societal value judgements. For example, the committee recognized that there is no basis in science for establishing acceptable radiation exposure limits but, rather, "acceptability" was a societal value judgement that was best established through the rulemaking process. Similarly, the TYMS committee noted that the time period of applicability of the standards has both scientific and policy aspects.

EPA published its draft radiation protection standards in the Federal Register (64 FR 46976-47016) on August 27, 1999. The BRWM, acting under its own initiative and with approval of the National Research Council's governing board, decided to issue a report that compared the draft EPA standards with the recommendations in the TYMS report. The purpose of this comparison was to determine whether EPA followed the recommendations laid out in the TYMS report and, if not, to suggest how EPA could modify its draft standards to make them consistent. The BRWM's report was submitted to the public docket during the comment period for EPA's draft standards. This report reflected the consensus of the BRWM and was approved for release by the National Research Council after being subjected to the Research Council's review process.

The BRWM found that EPA's draft standards were consistent with the 1995 TYMS report in several important aspects, the most significant of which are the following:

- **Who is Protected.** The TYMS report recommended that the radiation protection standard be applied to representative individuals who have the highest risk from radiation releases from the repository. EPA proposed a standard to protect individuals living near the repository—using a *reasonably maximally exposed individual* (RMEI)—that is broadly consistent with the TYMS report's recommendation.
- **Level of Protection.** The TYMS report concluded that the numerical value for the radiation protection standard was a policy decision to be established through the rulemaking process. EPA has used rulemaking to establish an "all-pathways" standard. This standard sets an upper limit on the exposure the RMEI can receive from radiation releases through all potential release pathways, including groundwater and the atmosphere. The numerical value of this standard proposed by EPA falls within the range of values suggested in the TYMS report.
- **Human Intrusion.** EPA follows the TYMS report's recommendations that the standards should require active and passive institutional controls to prevent human intrusion into the repository in the near term; that the standard should be based on explicitly defined assumptions about how human intrusion could occur in the long term; and that the standard should set limits on radiation exposure to individuals as a result of a human intrusion that are no more stringent than the all-pathways standard.
- **Exposure Scenarios.** The TYMS report concluded that there is no scientific basis for predicting future scenarios by which humans could be exposed to radiation from a Yucca Mountain repository. Therefore, the report recommended that such scenarios be established through the rulemaking process. EPA has used rulemaking to define exposure scenarios based on the state of society, human biology, and knowledge that exists at the time of submission of the license application for the repository.

There are also several elements of EPA's proposed standards that are inconsistent with the recommendations in the TYMS report. My testimony will focus on the three most important elements:

- risk- versus dose-based standards;
- the inclusion of a separate groundwater standard; and
- the time period over which the standard should be applied.

Risk- Versus Dose-Based Standards

EPA proposes a standard that is based on the dose an individual may receive as a result of radioactive releases from the repository. The TYMS report specifically recommended against basing the standard on dose. Instead, the report recommended that the standard be based on the risk to individuals of an adverse health effect from radiation releases, and the report further recommended that rulemaking be used to establish an acceptable risk level.

The TYMS committee recommended a risk-based standard for several reasons. First, the committee recognized that a risk-based standard is more understandable to the public than a dose-based standard and its use would therefore promote more meaningful public involvement in what truly is a public-policy decision. A risk-based standard can be expressed as a simple probability of developing a fatal cancer—for example, a standard that has a numerical annual risk value of 10^{-4} would mean that an individual living near the repository could have no greater than a 1 in 10,000 chance per year of developing a fatal cancer from radiation releases from the repository. A dose-based standard, in contrast, provides no indication of hazard levels and is understandable only by experts. The proposed EPA all-pathways dose standard of 15 millirems per year, for example, provides no indication of the number of fatal cancers that could be expected in a given year from repository releases.

Second, a risk-based standard for Yucca Mountain can be compared directly to other risk-based standards, such as EPA's standards for toxic chemicals, because they use common units of measurement. Also, the magnitude of the risk value corresponds directly to the level of hazard. For example, a 10^{-5} (1 chance in 100,000) risk standard for Yucca Mountain would provide the same level of public protection as a 10^{-5} risk standard for regulating a particular toxic material, assuming of course that both standards were based on the same health effect such as fatal cancers. EPA currently regulates hazardous chemicals on the basis of risk, so the adoption of a risk-based radiation protection standard for Yucca Mountain would promote uniformity across EPA's family of regulations.

Third, a risk-based standard would not have to be revised by subsequent rulemaking as advances in scientific knowledge improve our understanding of radiation effects on human health. There have been significant improvements in our understanding of radiation effects on human health over the past few decades, and dose-based standards have had to be adjusted as our knowledge has improved. There is reason to believe that these improvements will continue and that adjustments to dose-based standards will be necessary in the future. For a risk-based standard, the level of acceptable risk would be established during initial rulemaking. This level would not have to be changed if new science indicated a change in the relationship between dose and health effects.

EPA's use of a dose-based standard not only makes it difficult for the public to provide meaningful input to the rulemaking process, but it may also lower public confidence in the output from that process. Take, for example, the disagreement between the EPA and U.S. Nuclear Regulatory Commission (USNRC) over radiological criteria for unrestricted use of nuclear sites. The EPA standard (based on 40 CFR Part 191) is 15 millirems per year, whereas the USNRC regulation (10 CFR 20.1402) is 25 millirems per year with ALARA (as low as reasonably achievable). Both agencies claim that their release limits are protective of public health. What is the public to think when the two federal agencies charged with protecting public health cannot agree on what the protective limits should be? The reason the EPA's and USNRC's limits are different is that each agency has a different starting point for establishing the exposure limit values, and neither agency uses risk to establish such limits.

EPA points out in the preamble to its draft standards that it was directed by the Energy Policy Act to develop a "dose-based standard." The TYMS report's recommendation that the *form* of the individual-protection standard be based on risk does not preclude EPA from expressing the *numeric* value of the standard in units of risk and in derivative units of dose, so long as the risk value is clearly understood as the underlying basis for the proposed dose standard. In its 1999 report, the BRWM noted that such an approach "would achieve the aims of the TYMS report's recommendations and it would allow EPA to meet its Congressional mandate."

To summarize, the use of a risk-based standard in the Yucca Mountain rule would have several benefits:

- there would be clear traceability between the numerical value of the standard and the public policy decision on what is an acceptable risk;
- the standard would be more readily understood by nonexperts, which could help promote more meaningful public input to rulemaking and greater public confidence in the resulting regulations;
- this approach would facilitate uniformity of the standard with regulations for other hazards such as toxic chemicals; and
- if a risk-based approach were implemented for all elements of the Yucca Mountain standard, it would eliminate the current problem with the groundwater element of the standard, which I will discuss next.

The 1999 BRWM report noted that a risk-based standard would be more difficult to implement than a dose-based standard, and that EPA might find it far more difficult to ask the public about acceptable risk levels than to follow established precedents. Nevertheless, a risk-based standard was recommended both in the TYMS report and the 1999 BRWM report because it requires public involvement in what is fundamentally a public-policy decision.

Inclusion of a Separate Groundwater Standard

EPA has included a standard for the protection of groundwater in its proposed rule in addition to the all-pathways standard described previously. The proposed groundwater standard appears to be designed to protect both individuals living near the repository and the general public living at some distance from the repository. The groundwater standard is a holdover from EPA's 1985 disposal regulations (40 CFR Part 191) and is taken directly from the EPA's safe drinking water regulations (40 CFR Part 141).

In incorporating the groundwater standard into the Yucca Mountain standards, EPA has made several modifications from the safe drinking water regulations. First, the groundwater standard in EPA's safe drinking water regulations applies to public water systems. For the Yucca Mountain standards, EPA proposes to apply the groundwater standard to a groundwater aquifer some 2,000 feet below the Earth's surface at the Yucca Mountain site and at some as-yet undetermined distance from the repository boundary—the point of compliance for alternatives being proposed by EPA range from 5 to 30 kilometers (3 to 19 miles) from the repository boundary. The Yucca Mountain standard also applies to a volume of groundwater in the aquifer rather than to water delivered by a public water system—EPA has proposed a

value of 1,285 acre-feet (about 420 million gallons) but has also asked for comments on values that range from 10 to 4,000 acre feet (3 million to 1.3 billion gallons). The numerical value of the standard itself is based on 40-year-old dosimetry and does not conform with current international standards, and it represents a different level of risk than the all-pathways standard of 15 millirems per year.

The TYMS committee recognized that groundwater is likely to be the primary source of individual exposure to radioactive materials that escape from Yucca Mountain, and that committee found that the all-pathways standard would protect both local and distant populations. Therefore, the TYMS committee did not recommend a separate groundwater standard. The 1999 BRWM report concluded that the imposition of a separate groundwater standard "may greatly complicate the licensing process [for Yucca Mountain] and have but a negligible impact on protection of the public."

The 1999 BRWM report concluded that there was no basis in science for establishing a separate groundwater standard and recommended that EPA either "make more cogent scientific arguments to justify the need for this standard," or if it wishes to establish a separate standard as a matter of policy, that it "explicitly state the policy decisions embedded in the proposed standard and ask the public to comment on those decisions." The 1999 BRWM report did not suggest what scientific arguments EPA could use to justify a separate groundwater standard, but I would like to close this part of my testimony by suggesting one possible approach for resolving the BRWM's objections.

I believe that EPA could justify a separate groundwater standard by adopting the risk-based approach recommended in the TYMS report. If EPA based its Yucca Mountain standards on a SINGLE VALUE OF ACCEPTABLE RISK, it could express that risk in terms of two elements, one for radiation exposures through the groundwater pathway (a groundwater standard) and one for exposures through all pathways (an all-pathways standard). These two elements would be scientifically consistent so long as they are based on a single value of acceptable risk. To implement this approach, EPA would have to modify the dose values for the all-pathways and groundwater elements that currently exist in its proposed rule so that they represent the same value of acceptable risk.

Time Period Over Which the Standard Should be Applied

EPA proposes that the radiation protection standards at Yucca Mountain be applied over a time period of 10,000 years. The TYMS report concluded that (1) an arbitrary time limit such as 10,000 years has no scientific basis, and (2) peak risks from radiation releases from the repository are likely to occur beyond 10,000 years. The report recommended compliance be assessed for the site's period of geologic stability and noted that a technical assessment of the site should be feasible for on the order of one million years. After the TYMS report was published, EPA asked for public comment on the timescale issue, and the majority of those commenting stated that compliance should be assessed at the time of peak risk.

EPA has nevertheless retained its earlier recommendation for quantitative compliance assessment only up to 10,000 years and has given a series of policy and technical arguments for this choice. The TYMS report excluded policy considerations from its deliberations on this issue, but concluded, as noted previously, that "there is no scientific basis for limiting the time period to . . . 10,000 years. Clearly, the 10,000-year limit is strictly a policy choice and should be acknowledged as such" by EPA. As the proposed standards currently read, the policy origin of the limit is not evident.

Though compliance is assessed for a period of 10,000 years, EPA requires that the repository performance be examined past this point "to see if dramatic changes . . . could be anticipated" (64 FR, p. 46993). Here EPA provides no guidance as to what qualifies as a dramatic change or as to the purpose of the examination. The BRWM believes that this aspect of the standard will provide "no real benefits to protection of the public." The BRWM noted that EPA "may wish to be more specific in providing guidance on how the analyses beyond 10,000 years could be used in determining compliance" or explicitly pass this task to the USNRC.

In conclusion Mr. Chairman, a Yucca Mountain repository must isolate waste from the environment for many millennia. It is essential that the standard for this repository reflect the best thinking that science has to offer. The overall conclusion of the 1999 BRWM report is that the current EPA draft standards fall short of this goal in some important respects. The BRWM hopes that EPA will accept the suggestions it has made for improvements in the proposed standards.

This concludes my testimony to the committee. I would be happy to clarify my comments or answer committee members' questions. Again, thank you for the opportunity to testify.

Mr. BARTON. Thank you. Let's do 7-minute question rounds, but we will have numerous rounds. The Chair will recognize himself first.

First, let me say that we cannot have a democracy if we do not have debate. So it is good to have this panel here. But I want the record to show, because of what our two Nevadans said, this is not a hearing that is about politics. There is not one member on this dais right now that is going to get any political plus of sitting through 3 hours of technical details about what the radiation standard or the groundwater standard at Yucca Mountain ought to be. The members that will get political support and send out press releases have already been here—the two Nevadans. And they will send out press releases saying they stood up to the Congress and they spoke in no uncertain terms about how it shouldn't be Yucca Mountain, and that is how should be.

But none of us are going to send out press releases about how we sat through 3 hours of some of the most boring information you are ever going to have to listen to because we want what is good public policy, and that is why we are here. That is why this subcommittee is here is because this is an issue that is very important. If you assume that each Member of Congress represents about half a million people you have members that represent 3 million people, or 3 percent of the American population sitting at this hearing. And we are all in this together.

As Congresswoman Berkley said, we are for America, and I happen to think that the United States of America should have a comprehensive nuclear policy that includes a repository, or a depository, where the high level nuclear waste can be safely stored. Now, we are not technical experts; you folks are. So we have got to ask you some questions, and we have got to have this debate. After 18 years, I was a White House Fellow in the Department of Energy in 1981 and 1982, and participated in policy debates at a minor level about what has come to be known the Nuclear Waste Policy Act of 1982. Eighteen years later I am the subcommittee chairman and we are basically having the same debate, although at, admittedly, a higher technical level. So I just want to get that on the record before we get into the questions.

Now, Mr. Page, you represent the Environmental Protection Agency. Are you the decisionmaker on this separate groundwater standard that is currently pending?

Mr. PAGE. No, sir, I am the office director of the Office of Radiation Indoor Air. Carol Browner, my boss, will be taking the recommendation forward to the administration, and that is where that will get resolved.

Mr. BARTON. Who made the decision within the EPA to go to a separate groundwater standard?

Mr. PAGE. That decision was across EPA looking at what we do in the rest of our environmental programs. And it is consistent with that.

Mr. BARTON. Did you have any influence in that decision? My question is, are you a decisionmaker or are you a message-giver?

Mr. PAGE. I participate in the meetings where the decisions are made.

Mr. BARTON. So you are at least high enough in the EPA that you have some influence in the decisions?

Mr. PAGE. Yes, sir. Yes, sir.

Mr. BARTON. That is good. That is not bad.

Now, does EPA have a problem with the concept of an all-pathways standard?

Mr. PAGE. No, sir, we recommend an all-pathways standard.

Mr. BARTON. I know there is a disagreement about the level of all-pathways standard. I think the Nuclear Regulatory Commission recommended 25 millirems and the EPA all-pathways is 15; is that correct?

Mr. PAGE. That is correct. And I would also note that the National Academy of Sciences recommended their range, which is consistent with ours, with EPA's.

Mr. BARTON. So we could have a real good debate between 15 and 25, in the spirit of the congressional give-and-take, we would agree on 20. But that is a different debate. But there appears to be, in the academic community, in the technical community, not too much support for the EPA position that there should be a separate groundwater standard. And if you look in the law, there is no requirement for that. It appears that it is an EPA policy decision that, in addition to protecting public health and safety, the Carol Browner administration has decided to also protect resources. Am I wrong in making that last assumption?

Mr. PAGE. The protection of groundwater policy is the policy of this administration as it was previous administrations. Yes, sir.

Mr. BARTON. But it is not a Federal law? You have got to protect public health. You do not have to necessarily protect resources?

Mr. PAGE. Correct.

Mr. BARTON. But you have decided that it is in the public good to protect resources, and that is a good public policy.

Mr. PAGE. Especially as these resources are being used as sources of drinking water, which these are.

Mr. BARTON. Under the Safe Drinking Water Act, la-dee-da-dee-da, which I think is in the 1970's, the groundwater standard has been implemented, so that it is enforced and measured at the tap; is that not correct? Whatever the standard is, you regulate it and monitor it at the tap where the water comes out and people actually get ready to drink it.

Mr. PAGE. That is true for drinking water.

Mr. BARTON. Now, the standard that is pending, as I understand it, you are setting this 4 millirem not at the tap but at the source; is that not correct?

Mr. PAGE. That is correct.

Mr. BARTON. Okay. Now, is it not technically possible—let's assume because it is a big assumption that we agree that there ought to be a 4 millirem standard for groundwater, wouldn't it be just as defensible to enforce it at the tap as opposed to at the source?

Mr. PAGE. We believe——

Mr. BARTON. I am not real interested in what you believe right now. I am interested though in whether, if we agreed with the 4 millirem that we could enforce it, you know, where the people are actually getting ready to drink it as opposed to wherever it might emigrate from?

Mr. PAGE. Mr. Chairman, EPA and many, many states use the 4 millirem to protect future or current sources of drinking water. It is true what you are saying that you can regulate that at the tap. That is the bottom line, if you will. But prevention in this case very often, especially in the case of Yucca Mountain, if you can develop designs that are reasonable and can prevent the initial pollution of the resource——

Mr. BARTON. But that is not a technical necessity nor is it a Federal law.

Mr. PAGE. That is a policy call, sir.

Mr. BARTON. That is an EPA policy call. Does anybody else in the Clinton administration, other than EPA, support that policy call? Does the Department of Energy? Does the Nuclear Regulatory Commission? Does the Department of Agriculture? Does the Department of Defense? Do any of them support that EPA policy call?

Mr. PAGE. I guess I haven't polled all of those agencies that you named. I can tell you that many, many States who carry out——

Mr. BARTON. I did not ask you about the States, I asked you about within the Clinton administration, because we have—I shouldn't admit this, but that was kind of a set-up question because we can put into the record that all of those agencies, I think all of those agencies do not support that.

Mr. PAGE. I can tell you that, from the Department of Energy and from the Nuclear Regulatory Commission and others who comment on the Yucca proposal, they expressed their concerns with that policy. And that is what we have up ahead of us.

Mr. BARTON. I think they opposed it, other than expressed concerns with it, but that is, again, semantics. The Chair would recognize Mr. Boucher for 7 minutes.

Mr. BOUCHER. Thank you very much, Mr. Chairman. I want to commend our witnesses this morning for informing us about these technical and policy matters. I agree with the chairman that this is where we earn our salary. There is not a lot of political benefit in listening to this, but it is extraordinarily important information, nonetheless.

In the rank of importance, I think the budget is fairly far up the scale. Dr. Itkin, I would like to engage in a discussion with you about that.

In 1982, in the Nuclear Waste Policy Act, we established the Nuclear Waste Fund. It is comprised of a fee of 1 mill per kilowatt, which the utilities are required to pay into the fund. They pass that charge along to their ratepayers. And in the years that this fund has been in existence, that 1 mill per kilowatt has accumulated $10 billion in principal for the fund. That $10 billion in principal has accrued $4 billion in interest. So $14 billion in potentially expendable funds have been made available through the Nuclear Waste Policy Fund. But of that $14 billion, Congress has appropriated to the DOE only $5 billion for your various activities.

The balance of that fund remains subject to appropriations, and in the current state of play under the current law, you would only have access to the balance of it through the grace of the appropriation process in the Congress.

Now, if you look at that appropriations process, starting in 1996, the administration's requests have not been met by the congres-

sional appropriations. In fact, in the year 1996, the administration's request was $630 million. Congress provided exactly half of that amount, $315 million. And in each succeeding year since 1996, Congress has appropriated less than the administration has requested for your activities to prepare Yucca Mountain.

And it appears that the trend is continuing even today. We are prepared to bring the energy and water appropriations bill to the floor of the House next week, and that bill, once again, falls short of the administration's request.

I think Congress has a clear responsibility to meet our need to keep this program on track, and I really question whether this appropriations history complies with that responsibility. I would welcome your comments concerning the general subject.

Let me just phrase a precise question to you. The Department of Energy historically has made projections of the extent to which it will be able to continue its work in a timely fashion, given the appropriations that you receive. And you make several assumptions as you make projections of your ability to perform. One of those assumptions is that the continual trend of appropriations will be pursued, that it will continue and that you will get roughly the same level of appropriations that you have.

The other assumption that you have made for purposes of the projection is that the balance of the Nuclear Waste Fund will not be made available to you. That legislation, such as H.R. 45, will not be enacted into law, and that you would continue to have to get annual appropriations.

Now, given those assumption, and given the appropriations history that we have seen, and given the level of appropriations that you might reasonably be able to expect for fiscal year 2001, at what point in time would you anticipate that the Department of Energy is going to fall behind its schedule for the activities that are necessary to finish the design and construction of Yucca Mountain, to load Yucca Mountain, and then to engage in the sealing of the repository under the schedule that you currently have? At what point in time do you think if these trends continue that you are going to fall behind schedule?

Mr. ITKIN. Thank you very much, Congressman, I am very pleased to address the subject. It is a very important one for our agency, and you have correctly characterized the lack of funding to the office in order to carry out its mission of characterizing the Yucca Mountain site.

In the short term, we are somewhat gratified by at least the initial reaction of Congress toward our appropriation. I would like to preface that by saying that before we went to the Congress, my office went to the department and to the administration asking for a budget proposal that was 25 percent higher than what we had gotten traditionally. Our current budget this year is $351 million. We asked the administration for $437.5 million. We made our case and the administration did, in fact, recommend to the Congress the full $437.5 million.

What that level would do would be allow us to continue and to finish the site suitability studies, the scientific work necessary for a Presidential decision, and would allow us to catch up and to prevent any further delay in the next process if there is a positive rec-

ommendation. And that is in the licensing stage. So in order to ensure that we do not fall behind further, we need the full $437.5 million.

The House Energy and Water Development Appropriations Subcommittee did give us a mark which is far higher than the House has ever done before of $413 million. I think that they were under a misimpression that at $413 million, it would fully fund our program. It will fully fund making a decision next July. In other words, we will have the resources necessary to do the scientific work to inform the Secretary, and if he so chooses, to inform the President. And we think that is very, very important.

But it will not allow us to catch back up to the deferred work that we have had to do because of these cuts with licensing application.

So if I have an opportunity to get on my soap box, I am asking Congress for the full $437.5 million. And I am hoping that the other body will, in fact, provide with us a higher appropriation and hopefully get this thing resolved in conference.

Mr. BOUCHER. But you are concerned that if you do not get the full appropriation, that fact will result in delay; is that correct?

Mr. ITKIN. Yes, if we get the $413 million, we will make our fiscal year 2001 milestone, but we will probably have to defer perhaps some months, maybe a year, getting our license application submitted and approved. Which I think from many Members of Congress, it is not these interim points that are important, it is a desire by at least 2010 for us to accept the waste. And I am trying to keep that schedule, and I will—if I get the 437.5, we will be able to do the Presidential recommendation and also provide the necessary makeup work that is required so that we can get a license application on time.

Mr. BOUCHER. Mr. Chairman, if you will indulge me just for one additional question.

Mr. BARTON. Sure.

Mr. BOUCHER. My really deep concern is that as we approach the time and perhaps the year 2003 when construction of the facility is scheduled to begin, and your costs are going to escalate dramatically, that we are going to really find a crunch, and you are going to have difficulty moving forward at that time, unless you get access to the full fund. Is that a realistic concern or are you less concerned for some reason?

Mr. ITKIN. Congressman, it is a real concern that we have to adjust the outyear funding. We are trying to moderate some of our needs. I have taken the initiative of trying to develop a modular procedure in the construction activities that would tend to smooth out the cost so it wouldn't be such a burden or spike in certain years. But even doing that, we will need to work together, the administration and the Congress, to come out with a new funding mechanism to deal with this problem, because we will probably need, at the minimum, two to three times our current funding levels.

And having said that, it becomes—you mentioned about having full access to the fund. You know as well as I, there is approximately $10 billion, $9-, $10 billion sitting there, and that it is being

used both by the Congress and the administration to take care of other matters, to so-call balance the budget.

Mr. BARTON. I am sure you are aware that the House-passed bill freed the waste depository fund. You are aware of that?

Mr. ITKIN. I appreciate the House doing that. The law of the Congress requires both Chambers to act in unison. That did not occur. I am a legislator, at least a State legislator for 26 years. I understand how the legislative process works.

But having said that, I want to work with you, the committee and the subcommittee, and the Congress in general because we do have to solve this problem.

Mr. BARTON. Next year, assuming that we are here and that you are there, and we are doing this as an early hearing before we move another waste depository bill, will the administration, if you are still a part of it, put a proposal on the table that addresses the issue that my good friend from Virginia has put on the table? In other words, we never saw a Clinton administration proposal this year that solves the funding problem. We got a lot of reports about all the problems they saw with our way to solve it. But thankfully, Mr. Dingell, Mr. Boucher and Mr. Hall worked with Mr. Bliley and myself, and we went ahead and went to the Budget Committee and the Appropriations Committee and the Speaker of the House, and our bill solved that problem.

So can we expect to see reciprocal problem solution to this funding issue next year if you are still in charge?

Mr. ITKIN. Mr. Chairman, we are working on that problem. We recognize for our own future well-being in carrying out our mission as directed by the Congress, that we will have to resolve this. I cannot speak for the next administration in terms of what they——

Mr. BARTON. I said if you are still where you are. I am not tying your hands to the future administration. But my guess is that you are going to be here next year, even if there is a change in political calculus at the White House because it takes a while for those transitions to occur.

Mr. ITKIN. Well, I will go on record saying it needs to be changed and I want to be part of that solution.

Mr. BARTON. That is mighty big of you.

Mr. BOUCHER. Mr. Chairman, thank you for your indulgence and I yield back.

Mr. BARTON. In order of appearance, we are going to go with Mr. Shimkus unless there is another member that has a pending—Mr. Shimkus for 7 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman. I am shocked that the ranking member started at 1996, and I did not have any of the numbers from 82 to 95 to be able to evaluate the budgetary aspects of the whole program. But I would like to join my colleague on the mandatory process of the appropriation bills. And if we can find a way to rob Peter to pay Paul to make folks better served, understanding budgetary constraints, and look for waste fraud and abuse in other areas of the Federal Government, then I would be happy to join with him to address those issues.

First of all, I want to ask a question to all of you at table. Do any of you have any black helicopters? Do you know in your agencies is there any black helicopters? No? Any of the roofs painted

blue, do you know, on any of the buildings? Because of the different agencies involved, and there was a statement I think by Dr. Crowley that you are working in a cooperative spirit. Does that mean that you are in collusion with each other to try to deceive the public and rain bad science and ill-gotten gains from those who are participating, destroying the health and the welfare of the citizens of this great country? No?

For the record, everybody is shaking their head "no" for all of these questions. And for all of those conspiracy theorists out there, I am glad to say that you are on record saying that there is no great conspiracy to game the system for whatever organization—nefarious organization that may be out there, and that you are all working diligently trying to move public policy in a direction that will, in the end, protect the safety, health and welfare of all the citizens in this Nation.

Can I make that assumption to you all? Is that correct? And for the record, everybody is shaking their head "yes," and I appreciate that.

That is kind of in response to my colleagues who made some implications based upon past practices and current practices that—may be current practices. And I think that the fact that we have in this debate and the fact that there is disagreement and that we have outside people being brought in to review the technical aspects, is a good response to my colleagues who may not believe that we are attempting to move public policy in a scientific manner, and that is probably why it has taken us so long to get through this process to begin with.

I have been told and I tried to confirm this during some of the testimony, that if you work in the Library of Congress for a year you are subject to 700 millirems in that year. If you work in this building for a year, probably 300 millirems. Does—because of the millirem standard the EPA is proposing for groundwater, wouldn't you think it would be in the EPA's best interest to call for the immediate vacation of all the Federal buildings in Washington, Mr. Page, based upon those standards?

Mr. PAGE. No, sir, I don't think EPA would agree with that.

Mr. SHIMKUS. Maybe your building we might agree. No, I am just joking. But the—I think that is really the debate, especially on this issue of groundwater; and I don't have all the terminologies correct, but the other type of water evaluations and——

Mr. CROWLEY. All-pathway standards.

Mr. SHIMKUS. Obviously, that is an area of debate and a difference.

And, Dr. Crowley, can you talk to me about—and I think it was the National Academy of Sciences that said the groundwater issue raised by the EPA, there is no basis in science. Can you elaborate on that?

Mr. CROWLEY. Thank you for asking that question. I can.

The issue of a groundwater standard, conceptually, it is really very difficult to understand, even for experts. So I took the liberty of scratching down some notes here so that I was very careful in how I answered the question. What I am going to do is, I am going to give you a short answer. Then I will give you a slightly longer rationale for it.

The short answer, the reason that the groundwater standard is not based in science is that if you adequately protect people with an all-pathway standard you protect groundwater as a resource. In other words, you do not need a separate groundwater standard. Let me explain why that is true.

Firstly, you should understand that when the National Academy undertook its work, the committee that was charged with that, the TYMS Committee,was actually charged with asking—it was asked to recommend standards to protect people, not groundwater. The TYMS Committee concluded that an all-pathways standard would protect people if it was set at an adequate level and that an additional groundwater standard was not needed. The committee reasoned if you protect the people with an all-pathway standard then at each leg of the pathway, the groundwater leg of the all-pathway standard, the atmospheric leg of the all-pathway standard would be protective.

The phrase groundwater is a resource as EPA uses it in the standard. I personally interpret that to mean groundwater for future human use. As a resource, we are going to use it either now or in the future. EPA notes that future users include both individuals living close to and some distance from the repository who might use groundwater from Yucca Mountain. In other words, the EPA groundwater standard is also designed to protect people.

EPA has proposed, as you know, to establish two standards, the all-pathways standard and a separate groundwater standard. The important things about these standards is each is really based upon a different level of risk. In other words, you are providing a different level of protection to people who might be exposed to radiation from a particular pathway. This really has very important implications because it means that for some radionucleides the groundwater standard actually provides more protection to the groundwater than an all-pathway standard provides to people. But this is illogical because EPA states that it is protecting groundwater as a resource for use by people. So it really doesn't make sense to provide more protection for groundwater than the people who consume that groundwater. The TYMS Committee concluded that if you set an adequate all-pathway standard you have protected people.

Mr. BARTON. Would the gentleman yield? Is there any correlation mathematically between the 15 millirem all-pathway standard that EPA recommends and the 4 millirem groundwater standard? Is there any way to compare the two standards or are they noncongruent?

Mr. CROWLEY. I will take a swing at that, and perhaps Mr. Page could also take a swing at that.

The 15 millirem all-pathways standard and the 4 millirem groundwater standard really have different pedigrees. They come from different parts of EPA. The 15 millirem standard comes from 40 CFR 191. The 4 millirem groundwater standard comes from the Safe Drinking Water Act. They are related in a very gross way but not in a very exact way. If you look at the details of the groundwater standards, you find that the different radionucleides within that standard provide different levels of protection.

Mr. BARTON. Mr. Page, you want to comment on that? I want to yield back to Mr. Shimkus if he——

Mr. SHIMKUS. That is fine. I just don't know if I had any idea what he just said.

Mr. BARTON. That is why I am the chairman and you are not.

Mr. SHIMKUS. Thank you, Mr. Chairman. I am done, but I want to ask just this one other question.

Mr. BURR. Mr. Page, then Mr. Paperiello wanted to say something.

Mr. SHIMKUS. That is fine. Mr. Page.

Mr. PAGE. Sure. The 15 millirems all pathways is designed—it has a risk base to it. And what it is designed to do is land where EPA typically carries out environmental regulations for hazardous waste, drinking water the 10^{-4}, 10^{-6} risk for cancer.

Mr. BARTON. And to convert, 10^{-4} is 1 in 10,000 and 10^{-6} is 1 in a million.

Mr. PAGE. Yes, sir.

Mr. SHIMKUS. Thank you, Mr. Chairman.

Mr. PAGE. The 4 millirem as well, if you look at the MCLs and look at what they were based on back in 1975 when they were developed, what you have there if you look at all the radionucleides, all the radioactive materials that could be in the drinking water, they also land in that range, in that risk range. Most of them do. The 10^{-4}, 10^{-6}. So there is the correlation that I think that you were asking.

Mr. SHIMKUS. We are going to let Dr. Paperiello answer, but I want to follow up on one question. Four millirems at the source, 15 millirem at the faucet, is there any—is there—do we see an increase in radioactivity, an increase as the stuff gets into the groundwater, the groundwater flows toward the faucet? Is there a possibility of more millirems being glommed on as it goes downstream to make it obviously more powerful?

My position is, you would think there would be a higher standard at the site because there is going to be some dissipation down the stream. But, in this case, you have a higher standard at the source and a weaker standard at the faucet. Is that—can I make that assumption?

Mr. PAGE. Let me respond to your question. I think you are raising a point that was raised a lot in the comments that we had on our rule, and I think it is a good one.

First of all, the 4 millirem, again, at the risk of belaboring the issue, the 4 millirem is the level of protection we offer all across the United States around hazardous waste site facilities' wellhead protection, that we don't want that amount of more than that amount going into the resource.

Now, Congressman, you said, what about close to the site? How about further away? It is possible that somebody can draw up because of how a plume has behaved in moving downgradient that it is possible that you could have something show up that is higher away from the site than it is close to the site. Normally, you would expect it to dilute, et cetera, but these travel in plumes; and this is part of the uncertainty that has to be taken into account.

The point that I would make is the—the important question I think that you have to ask on the 4 millirem, is it prudent, you

know, by cost or feasibility to protect at that level? That has to be judged by that standard. And is it worthwhile offering that amount of prevention? Because as that plume moves down and hits the tap, the people at the tap are going to have to pay for the cost. If that hits there and it is over the 25 or the 15 issues, the people have to pay the tap, have to pay the cost of the cleanup.

Mr. SHIMKUS. I know I am way over, but if Mr. Paperiello—and I will——

Mr. BARTON. Mr. Paperiello answer. Then we are going to go to the long-patient Mr. Burr.

Mr. Paperiello, if you want to answer the question for Mr. Shimkus.

Mr. PAPERIELLO. Let me talk about the drinking water standard, which, of course, the commission objects to. I want to make something clear. It is not a 4 millirem standard. The MCLs are based on old science which is inconsistent with current science. In fact, the current science which EPA has put into Federal Guidance 13, the doses vary by a factor of almost a hundred. And, in fact, for Yucca Mountain, the MCLs, not 4 millirem, is the standard, corresponds at the end of 10,000 years for the most mobile isotope to a dose of two-tenths of a millirem per year.

Congressman you are correct. The average background to a citizen of the United States is about 300 millirems from natural background. It can vary a lot easily, a factor of 2. Our standard is 25. If you use the models, the linear model of risk, it is in the right risk range in the National Academy.

Mr. BARTON. Can I ask you, just—if the average around the country is 300 millirems, do we know what the average is in the Yucca Mountain area? Is it 300?

Mr. PAPERIELLO. Congressman, we do know that. I don't know it off the top of my head.

Mr. BARTON. Whatever it is—and we can get that for the record—are these standards that we are debating today, are they going to be in addition to the normal background naturally occurring radiation that the folks are exposed——

Mr. PAPERIELLO. They would be additional to the normal background.

Mr. BARTON. So is it technically possible—let's—assuming that the—if the national average is 300, it is possible that the Yucca Mountain average is 200. So if you add 15 or 25 or 40 or whatever, they are still going to be under the national average. It is also possible they could be over if it is in the background.

Mr. PAPERIELLO. Let me give you an example. I am going to be in Denver next week. Denver is a mile above sea level. It is also in the middle of the Rocky Mountains. That has been the typical example in radiation protection, any field of a high natural background where the doses are approximately a hundred to 150 millirem higher than what I get living in the DC area.

Mr. BARTON. So that is 450.

Mr. PAPERIELLO. That is right. There is no empirical evidence that that represents a risk to the citizens of Denver. I am just giving you a perspective. I know all the theory—I know theory. I know how to derive the risk from radiation. It is my field. I am just giving you a fact that the—empirically you don't see an effect.

Mr. BARTON. We would like to have for this subcommittee's record what the natural occurring background radiation is in Yucca Mountain. I think that is—if we are going to get into this millirem debate, that would be a good number to have.

Mr. PAPERIELLO. I will see what I can do, Congressman.

[The response had not been received at time of printing.]

Mr. BARTON. Continue on your answer to Mr. Shimkus. Are you concluded with it?

Mr. PAPERIELLO. I just want to point out the fact that the groundwater standards if it were 4 millirem would be one thing, but it is not 4 millirem. It varies widely because of the old science that was used. And, in fact, for Yucca Mountain it will translate effectively into a two-tenths of a millirem standard.

Mr. BARTON. Mr. Burr.

Mr. BURR. I won't even pretend that I understood everything that you said, but I believe I heard you to say that there is currently new science available, but the EPA, to set the standard, used old science because it made it work out in their behalf, is that——

Mr. PAPERIELLO. For a variety of reasons, they have chosen to stick with the old science.

Mr. BURR. Is that common in the scientific community when there is new science available to revert to old science to come to new conclusions?

Mr. PAPERIELLO. In the scientific community, no. However, when you get into law and regulations, the time that it takes to change can allow old science—laws and regulations based on old science to remain in effect until somebody can affect a change.

Mr. BURR. Clearly, the EPA is concerned with law because Mr. Page said in his opening statement—I didn't catch the whole phrase—that it was legally defensible. So, you know, I am sure that there is some consideration that has already been put to that.

Let me move to Dr. Itkin real quick, because I am concerned and inquisitive on the recompete decision. It is my understanding that the policy says you can recompete or extend contracts, correct?

Mr. ITKIN. Yes. That is correct.

Mr. BURR. Tell me where TRW has openly underperformed in their 10-year contract.

Mr. ITKIN. I am not going to suggest that TRW did underperform. There is Department policy, and also directives of the Congress and appropriations act, that we recompete these contracts when those contracts expire. And TRW had a 10-year contract from 1991, and their contract will expire in February of 2001.

Mr. BURR. But the agency has the ability to extend that.

Mr. ITKIN. We could have extended it. We felt that there was no good time to do this——

Mr. BURR. Was that the recommendation of you and your team, that this contract be recompeted?

Mr. ITKIN. It was the recommendation of the Department to do that.

Mr. BARTON. Would the gentleman yield on that point?

Mr. BURR. I would yield.

Mr. BARTON. You gave a very careful answer to that. Now, I am told that it was the internal recommendation that it not be recom-

peted, that it actually be extended and that the Secretary of Energy overruled that, and it is the Secretary of Energy who made the decision against the recommendation internally to recompete. Have I been told correctly or have I been told incorrectly?

Mr. ITKIN. Let me say that there were differences of opinion within the internals of the Department that the—the decision was made by the Department, and I interpret that to mean the Secretary concurred in that decision.

Mr. BARTON. Was this decision made before you became—you obtained the position that you currently hold or——

Mr. ITKIN. No, this decision was made subsequent to my appointment.

Mr. BARTON. Subsequent.

Mr. ITKIN. Subsequent.

Mr. BARTON. That means after.

Mr. ITKIN. After.

Mr. BARTON. Let's talk Texan here. Mr. Burr has raised this. You know, sometimes we have to be a little pushy. And I am going to be a little bit pushy. What was your recommendation to the Secretary on recompete or extend?

Mr. ITKIN. I was concerned about it, but I had mixed feelings as to which way to go. Because, as a new person in this position, I was concerned about what the effects might be to the operation of the activity.

Mr. BARTON. You share the concerns that I expressed in my opening statement.

Mr. ITKIN. Yes, but I have been now feeling—after managing the program through the recompetition, as we go to recompetition, I feel that my fears were not called for.

Mr. BARTON. Before the decision was made to recompete, did you make a recommendation to the Secretary on recompete or extend?

Mr. ITKIN. There were discussions that——

Mr. BARTON. Did you make a recommendation, either verbally or in writing?

Mr. ITKIN. I don't remember personally making that recommendation to the Secretary, although there were concerns about recompetition.

Mr. BARTON. So you made no recommendation.

Mr. ITKIN. We basically made the—entered into discussion as to the pros and cons of such recompetition.

Mr. BARTON. You personally—the office that you represent made no recommendation. The Secretary of Energy just had to take—call these concerns, and then he made the decision. He got no recommendations, he got pros and cons, and then he made the decision. As opposed to you sending him a decision memo initially——

Mr. ITKIN. We did not send him anything in writing, as I recall, in terms of a formal recommendation. There may have been some internal discussions.

Mr. BARTON. Did anybody within the Department of Energy make a written recommendation to the Secretary whether to recompete or renegotiate—or extend?

Mr. ITKIN. One moment.

Not to my knowledge. I am told—I checked with my deputy to make sure that he was not—may have been knowledgeable. To the

best of our knowledge, there was no formal recommendation not to recompete.

Mr. BARTON. So there were no recommendations yes or no. It was simply a debate, pros and cons, and then the Secretary took that debate and he made the decision.

Mr. ITKIN. There was a discussion about the concerns raised about what recompetition might do. We also, on the same point looked at when we would recompete, what the problems would be in the future. And it was the Secretary's feeling that the Department should observe the departmental policy and that the—and also respond to congressional directives which have repeatedly been placed in the appropriations documents about going ahead and recompeting.

Mr. BARTON. I guarantee you there is no congressional directive to recompete this contract at this time.

Mr. ITKIN. I can't say that.

Mr. BARTON. I can say that. There is no congressional directive to recompete this particular contract.

Now, we have done everything we could to direct the Secretary of Energy to recompete the Los Alamos contract with the University of California but not on this one. So when the Secretary is here next week, if we have a chance—it is going to be a broader subject, but I will ask him this question, too.

But from all of your hemming and hawing and dodging and weaving and bobbing and everything, I still take it that you would admit if we were under oath, which we are not, this is not the oversight subcommittee, that it was the Secretary's decision to recompete this contract?

Mr. ITKIN. Let me say this, in our Department the Secretary is responsible for the conduct of the operation. Any decision made by the Department obviously is something made with his concurrence.

Mr. BARTON. Okay. Mr. Burr. We will give you quite a bit of time, since I took about 6 minutes on that.

Mr. BURR. I thank the chairman. I probably am concerned more at the conclusion of the answer then I was when I originally asked it. Because I think what, in fact, you said to me, Dr. Itkin, if you are accurate, is that—do you consider this a major contract?

Mr. ITKIN. Oh, yes, it is a major contract.

Mr. BURR. I consider it a major contract, too. What you have told me is that the Secretary didn't ask line management for recommendation as to whether a major contract was extended or recompeted. Is that an accurate depiction of what you told me?

Mr. ITKIN. That he asked—obviously——

Mr. BURR. The Secretary of Energy did not ask for a recommendation from his line management on a major contract as to whether it should be recompeted or extended.

Mr. ITKIN. No, we had input in terms of—as I mentioned.

Mr. BURR. Input is significantly different than a recommendation. And I have yet to find through my service as vice chair of the oversight committee any major contract where there was not paperwork involved for a recommendation.

Mr. ITKIN. Just to reiterate, there is—there was no formal recommendation on the part of my office to recompete or not to recompete.

Mr. BURR. And it is not a fault of yours for not making the recommendation, but, clearly, great concern as it relates to the Secretary's not requesting a recommendation from the line management of this project, which we consider to be a major contract.

Let me move to Dr. Crowley, if I could. Let me read from your statement and just ask you one question.

You said, the Energy Policy Act of 1992 directed the EPA administrator to obtain advice from NAS on the technical basis for radiation protection standards; and the act further mandated that EPA base its standard on NAS recommendations. Did they base their standard on the NAS recommendations?

Mr. CROWLEY. I think the answer to that question, based on the report that the board did in 1999, is no.

Mr. BURR. So the EPA has not followed the Energy Policy Act in its directions to the EPA administrator.

Mr. CROWLEY. That is the judgment of the Board on Radioactive Waste Management, yes.

Mr. BURR. I thank you, Dr. Crowley.

Mr. Page, your turn. What is your background? Are you a scientist?

Mr. PAGE. No, sir, general policy background.

Mr. BURR. You graduated from the University of Southern California with a masters degree in public administration.

Mr. PAGE. Yes, sir.

Mr. BURR. Why did everybody else send scientists and the EPA sent public relations to this hearing?

Mr. PAGE. I am sorry. I didn't——

Mr. BURR. Why is everybody else up here a scientist, Ph.D.; and the EPA on the issue of this technical aspect sends somebody with a public administration background?

Mr. PAGE. I was sent because I head the Office of Radiation, Indoor Air. I am the senior person in the agency who makes recommendations to the administrator on radiation policy.

Mr. BURR. But your background is not such that the technical aspects of it are something that——

Mr. PAGE. The operation of my office—within the operation of my office, we have many people.

Mr. BURR. I am talking about you. Do you make technical recommendations or do you make——

Mr. PAGE. Yes, sir.

Mr. BURR. [continuing] policy recommendations?

Mr. PAGE. We are responsible for making——

Mr. BURR. You. You. Not your office, you.

Mr. PAGE. In my position, I am responsible for making recommendations to the administrator that are both policy and science based.

Mr. BURR. Based upon what your scientists found out or based upon what you determine to be——

Mr. PAGE. Based on the work that my scientists do at the scientific community. Based on other policy considerations that we take into account in addition to the science—cost effectiveness, practicality of implementation, things like that.

Mr. BURR. What do you say to Dr. Crowley's statement that, in fact, the EPA has not followed the Energy Policy Act of 1992?

Mr. PAGE. As I said in my testimony, in most of the areas I think we were generally consistent with the NAS. I think, as their testimony pointed out, that on the matter of, for instance, groundwater that is a policy call. I think they were right in saying that EPA needed to elaborate in its final rule if that is where it goes on the policy aspects of that and make that clear, that that is a policy, not a scientific judgment.

Mr. BURR. How many times have you been to Yucca Mountain.

Mr. PAGE. One time.

Mr. BURR. One time.

Mr. PAGE. Yes, sir.

Mr. BURR. And you have been in charge of this area of responsibility for how long?

Mr. PAGE. A year and a half.

Mr. BURR. How long was that trip? How long were you at Yucca Mountain.

Mr. PAGE. We were out there a full day and got a tour of the facility.

Mr. BURR. Full day.

Mr. PAGE. Yes, sir.

Mr. BURR. What was the purpose of that?

Mr. PAGE. To be briefed by the Department of Energy at what stage they were in the process, to get familiar with the facility and to try to—in addition to the studies that I have been looking at and studying and hearing from my staff, to kind of hear from them directly on any concerns or issues they have with the facility.

Mr. BURR. Could you accomplish that, all of that, in this 1-day visit?

Mr. PAGE. The site visit was to go through the facility and match up with things that I have read, diagrams that I have seen with the real situation.

Mr. BURR. And from a standpoint of the individual—and I know the University of Southern Cal is a great school, but, from your background, 1 day at the Yucca Mountain, you could take all of the information that your scientific team has based their recommendations on and you could make that evaluation on that everything was accurate from a 1-day site visit to Yucca Mountain?

Mr. PAGE. Mr. Burr, the site visit was intended to complement all of the other information that I had been presented and been collecting and have done over the last year and a half. I think you would probably be more upset with me had I not gone at all and sat in Washington behind a desk.

Mr. BURR. Actually, I think that is the only reason you went, so you—if you were ever asked the question you could say, yes, sir, I have been to Yucca Mountain.

Mr. BARTON. You have been on 24 minutes, of which I took about 6. So I think——

Mr. BURR. The clock was on the chairman, and he took 12. But I will be happy to wrap it up.

Mr. BARTON. We are going to do more than one round.

Mr. BURR. I appreciate the chairman's indulgence on this. One last question.

Mr. BARTON. All right.

Mr. BURR. Is your policy based on old science or new science?

Mr. PAGE. Which policy are you referring to, Congressman?

Mr. BURR. The policy as it relates to what Dr. Paperiello——

Mr. PAGE. We are in the process right now of updating the MCLs, the maximum contaminant levels, for the drinking water. It is true that what we used for the purposes of the proposal was the best science that was available legally. We are in the process—though we were aware that the updated science is out there, we are in the process of updating it right now.

Mr. BURR. I thank all of our witnesses. I am sorry I didn't have an opportunity to spend some time with the other ones. I yield back.

Mr. BARTON. The gentleman from Virginia is recognized for 7 minutes.

Mr. BOUCHER. Thank you, Mr. Chairman.

I want to inquire concerning another area; and, Dr. Itkin, I suppose this question should be directed to you. In the 1982 act, a requirement was made that the Federal Government begin to accept nuclear waste from the utilities beginning in 1998. Obviously, that didn't happen; and the utilities have filed suit. The U.S. Court of Appeals has held that the contract that DOE entered into with the various utilities pursuant to that statute to accept the waste was, in fact, breached; and now the Court of Claims is considering the damages that will be awarded. And I have got two questions about that.

First of all, are these damages going to be significant, in your opinion? What do you think the size of the damages will be? And that question is important because of the second question. And that is, from what source will these damages be paid?

The Federal Government has a judgment fund that is administered by the U.S. Department of Justice that is available for the payment of judgments against the United States. However, in the contract that was entered into between DOE and the utilities, under the terms of which DOE obligated itself to accept this waste, there are specific provisions that relate to any penalties that are assessed or damages that rise from a breach of the contract. And in those clauses the contract says that the utility is entitled to realize its damages by deducting its future payments under the waste management fund. So, in other words, if the utility is entitled to money from the government, it can recover that by just not paying its future obligations into the waste management funds.

So we create a cycle through this. If this becomes the means by which the utilities are compensated, you wind up with a worsened problem with the perpetual inability of DOE to prepare the site and—because it doesn't have the funding to do it and then further claims by the utility being filed with that. I think that is a troubling potential scenario.

So my two questions to you are, first of all, how significant are these damages likely to be? And, second, given the two potential funds that the government might use to pay those damages, what is your prediction of which it is going to be? Will it be the government's judgment fund or it will be this precise clause in the contract that would result in the waste management fund being reduced as a consequence of the damages?

Mr. ITKIN. Congressman, I will try to answer that question.

The first question that you asked was on our failure to realize the provision of the contract on starting to accept the waste in 1998 if—and this is just very, you know, back of the envelope calculations in terms of what it might cost in the aggregate, you know. Looking at every utility, not just the ones that have sued us or utility by utility, it is going to be significant. It will probably run in the range of—for every year delay it probably could range a few hundred million dollars, which can add up, as you know, into substantial sums of money, into billions.

Mr. BOUCHER. This is the total of all of the claims.

Mr. ITKIN. The total. We assume that whatever judgment is awarded, whatever claim is awarded to one will probably be replicated to the others in a similar fashion. So——

Mr. BOUCHER. All of those taken together would be——

Mr. ITKIN. All of those taken together, we are talking about a few hundred million dollars a year. Which means to me, as I have characterized it, as rent. It is almost where we have bought the new home, and we are paying the mortgage, but we can't get into the new home, and we are still paying the landlord rent.

It is an unfortunate circumstance which I would like to correct, and the easiest way of correcting it is to move as expeditiously as possible. We can, using—you know, making good determinations; and that is why I have asked Congress to fully fund our program this year. And with respect to an earlier comment, by 2003 is when we have to ramp up substantially in terms of the dollars we need. So that will have to be done.

The second question, about who will pay or where will the money come from, you have correctly, I guess, determined that there are two possible sources. One is the nuclear waste fund, and the other one is the judgment fund. Since the Department of Justice will be making that decision, allow me the liberty of assuming that—out of whose pocket the Department would want that—Justice Department would want to take the money from. I am assuming that whatever liability we have will come out of the nuclear waste fund, not the judgment fund, although that is not a determination that I will be making. I am just assuming the bias that might occur on the part of the agency that will make that decision.

Mr. BOUCHER. Well, if the funding comes out of the nuclear waste fund in any manner——

Mr. ITKIN. What will probably happen is that if there is an adverse ruling, the judgment fund will pay it first, and then the Department of Justice will seek to have the waste fund repay the judgment fund for the amount of money that the judgment—the check will be originally cut from the judgment fund, and the judgment fund will seek recompense from the nuclear waste fund.

In order to probably deal with this in an orderly and responsible fashion, we will probably seek to work with the utilities in terms of offering credits on what is to be paid up in the future.

Mr. BOUCHER. Well, then do you get yourself into this syndrome that I described earlier where this rent that you then deduct from their future payments into the fund winds up diminishing even further your ability to prepare the site and therefore multiplies the number of claims in the damages and eventually you find yourself

without the financial ability to go forward? I mean, is that a potential outcome?

Mr. ITKIN. Well, yes, it is a concern but—and we have looked at the projected income to the fund, and we have made some, you know, obviously some assessments as to what this might cost us, and we feel at this particular time we can accommodate it. But, obviously, I am not privy to, you know, a court of claims determination. I don't know what they will do. We are seeking to work with utilities in terms of arranging to deal with this problem out of court if we can.

Mr. BOUCHER. Have all of the utilities that have nuclear facilities and with regard to whom you are currently under contract to accept their waste filed claims against you?

Mr. ITKIN. No, that is—they have not, not all have.

Mr. BOUCHER. Are you anticipating that those that have not will eventually file claims? When you characterize this as basically a rent, it is kind of an open invitation for them, isn't it?

Mr. ITKIN. I would think that every utility would want to adjudicate its additional costs either with the Department directly or, as you indicated, by suing us in court. But we are hoping that we can be able to sit down and work with the utilities. After all, we—utilities want us to get along with our business. It is in their best interest for us to move this whole process along expeditiously, and I think they recognize that some of—some of them recognize, at least the operating ones, the ones that have a future, recognize that this is something that they would like to work out with us collectively.

Mr. BOUCHER. So to summarize this discussion, your opinion is that the nuclear waste fund is going to have the ultimate financial liability for the damages that the utilities are claiming, even if the judgment fund has the first responsibility, is that correct? That ultimately the responsibility will rest with the nuclear waste fund.

Mr. ITKIN. It has been an opinion of mine. It is not legally binding. It is just you asked for my thoughts, and I presented you as I honestly believe the way it could happen.

Mr. BOUCHER. My concern then is that at the time that the fund was structured and this one bill per kilowatt fee that creates the fund was established, I don't think that it was contemplated that the fund was going to have to be responsible for several hundred million dollars per year in payments to utilities because of the breach of the government's contract to accept the waste in a timely way. And if this fund is going to have to bear that financial responsibility, I really would question whether the fund is going to be adequate.

Even if you get the whole thing—if Mr. Barton and I are eventually successful in having the Congress that grants the fund to you, I question whether it is going to be sufficient, given the fact that these costs are going to multiply. They are going to reach more than a billion dollars by that arithmetic, easily. Aren't you concerned?

Mr. ITKIN. I am concerned. I mean, I don't want to move over this lightly. Obviously, if we could have prevented this from happening, we would. Simply, we could not pick up the spent fuel from these commercial facilities because we had no place to put it.

Mr. BOUCHER. I think, at minimum, this discussion underscores the importance of getting the full fund into your hands and making sure that you have access to it at the earliest possible time.

Mr. Chairman, I think it is yet another argument in support of legislation that we are trying to process that would achieve that result.

Mr. Itkin, thank you. I appreciate your responses.

Mr. BARTON. The chairman is going to recognize himself for 7 minutes. Before Mr. Boucher leaves, I want to get this on the record.

We have had informal discussion up here. The Energy and Water appropriation bill is going to be on the floor next week. Under the rules that we operate in the House, any Member can offer an amendment. It is an open rule. And I am prepared and Mr. Boucher is at least prepared to discuss the possibility of an amendment that would restore your $26 million request to get you full funding for the coming Fiscal Year.

But—and I am just speaking for myself—I am not willing to do that unless the Department of Energy is willing to work with us to find an offset within the Department's budget. In other words, so it is in order under our rules. I can say to add $26.6 million to this particular program, but I have to have an offset for it. I am willing to do that, and I think Mr. Boucher is willing to at least consider doing that in a bipartisan fashion. But at least I am willing to do that if you call me pretty quick and say we want the $26 million to come from A, B, C or A or A and B or an across-the-board cut in the discretionary programs under the Department's permission.

Mr. BOUCHER. Would the gentleman yield to me?

Let me say that I think it is a worthwhile endeavor, and what we are offering to you today is an opportunity, and that is our shared willingness to go to the floor of the House and offer this amendment. But we are going to need the help of the Department of Energy in suggesting to us the offset for the $26 million that would bring your appropriation up to the level of your request. I am not sure it is actually 26. It looks like—is it 26?

Mr. BARTON. It is 413, 437.

Mr. BOUCHER. So it is an opportunity. What you might do as a practical matter is go back and have some other conversations with DOE about it and just see if it is the policy of DOE to fully fund this program perhaps at the expense of some others. And if a consensus can be arrived at that to do that, we are happy to help. But we are going to have to hear back from you. We are going to need to hear from you pretty soon if you want to do it.

Thank you, Mr. Chairman.

Mr. BARTON. Do you understand what we are saying? We are going to get you $26 million if you can show us where to get it from.

Mr. BOUCHER. He has had more years in the legislative body than you or I.

Mr. ITKIN. Somebody has to pay within the Department for the $26 million we need. I can certainly inquire, but I am not in a position to make the call. But thank you very much for your offer to help. I wish it was more encompassing than just the Department.

Mr. BARTON. We have to work within the framework of the appropriations cycle. We want to get you your money. But since, you know, this is Energy and Water we think it is only fair that it come from other Department of Energy funds. At least, I think it is only fair. But think about it. If you want to pursue that, let my personal staff or committee staff know. We will get to work on it.

Mr. ITKIN. Thank you very much for, at least, the help.

Mr. BARTON. With the offer.

Mr. ITKIN. The offer to help.

Mr. BARTON. Let's be honest. We have not helped.

Mr. ITKIN. I understand your offer, but there is no commitment that it would work. You would offer an amendment.

Mr. BARTON. I think if Rick Boucher and Joe Barton offered the amendment in a bipartisan way and we would say that the Department of Energy supported it, I think it would pass.

Mr. BOUCHER. I agree with that.

Mr. ITKIN. I understand. Thank you.

Mr. BARTON. Now I am going to ask my questions.

Mr. Page, I hate to belabor this, but I am going to belabor it a little bit. I am going to read you some statements and tell me if you have ever heard of the statement and, if you have heard of it, who made it. These are direct quotes.

This is on the proposed EPA groundwater standard. "It is redundant and unnecessary for the protection of public health and safety." Have you ever heard of that?

Mr. PAGE. I have heard of that.

Mr. BARTON. Do you know who said that, what agency said that?

Mr. PAGE. Might have been the National Academy of Sciences.

Mr. BARTON. That is a pretty good guess, but if that is your final answer, that is not the right guess. That was made by the Department of Energy. I don't know if Dr. Itkin made that.

Now let me read you another one, again on the EPA proposed groundwater standard: "Would result in non uniform risk levels. They misapplied the maximum contaminant levels for radionuclides and they far exceeded what is needed for the protection of public health and safety." Have you heard that?

Mr. PAGE. I have heard that.

Mr. BARTON. You want to make a guess?

Mr. PAGE. I am not going to take that bait. I know somebody made that——

Mr. BARTON. That is the Nuclear Regulatory Commission that went on the record in a comment period and said that.

One more. "EPA's proposal to include a separate groundwater standard lacks a sound scientific basis and will add little, if any, additional protection to individuals or the general public from radiation releases from the repository." Have you heard that?

Mr. PAGE. I have heard that. Yes, sir.

Mr. BARTON. That comes from the National Academy's Board on Radioactive Waste Management.

[The material referred to follows:]

Department of Energy
Washington, DC 20585

U.S. Environmental Protection Agency
Central Docket Section (6102)
ATTN.: Docket A-95-12
401 M Street, S.W.
Washington, DC 20460-0001

Re: **Docket No. A-95-12; Comments on the Proposed Environmental Protection Standards for Yucca Mountain, Nevada**

Dear Mr. Clark:

This letter provides the U.S. Department of Energy's (DOE) views on the U.S. Environmental Protection Agency's (EPA) proposed Environmental Protection Standards for Yucca Mountain, Nevada, published at 64 Fed. Reg. 46,975 (Aug. 27, 1999). DOE appreciates EPA's responsibility under section 801 of the Energy Policy Act of 1992 (the EnPA) to develop site-specific standards that will be the sole standards applicable to the Yucca Mountain Site. The release of the proposed rule is an important step in fulfilling that responsibility to ensure adequate protection of public health and safety.

EPA's standards will play a pivotal role in achieving the long-standing policy of the United States to properly dispose of high-level radioactive waste (HLW) and spent nuclear fuel (SNF) in an underground mined geologic repository. The Nuclear Regulatory Commission (NRC) must implement EPA's standards in its regulations for licensing a repository at the Yucca Mountain site, and DOE must be able to comply with those NRC regulations in order to construct a repository. If EPA were to select unrealistic, unnecessarily conservative, or non site-specific standards, the result could be the rejection of an otherwise suitable site, and the *de facto* rejection of the geologic disposal option without commensurate benefit to the protection of public health and safety. Such rejection would not avoid the consequences of radioactive waste management, but it would require resort to a different and currently undefined approach.

EPA proposes three disposal standards that a repository must meet for a period following closure. First, an Individual Protection Standard (IPS) limits exposure to future populations in the vicinity of Yucca Mountain. Second, a Groundwater Protection Standard (GPS) limits groundwater contamination to levels at or below EPA's Maximum Contaminant Levels (MCLs) for drinking water. Third, a Human Intrusion Standard requires a separate assessment of the effects of human intrusion upon the resilience of the Yucca Mountain disposal system. EPA also proposes a separate storage standard that would limit doses to the general population for the pre-closure period.

EPA's proposed 15 mrem/year all-pathways IPS dose limit is extremely rigorous. DOE believes a 25 mrem/year all-pathways standard is more reasonable and fully adequate as the generally applicable standard for all nuclear facilities. The proposal does not provide a convincing rationale as to why a more stringent standard is necessary for Yucca Mountain. Accordingly, DOE believes that a 25 mrem dose limit is appropriate as the only standard necessary to protect human health and safety.

DOE is particularly concerned with the proposed GPS. While DOE supports the general goal of protecting individuals from exposures through any potential pathway including groundwater, the proposed GPS is redundant and unnecessary for the protection of public health and safety because the IPS adequately protects human health and safety without the need for another standard. The IPS fully considers exposures through all possible pathways to the hypothetical receptors, including direct exposure, drinking of contaminated water, eating food irrigated with contaminated groundwater or grown in contaminated soil, and exposure to airborne releases.

There is no specific legal requirement in Section 801 of the EnPA for EPA to promulgate a separate groundwater standard. Moreover, in fulfilling its responsibilities under the EnPA, the National Academy of Sciences (NAS) made no recommendation for a separate groundwater standard as part of their comprehensive findings and recommendations. The proposed GPS does not appropriately apply the maximum contaminant levels (MCLs) for radionuclides, which were promulgated pursuant to the Safe Drinking Water Act (SDWA) and for a different purpose. The MCLs under the SDWA apply "at the tap," after treatment, rather than to groundwater sources. Many of the radionuclides at issue for the potential repository are not specifically addressed by the MCLs. Application of the MCLs would render differing and inconsistent exposure levels depending on the radionuclide, and, in some instances, would render exposure levels that differ from the IPS. Under these circumstances, the proposal does not appear to articulate a rational basis for the proposed GPS.

DOE believes that EPA's proposed 10,000 year period of compliance is reasonable and appropriate for this site. A significantly longer time period for assessing compliance would be unprecedented, unworkable, and probably unimplementable. As discussed in EPA's preamble, there is significant uncertainty whether quantitative performance assessment can produce meaningful projections over periods of tens of thousands to hundreds of thousands of years. Further, we agree with EPA's statement in the preamble that there is no policy basis for the acceptable level of confidence necessary to determine compliance using such long-term projections.

EPA proposes two alternatives for the evaluation of impacts of human intrusion, without indicating any preference for either alternative. DOE believes that the assumed human intrusion scenario is based on a highly improbable and inherently inconsistent set of assumptions including hypothetically drilling for water from on top of a mountain above the repository through a robust waste package and then continuing to the water table. This scenario is too implausible for a quantitative dose limit to a hypothetical individual and could potentially lead to a suboptimal design or unwarranted disqualification of the site. DOE recommends rejection of this alternative.

DOE agrees that a human intrusion analysis is appropriate but recommends that the results be considered by decision makers as only an indicator of resilience of the repository rather than a "go- no go" quantitative limit. Consistent with this view, DOE believes that EPA should select the second proposed alternative.

The EnPA makes EPA responsible for establishing public health and safety standards for the Yucca Mountain site. Consistent with the statutory direction of the EnPA, EPA should adopt reasonable, site-specific standards to provide adequate protection for individuals. Some of the proposed standards, however, are unrealistic and unnecessary to protect public health and safety. EPA should reject these unrealistic and unnecessary proposed standards because they would impede the important national interest in the safe disposal of spent fuel and high-level waste, including the significant amounts that have already accumulated, without any appreciable additional protection of public health and safety.

DOE appreciates the opportunity to comment on the proposed rule. If you have questions concerning these comments or the more detailed comments that are attached, please contact me.

Sincerely,

Ronald A. Milner

for Lake H. Barrett, Acting Director
Office of Civilian Radioactive
Waste Management

Enclosures

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 2, 1999

Mr. Stephen D. Page, Director
Office of Radiation and Indoor Air
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Mr. Page:

This letter provides the comments of the U.S. Nuclear Regulatory Commission (NRC) staff on the Notice of Proposed Rulemaking, "Environmental Radiation Protection Standards for Yucca Mountain, Nevada" (64 FR 46976) at proposed 40 CFR Part 197. As the Agency responsible for licensing a possible repository at Yucca Mountain, Nevada, the NRC is concerned that the standards exhibit a sound scientific and technical basis and that the need for the standards adopted be fully justified on health and safety grounds. The NRC staff disagrees with the need for, and health and safety basis of, some of the requirements in the proposed standards. In addition, the NRC staff is concerned that EPA has not provided any analysis of the costs and benefits of its approach to regulating radioactive waste disposed at Yucca Mountain. The staff's objections to the proposed standards are given below and in the enclosure to this letter.

1. **The NRC staff objects to the inclusion of separate ground-water protection requirements for the proposed repository at Yucca Mountain because these requirements would result in non-uniform risk levels, they misapply the Maximum Contaminant Levels for radionuclides, and they far exceed what is needed for protection of public health and safety.**

Although Maximum Contaminant Levels (MCLs) may have been considered reasonable standards during their development in 1975, current understanding of the risk posed to individual organs by radiation exposure demonstrates that the MCLs for individual radionuclides provide a level of protection that varies significantly. For example, consider the annual risk of developing a fatal cancer from drinking water that contains Neptunium-237 (Np-237) and Iodine-129 (I-129) at their respective MCL. The risk of developing a fatal cancer from ingestion of Np-237 at its MCL is 30 chances in 1,000,000 (3×10^{-6}), while the risk from ingestion of I-129 at its MCL is 0.07 chance in 1,000,000 (7×10^{-8}). More than a four-hundred fold difference exists between the risk levels prescribed for these two radionuclides. Therefore, this simple comparison shows an application of MCLs that results in non-uniform risk levels which are likely to lead to greater confusion about the level of risk which is acceptable and attainable, rather than confidence that the health and safety of the public are being protected. It is our understanding that there are no EPA efforts currently underway to modify the MCLs to ensure a uniform risk level.

The EPA does not demonstrate a need for such an overly conservative, separate groundwater limit to protect public health and safety. The all-pathway dose limit, by definition, ensures that risks from all radionuclides and all exposure pathways, including the groundwater pathway, are acceptable and protective. All radionuclides and all exposure pathways will have to be acceptably evaluated at Yucca Mountain, and will have to meet an individual protection standard that is fully protective of public health and

safety and the environment. Therefore, the proposed standard should not contain separate ground-water protection requirements because they are unnecessary for protection of public health and safety and because they lead to inconsistent and unreconcilable results as described above, which we believe will cause confusion and diminish rather than enhance public confidence that adequately protective limits have been established.

Certain MCLs maintain a risk level so small that the individual, all-pathway dose limit is meaningless. EPA has proposed an annual, individual dose limit of 0.15 mSv (15 mrem) which is equivalent to an annual risk of developing a fatal cancer of 9 chances in 1,000,000 (9×10^{-6}).[1] The MCL for I-129 (annual risk of 0.07 chance in 1,000,000) is more than 100 times below the risk of the individual dose limit. Consequently, the groundwater protection criteria become the de facto standards instead of the individual protection limit called for by the Energy Policy Act of 1992 (EnPA - Public Law 102-486).

The EPA's current proposal is a continuation of EPA's practice of using the MCLs without appropriate justification. Specifically, EPA would have NRC require that groundwater in the vicinity of Yucca Mountain meet EPA's MCL, originally established to implement the Safe Drinking Water Act (SDWA). The MCLs were based on an analysis of treating contaminated water in public drinking water systems subject to the SDWA and not on an analysis of technology and costs of remediating groundwater at actual sites. In this rule, EPA proposes to apply the same MCLs to groundwater supplies before treatment rather than "at the tap" after treatment. Therefore, in the absence of an appropriate and comprehensive cost-benefit analysis, EPA should not require the expenditure of potentially significant amounts of taxpayer money to prevent potential contamination of groundwater that may require treatment prior to use anyway. Instead, EPA's standards should permit a decision to spend much smaller sums for water treatment in the event that such contamination should occur. Finally, EPA's application of MCLs at DOE's Waste Isolation Pilot Plant (WIPP) site in New Mexico should not be considered a precedent for the Yucca Mountain site since the WIPP site is located in a salt formation and lacks potable groundwater making the application of MCLs irrelevant.

Furthermore, the NRC staff is troubled by the discussion of ground-water protection that suggests additional options that are not representative of ground-water conditions at Yucca Mountain and further increase the conservatism in applying these unnecessary separate requirements. The preamble to the standard requests comment on alternative dilution volumes that are extremely small (e.g. 10 and 120 acre-feet). These dilution volumes are not reflective of the resource to be protected (the EPA states the representative volumetric flow is 4000 acre-ft/year for the sub-basin in which the proposed repository is located). The standard also requests comment on alternative locations for determining compliance (e.g., 5 kilometers) that are similarly not reflective of the resource. As explained in connection with the compliance location for the individual protection (e.g., 20 kilometers), cautious and reasonable assumptions for

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[1] This value was calculated by EPA's use of NCRP Report No. 126 risk value of 6×10^{-2} health effects per Sievert (Sv) [6×10^{-4} health effects per rem] and the NAS recommendations for an annual risk limit.

lifestyles and the practicality of obtaining water provide no basis for identifying the 5 kilometer location for protection of ground water.

Is there a better approach? Yes. An individual, all-pathway dose limit of 0.25 mSv (25 mrem) total effective dose equivalent (TEDE) properly accounts for the radiation sensitivity of individual organs, and ensures the risks from all radionuclides and all exposure pathways are acceptable and protective.

2. The NRC staff objects to those portions of the proposed standard that address technical matters of compliance determination and implementation - matters which Congress has assigned to the NRC, not to the EPA.

In the proposed rule, there are many requirements where the EPA has inappropriately assumed the Commission's responsibility. For example, the EPA introduces a new term, "reasonable expectation," in place of the Commission's term, "reasonable assurance." Confidence that the U.S. Department of Energy (DOE) has or has not demonstrated compliance with the EPA's standards is the essence of NRC's licensing process, and is the Commission's responsibility. The NRC has effectively used "reasonable assurance" in licensing a variety of atomic energy activities. The reasonable assurance standard is derived from the finding the Commission is required to make under the Atomic Energy Act that the licensed activity provides "adequate protection" to the health and safety of the public; the standard has been approved by the Supreme Court. Power Reactor Development Co. v. Electrical Union, 367 U.S. 396, 407 (1961). This standard, in addition to being commonly used and accepted in the Commission's licensing activities, allows the flexibility necessary for the Commission to make judgmental distinctions with respect to quantitative data which may have large uncertainties. The NRC staff has incorporated this concept of reasonable assurance in its development of implementing regulations for Yucca Mountain (Proposed 10 CFR Part 63).

A second example is the EPA's requirement that the dose should be calculated to the "reasonably maximally exposed individual" (RMEI). The RMEI is the EPA's proposal of a technical criterion for determining whether the standard will achieve its purpose of protecting the individuals most likely to receive doses from any releases from the repository. The RMEI is untested in NRC's licensing process, and involves a matter of implementation within the NRC's statutory responsibilities. The NRC staff, consistent with the National Academy of Science (NAS) recommendations and international practice, intends to use the "average member of the critical group" approach to determine the population that should be the focus in implementation of the individual protection standard. The EPA should conform to the recommendations of the NAS and international practice by adopting the use of the "average member of the critical group." [Comments on other examples of the EPA's intrusion into implementation matters are provided in the Enclosure to this letter.]

3. The NRC staff objects to the imposition of a 0.15 mSv (15 mrem) per year individual dose limit from all pathways, because this lower dose limit will unnecessarily increase the conservatism of the dose assessment.

An annual all-pathways individual dose limit of 0.25 mSv (25 mrem) is fully protective of public health and safety and is a suitable standard for a potential repository at Yucca Mountain. The 0.25 mSv/year (25 mrem/year) limit represents a small fraction of the national and international public dose limit of 1 mSv/year (100 mrem/year) and provides a level of radiation protection that is consistent with our and EPA's regulations for related activities (e.g., low-level, high-level, and transuranic waste management, storage, and disposal; spent fuel storage and disposal). Although the EPA rule proposes a lower limit of 0.15 mSv (15 mrem), and the difference between 0.15 and 0.25 mSv (15 and 25 mrem) is small, the lower value is not necessary for protection of public health and safety and would provide little, if any, reduction in health risk when compared with 0.25 mSv (25 mrem). It is also important to consider that the average American receives approximately 3 mSv/yr (300 mrem/yr) from natural background radiation. In addition to the lack of public health and safety benefit, there are regulatory concerns associated with lowering the dose limit to 0.15 mSv (15 mrem). Specifically, as the dose limit becomes smaller, limitations in the DOE's models used for estimating performance, and the associated uncertainties in supporting analyses, become more pronounced. Further, a 0.15 mSv (15 mrem) dose limit is likely to cause unnecessary confusion for the public and cause the NRC to expend resources without a commensurate increase in public health and safety.

In addition to the above objections to provisions proposed in 40 CFR Part 197, the NRC staff also provides responses to the EPA's solicitation for input on specific questions annotated in Section IV of the "Supplementary Information" text. These responses are provided in the enclosure to this letter.

In summary, the NRC staff believes there are fundamental flaws in the proposed rule which EPA should reconsider before finalizing the rule. Moreover, many of the requirements in the proposed rule will, if included in the final rule, add significant cost and burden to the DOE license application process and significantly increase the complexity of the NRC's licensing process without a commensurate, if any, increase in the protection of public health and safety and the environment. The NRC staff will attend the EPA-sponsored public meetings on the proposed Yucca Mountain Standard and may provide further comments, if warranted.

Sincerely,

William D. Travers
Executive Director
for Operations

Enclosure: Additional Comments

cc: See attached list

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

Board on Radioactive Waste Management
National Research Council

November 26, 1999

The Honorable Carol M. Browner
Administrator
Environmental Protection Agency
Washington, D.C.

Dear Administrator Browner:

The Board on Radioactive Waste Management (BRWM) has prepared this National Research Council report[1] in response to the Environmental Protection Agency's (EPA's) request for comments on *Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Proposed Rule*[2] and requests that it be entered into public docket A-95-12. This report reflects a consensus of the BRWM and has been reviewed in accordance with the procedures of the National Research Council.

The Energy Policy Act of 1992 directed EPA to arrange for an analysis by the National Academy of Sciences of the scientific bases for radiation protection standards to be applied at Yucca Mountain. The Act also directed EPA to develop radiation protection standards that were consistent with the National Academy of Sciences' recommendations:

> *... the Administrator shall, based upon and consistent with the findings and recommendations of the National Academy of Sciences, promulgate, by rule, public health and safety standards for protection of the public from releases from radioactive materials stored or disposed of in the repository at the Yucca Mountain site. Such standards shall prescribe the maximum annual effective dose equivalent to individual members of the public from releases to the accessible environment from radioactive materials stored or disposed of in the repository.* (P.L. 102-486, Title VIII, Section 801. 42 U.S.C. Section 10141 note)

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[1] This National Research Council report should be referenced as follows: National Research Council, 1999, Comments on Proposed Radiation Protection Standards for Yucca Mountain, Nevada by the Board on Radioactive Waste Management: Washington, D.C., National Research Council–Board on Radioactive Waste Management.

[2] 64 Federal Register 46976-47016 (August 27, 1999), to be codified as 40 CFR Part 197. This document is referenced in the text as "EPA, p. xxx", where xxx is the relevant page number.

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Findings and recommendations to EPA on the technical bases for Yucca Mountain standards were provided in the National Research Council[3] report entitled *Technical Bases for Yucca Mountain Standards,*[4] hereafter referred to as the "TYMS report." This report was authored by a committee of experts that was appointed by the Chairman of the National Research Council and that operated with oversight from the BRWM. The TYMS committee was disbanded after its report was completed in 1995. However, the BRWM is a continuing National Research Council committee[5] and can, at its discretion and with prior approval from the National Research Council's Governing Board, prepare reports on significant and timely issues.

The Board's objectives in preparing this self-initiated letter report are the following: (1) to provide a comparison of the technical bases for Yucca Mountain standards recommended by the TYMS report with those proposed by EPA in its draft 40 CFR Part 197 (the "proposed standards");[6] and (2) where differences are noted, to provide comments on how EPA's draft standards could be changed to make them consistent with the recommendations in the TYMS report. This letter report describes the major recommendations in the TYMS report that EPA followed in its proposed rule, and it also highlights several areas in which the recommendations were not followed.

For nine major issues, the TYMS report provided recommendations on the technical bases for Yucca Mountain standards. A brief summary of each of those issues, the technical bases recommended by the TYMS report, and the standards proposed by EPA are given below. Several of these issues are discussed in more detail later in this report.

1. The Form of the Standard. Although the Energy Policy Act stipulated that EPA should develop a standard that prescribes dose equivalents, the TYMS report recommended that EPA develop a standard that sets a limit on the *risk* to individuals of adverse health effects from releases from the repository. EPA did not accept the TYMS recommendation. Instead, it proposes a *dose-based* standard.

2. Who is Protected. The TYMS report recommended that EPA apply the standards to a *critical group* representative of those individuals in the population who, based on cautious, but reasonable, assumptions, have the highest risk resulting from repository releases. EPA proposes standards based on a *reasonably maximally exposed individual* (RMEI). As discussed below, the proposed standards are broadly consistent with the recommendations in the TYMS report in light of the way in which EPA has proposed to implement them.

3. Level of Protection. The TYMS report noted that the level of protection was a policy decision to be established through the rulemaking process. EPA has accepted the

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[3] The National Research Council is the operating arm of the National Academies. Its reports do not necessarily represent the views of the members of the National Academy of Sciences, the National Academy of Engineering, or the Institute of Medicine.

[4] National Research Council, 1995, Technical Bases for Yucca Mountain Standards: Washington, D.C., National Academy Press. This report can be viewed online at the following URL: http://books.nap.edu/catalog/4943.html. This report is referenced in the text as "TYMS, p. xxx", where xxx is the relevant page number.

[5] A standing National Research Council entity on radioactive waste management has been operating continuously since 1958 and is responsible for oversight of studies on radioactive waste management and disposal. The current BRWM membership roster is given in Attachment A.

[6] The Board used the TYMS report and the Federal Register notice as reference materials for this letter report. The Board did not examine the additional documentation available from EPA.

rulemaking suggestion and is proposing to establish two levels of protection, one for an all-pathways standard to protect the RMEI, and another standard to protect users of ground water and ground water as a resource. The proposed numeric value for the all-pathways RMEI standard falls within the range of values suggested in the TYMS report. The proposed ground-water standard is discussed under *Protection of the General Public.*

4. PROTECTION OF THE GENERAL PUBLIC. The TYMS report concluded that an individual-risk standard would protect the health of the general public, provided that policy makers and the public were prepared to accept that very low radiation doses pose a negligibly small risk. EPA appears to agree with this conclusion. However, some parts of EPA's proposed standards are inconsistent with this conclusion, most notably with respect to estimation and consideration of collective doses, design alternatives to reduce carbon-14 releases from the repository, and a standard for protection of ground water as a resource.

5. HOW LONG. The TYMS report recommended that compliance assessment be conducted for the time when the greatest risk occurs, within the limits imposed by the long-term stability of the geologic environment, but also noted that EPA might choose a different compliance time to be consistent with its management of risks from long-lived hazardous non-radioactive materials. EPA proposes a 10,000-year standard, but also requires the peak dose within the period of geologic stability to be calculated. The proposed standard is consistent with the recommendations in the TYMS report in some respects, but there are also differences that may have a major impact on the licensing process without real benefit to protection of the public, as discussed below.

6. HUMAN INTRUSION. The TYMS report recommended that the standards developed by EPA should require active and passive institutional controls in the near term, should be based on an explicitly assumed intrusion scenario in the long term, and should set limits for the human intrusion scenario that are no more stringent than the undisturbed case. EPA proposes a standard that is broadly consistent with these recommendations, as discussed below. It is based on two alternative scenarios for a single human intrusion as a result of exploratory drilling for ground water.

7. ALARA.[7] The TYMS report noted that there is no scientific basis for incorporating the ALARA principle into the standard. The proposed EPA standard does not explicitly require ALARA, but does suggest an ALARA-like approach to reduce carbon-14 releases from the repository (see *Protection of the General Public*).

8. EXPOSURE SCENARIOS. The TYMS report concluded that there is no scientific basis for predicting the societal factors required to establish exposure scenarios and, therefore, the report recommended that such scenarios be established through the rulemaking process. EPA has used rulemaking to define exposure scenarios based on the state of society, human biology, and knowledge that exists at the time of submission of the license application for the repository. The proposed standard is consistent with the TYMS report's recommendations.

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[7] ALARA, or "As Low As Reasonably Achievable," is usually applied after threshold regulatory limits have been met. Under ALARA, all exposures shall be kept as low as reasonably achievable, social and economic factors being taken into account (e.g., International Commission on Radiological Protection Report ICRP-60, 1991).

9. TECHNOLOGY-BASED STANDARDS. The TYMS report recommended against imposing repository subsystem performance requirements in the Yucca Mountain standards. The proposed EPA standards do not contain subsystem requirements and, therefore, are consistent with the recommendations in the TYMS report.

• **THE FORM OF THE STANDARD.** Both the TYMS report and the draft EPA standards draw a clear distinction between the *form* of the individual-protection standard and the *numeric value* of that standard, whatever its form. We will follow that distinction in this report and focus the discussion in this section on the form of the standard. The numeric value of the standard is discussed in the section entitled *Level of Protection* elsewhere in this report.

The TYMS report recommended that EPA adopt a *risk-based* standard for protection of individuals for the following two reasons (TYMS, p. 64-65):

> *1. A risk-based standard would not have to be revised in subsequent rulemaking if advances in scientific knowledge reveal that the dose-response relationship is different from that envisaged today. Such changes have occurred frequently in the past, and can be expected to occur in the future ....*
>
> *2. Risks to human health from different sources, such as nuclear power plants, waste repositories, or toxic chemicals, can be compared in reasonably understandable terms. Doses or releases have to be stated in radiation units ... that are not easily understood by the general public and that can only be compared conveniently with other sources of radiation or radioactivity.*

In the Supplementary Information preamble (hereafter referred to as the "preamble") to its proposed standards, EPA states that (EPA, p. 46984) "We have reviewed and evaluated the merits of a risk-based standard as recommended by NAS. However, we are proposing a dose-based standard for the following reasons." EPA then provides the following four reasons for its decision to propose a dose-based standard for protection of individuals:

> *First, both national and international radiation protection guidelines developed by bodies of non-governmental radiation experts ... generally have recommended that radiation standards be established in terms of dose. Also, national and international radiation standards ... are established almost solely in terms of dose or concentration, not risk. Therefore, a risk-based standard will not allow a convenient comparison with the numerous existing radiation guidelines and standards that are stated in terms of dose.*
>
> *Second, we have an established methodology for calculating dose .... The development of this methodology was a combined effort of many Federal agencies involved in radiation protection and has become Federal policy. ... By contrast, there is currently no* [agreed upon guidance] *for calculating risk from radiation exposure.*
>
> *Third, we have based the proposed dose-based standard upon the risk of developing a fatal cancer as a result of that level of exposure based upon a linear, non-threshold, dose-response relationship. We would establish a risk-based standard in the same manner. Thus, a risk-based standard, like a dose-*

> *based standard, depends upon current knowledge and assumptions about the chance of developing a fatal cancer from a particular exposure level. Dose and risk are closely related; one can be converted to the other simply by using the appropriate factor. Therefore, both dose- and risk-based standards are based upon scientific assumptions that could change and no matter how it is expressed, the standard is based upon risk.*
>
> *Finally,* [the Energy Policy Act] *specifically calls for a dose-based standard.*

The Board believes that EPA's rationale for proposing a dose-based standard is flawed for the following reasons. EPA's statement in its reason #3 (above) that "a risk-based standard ... depends upon current knowledge and assumptions about the chance of developing a fatal cancer from a particular exposure level" is incorrect. A risk-based standard is not based on scientific assumptions. Instead, it is based on a public-policy determination of acceptable risk levels to individuals or populations, usually expressed in the form of a probability—for example, a 10^{-6} (or one-in-a-million) lifetime probability of developing a fatal cancer.

As noted in the TYMS report, there is no scientific basis for determining acceptable risk levels. Rather, the determination of acceptable risk levels is a policy decision established through the rulemaking process and is based on the risk that the public is willing to bear from potential radiation releases from a repository. Once the level of acceptable risk is established, then a numerical standard (e.g., a dose standard) that relates that risk to individual or population exposures to radiation can be obtained using data that are subject to change with improvements in scientific knowledge. For example, acceptable risk then can be characterized in terms of dose limits established from knowledge of the dose-response relationship and exposure pathways.

There have been several adjustments in the dose-response relationship between radiation and fatal cancers over the past several decades, as EPA acknowledges in the preamble to its proposed standards (EPA, p. 46979). Several BEIR (Biological Effects of Ionizing Radiation) reports have addressed the changing knowledge of dose-response relationships and another BEIR committee has just begun the latest examination.[8] However, establishing an acceptable risk level does not require knowing the dose-response relationship or exposure pathways. It is not a scientific issue but a public policy choice. Once established, this risk level could be changed,[9] but it would be, again, a public policy decision.

The EPA itself acknowledges the nature of the changing dose-response relationship in its discussion of the proposed standards: EPA states that the current proposal for a 15 millirem limit for whole-body dose is not a change from the previous 40 CFR Part 191.03(a) limit of 25 millirem because "the 25-mrem [millirem]/yr, whole-body-dose limit established in 1985 is essentially equivalent to the risk associated with today's proposed limit of 150 μSv [microsieverts] (15 mrem) CEDE [committed effective dose equivalent]/yr ..." (EPA, p. 46985). Thus, EPA writes that "the proposed dose level essentially maintains a similar risk level ..." (EPA, p. 46983).

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[8] BEIR reports are products of National Research Council committees operating under the auspices of the Board on Radiation Effects Research. The latest study, BEIR VII, was initiated earlier this year and is examining the health effects of low doses of ionizing radiation.

[9] The level of what is considered to be an acceptable risk by society might change over time, for example.

In explaining its decision to adopt a dose-based standard, EPA notes in reasons #1 and #2 that most national and international standards are expressed in terms of dose and that it has an established methodology for calculating dose. But what is EPA's basis for proposing what it believes the numeric value of the dose standard should be? EPA answers this question directly in its reason #3: "... we have based the proposed dose-based standard upon the risk of developing a fatal cancer as a result of that level of exposure based upon a linear, non-threshold, dose-response relationship. We would establish a risk-based standard in the same manner ...." In other words, EPA acknowledges that it is using risk to establish its dose-based standard.

EPA also states in reason #3 that dose and risk are closely related and can be converted by using the appropriate factor. Although this is certainly true arithmetically, EPA's statement obscures the relationship between these two factors. For the purposes of public policy making, these two factors are not equivalent—acceptable risk is derived from a public policy decision, whereas dose is derived from risk through the appropriate conversion factors.

By proposing a standard using dose as a proxy for risk, EPA is precluding the public from easily comparing the proposed individual-protection standards for Yucca Mountain with standards for regulating other kinds of hazardous materials. Furthermore, the use of dose as a proxy standard also makes it difficult for the public to compare the proposed individual-protection standard, which is now expressed by EPA in units of microsieverts per year and millirems per year, directly with EPA's proposed ground-water standard, which is expressed by EPA in terms of both millirems per year and picocuries per liter. Additional comments on the ground-water standard are made elsewhere in this letter.

The TYMS report's recommendation of a standard based on a specified level of acceptable risk that is determined through the rulemaking process represents a major departure from traditional EPA practice for setting radiation standards, as EPA itself acknowledges in reason #2 above. EPA has generally used dose-based radiation standards[10] and would no doubt find it difficult to adopt a risk-based approach. Indeed, asking the public about acceptable risk levels may be far more difficult than following established precedents. Nevertheless, a risk-based form for the standard was recommended by the TYMS committee because it requires public involvement in a critical decision on acceptable levels of risk from a Yucca Mountain repository, and because, fundamentally, this is a policy, not a scientific, judgment.

EPA points out in reason #4 that it was directed by the Energy Policy Act to develop a "dose-based standard." In fact, as noted at the beginning of this report, Congress directed EPA to develop standards that "prescribe the maximum annual effective dose equivalent to individual members of the public ...." In the Board's view, this directive does not prohibit EPA from basing such a standard on acceptable risk as determined through the rulemaking process. In other words, the TYMS report's recommendation that the *form* of the individual-protection standard be based on *risk* does not preclude EPA from expressing the *numeric value* of the standard in units of risk and in derivative units of dose, so long as the risk value is clearly understood as the underlying basis for the proposed dose standard. This approach would achieve the aims of the

[10] For example, as in 40 CFR Part 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes, which establishes standards for the Waste Isolation Pilot Plant, an underground repository for transuranic waste near Carlsbad, New Mexico.

TYMS report's recommendations and it would allow the EPA to meet its Congressional mandate.

The Board strongly recommends that EPA adopt an explicit risk-based individual-protection standard for Yucca Mountain.

• **WHO IS PROTECTED.** The standard proposed by EPA departs, in a strict sense, from the TYMS recommendation of using a "critical group" (CG) as the basis for the standard. EPA has chosen instead to write the standard for a "reasonably maximally exposed individual" (RMEI). As explained below, however, the Board does not view EPA's choice of the RMEI approach over a CG approach as a significant departure from the recommendations in the TYMS report because of the way in which EPA has proposed to implement this standard. In other words, the Board believes that the proposed EPA standard is broadly consistent with the TYMS report's recommendations.

EPA appears to recognize that its standard must be written in a way that provides appropriate protection to the individuals who have the highest potential for exposure to radioactivity released from a repository, while avoiding unrealistic and unnecessarily conservative assumptions for individual exposure. EPA's proposed standard sets forth a detailed definition for the implementation of the RMEI approach (EPA, p. 47014-47015). The Board believes that such detailed specification is needed for both the RMEI concept and EPA's *reasonable expectation* concept so that both can be appropriately implemented.

The CG concept is described in the TYMS report on pages 52-54. A key idea is that the individuals in the group should be "homogeneous in risk" (TYMS, p. 53). The TYMS report defines the critical group as being "representative of those individuals in the population who, based on cautious, but reasonable, assumptions, have the highest risk resulting from repository releases. The group should be small enough to be relatively homogeneous with respect to diet and other aspects of behavior that affect risks" (TYMS, p. 53). The report goes on to say that, for individuals living thousands of years in the future, "it will be necessary to define hypothetical persons by making assumptions about lifestyle, location, eating habits, and other factors" (TYMS, p. 54).

Whether the new EPA standard is written for a small homogeneous "critical group" of "a few to a few tens of persons" (TYMS, p. 53) or for a single "reasonably maximally exposed individual," the key issue in the implementation of the standard is the specification of the assumptions about location, behavior, and life style that will determine exposure. The choice of one individual or a homogeneous small group as the basis for the standard is less important than the specification of assumptions that will determine the potential exposure of that individual or small group.

EPA has provided considerable specificity in the proposed standards in its definition of RMEI. In so doing, the EPA has chosen to exclude some exposure situations, such as from a small quantity of contaminated ground water close to the repository in a location where no people live at present and where future agricultural activity would appear unlikely.

In preparing the final rule, EPA may wish to be even more specific in setting forth the location, behavior, and lifestyle of the RMEI for purposes of calculating risk in determining compliance with the standard. Alternatively, EPA may choose to pass to the U.S. Nuclear

Regulatory Commission (USNRC) the challenge of establishing specific assumptions for the compliance calculations. These specifics need to be clearly established prior to the process for evaluating whether compliance with the standard has been achieved in an application for a repository license.

- **LEVEL OF PROTECTION.** The TYMS report made no recommendation about a specific level (i.e., a specific numeric value) for the individual-protection standard to be set by EPA:

> *The level of protection established by a standard is a statement of the level of risk that is acceptable to society. We* [the TYMS Committee] *acknowledge that determining what is acceptable is not ultimately a question of science but of public policy. Whether posed as 'How safe is safe enough' or as 'What is an acceptable level of risk?', the question is not solvable by science alone. The rulemaking process ... is an appropriate method of addressing the question of an appropriate level of protection.* (TYMS, p. 49)

Table 2-3 of the TYMS report (TYMS, p. 43-46) provides a summary of the approaches that have been recommended or established by various advisory or regulatory bodies, both in the United States and abroad, for regulating high-level radioactive waste disposal. Table 2-4 of the TYMS report (TYMS, p. 50) lists protection levels in terms of annual dose limits, annualized individual-risk limits, or both, that have been established in the United States by either the USNRC or EPA for a variety of different activities, some similar to and others quite different from the activity associated with Yucca Mountain. The values range from about 10^{-4} to 10^{-6} (i.e., one chance in ten thousand to one chance in one million) in terms of annualized individual risk. The TYMS report recommends not only that rulemaking be used for establishing levels of protection, but also suggests that a "reasonable starting point" for the rulemaking would be for EPA to propose a numeric value somewhere within the range presented in Table 2-4 (TYMS, p. 49).

EPA is establishing the level of protection through the rulemaking process and is proposing a dose-based, all-pathways individual-protection standard of 150 microsieverts (15 millirems) CEDE/year, which, according to EPA, corresponds to an annualized risk level of 7 x 10^{-6} (EPA, p. 46985). EPA also proposes that the individual-protection standard should apply to the so-called "undisturbed" case, that is, a postulated future scenario in which no disturbances such as human intrusion occur. EPA has carefully spelled out the public-policy issues that support its position and notes, for example, that the proposed level of protection is consistent with other current standards. However, EPA provides only one example of such consistency, and it is not evident from the discussion if the standards are actually consistent.[11]

Although the dose-based *form* of the standard is inconsistent with the recommendations in the TYMS report, as noted previously, the risk-equivalent *numeric value* of the standard given by EPA falls within the range of values in Table 2-4 of the TYMS report. Thus, the *magnitude* of the proposed numeric value of the individual-protection standard is consistent with the recommendations in the TYMS report. However, EPA has failed to make clear the underlying risk basis for this proposed level of protection or to present this risk basis in a way that is easily understood by the public.

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[11] The comparison is made to limits for radiation releases to the atmosphere, where EPA's standards are 10 millirems/year. EPA argues that this limit is equivalent to the 15 millirems/year all-pathways standard embodied in the proposed individual-protection standard for Yucca Mountain.

In addition to an all-pathways individual-protection standard, EPA is proposing a separate ground-water standard that appears to be designed to protect both individuals living near the repository and the general public living at some distance from the repository. This standard is discussed in more detail under *Protection of the General Public* below.

- **PROTECTION OF THE GENERAL PUBLIC.** Section 801(a)(2)(A) of the Energy Policy Act specifically called for an answer to the question "whether a health-based standard based upon doses to individual members of the public from releases to the accessible environment ...will provide a reasonable standard for protection of the health and safety of the general public."

The TYMS committee answered this question as follows:

> *We conclude that an individual-risk standard would protect public health, given the particular characteristics of the site, provided that policy makers and the public are prepared to accept that very low radiation doses pose a negligibly small risk.*
>
> *The individual-risk standard that we recommend is intended to protect a critical group. In this context, the general public includes both global populations as well as local populations that lie outside the critical group. Global populations might be affected because radionuclide releases from a repository can in theory be diffused throughout a very large and dispersed population. In the case of Yucca Mountain, the likely pathway leading to widely dispersed radionuclides is via the atmosphere beginning with release of carbon dioxide gas containing the carbon-14 ... radioactive isotope which might escape from the waste canisters.*
>
> *The risks of radiation produced by such wide dispersion are likely to be several orders of magnitude below those of a local critical group.* (TYMS, p. 7)

In other words, the TYMS report concluded that individual-protection standards would also be protective of the health of the general public. Therefore, the TYMS report concluded that there was no need to establish a separate set of standards to protect the health of the general public.

EPA's proposed standard is, on first examination, in agreement with the TYMS report's recommendations:

> *We are proposing to find that the individual-protection standard is sufficient to protect public health based upon the unique characteristics of the area around the Yucca Mountain site. ... we are not proposing to adopt a separate limit on radiation releases for the purpose of protecting the general population, <u>but we are recommending that collective dose be estimated and considered</u>* [underlining added for emphasis] .... (EPA, p. 46992)

Moreover, with respect to carbon-14 releases from the Yucca Mountain repository, EPA also notes that the risk to the general public is very low:

> *The risk over an individual's lifetime from exposure to gaseous* [carbon-14] *released from the Yucca Mountain repository, as estimated by NAS, ... is extremely low and well below the risk level that we generally regulate.* (EPA, p. 46991)

Nevertheless, EPA goes on to write

> *While we are not proposing to adopt additional regulatory requirements for collective exposures of the general population ... we urge DOE to examine design alternatives for the disposal system, for the purpose of reducing potential risk to the general population ....* (EPA, p. 46992)

EPA's requirement that the collective dose be "estimated and considered" is inconsistent with both the TYMS report and with EPA's own conclusion (in the preamble to its proposed rule) that additional standards are not needed to protect the general public. Moreover, EPA has provided no guidance to either the licensee or the regulator on what they are to do with these collective dose estimates.

Further, EPA's urging of DOE to seek design alternatives to reduce potential risks to the general public from carbon-14 releases, even when individual-dose limits have been satisfied, is also without a firm scientific basis and will add little, if any, additional protection to the general public. Indeed, EPA's urging of DOE could be interpreted as an attempt to apply ALARA, which was also rejected by the TYMS committee because it lacks a scientific basis.

The TYMS report noted that "Defining the level of incremental risk that is negligible is a policy judgment" (TYMS, p. 60). In the Board's view, EPA is making policy judgments with respect to collective dose estimation and design alternatives to reduce carbon-14 releases but has not explained clearly its reasoning for these judgments. The Board recommends that EPA revise the preamble discussion to explain the embedded policy judgments, and that EPA explicitly include for public comment the option to exclude the estimation and consideration of collective dose and design alternatives to reduce gaseous carbon-14 releases from the standard for the purpose of protecting the general public.

EPA has also proposed to include a separate standard for protection of future human users of ground water:

> *... we believe that ground water protection for the Yucca Mountain site should focus upon the protection of the ground water as a resource for future human use. It is the general premise of this proposal that the individual-protection standard would adequately protect those few current residents closest to the repository. <u>The proposed ground water standards are directed to protecting the aquifer as a resource for current users, and a potential resource for larger numbers of future users either near the repository or for communities farther away comprised of as many as several hundred thousand people</u>* [underlining added for emphasis]. *(EPA, p. 47002)*

> *... we are proposing additional ground water protection standards that would establish specific limits to protect users of ground water and ground water as a resource.* (EPA, p. 46992)

> *... In its license application to* [US]*NRC, DOE must provide a reasonable expectation that, for 10,000 years of undisturbed performance after disposal, releases of radionuclides from radioactive material in the Yucca Mountain disposal system will not cause the level of radioactivity in the representative volume of ground water at the point of compliance to exceed* [specified limits] .... (EPA, p. 47015)

> *... we are proposing to protect the ground water to the same level as the maximum contaminant levels (MCLs) for radionuclides which we have established under the authority of the Safe Drinking Water Act* .... (EPA, p. 47000)

EPA states that its ground-water standard is intended to protect ground water as a resource for future human users. In fact, the proposed ground-water standard appears to be designed to protect both individuals living near the repository ("larger numbers future users ... near the repository") and the general public living at some distance from the repository ("communities farther away comprised of as many as several hundred thousand people").

The TYMS report concluded that an individual-protection standard would be sufficient to protect public health from a repository at Yucca Mountain. Therefore, the TYMS committee did not consider it necessary to comment on the need for a ground-water standard such as that established in the Safe Drinking Water Act and used in 40 CFR 191:

> *40 CFR 191 includes a provision to protect ground water from contamination with radioactive materials that is separate from the 40 CFR 191 individual-dose limits. These provisions have been added to 40 CFR 191 to bring it into conformity with the Safe Drinking Water Act, and have the goal of protecting ground water as a resource. <u>We make no such recommendation, and have based our recommendations on those requirements necessary to limit risks to individuals</u>* [underlining added for emphasis]. (TYMS p. 121)

EPA agrees that an individual-protection standard is appropriate to protect public health and says that it is not recommending a separate limit on radiation releases for the purpose of protecting the general population. Yet EPA is inconsistently proposing a carryover of 40 CFR 191 to establish separate ground-water protection standards for purposes of protecting individuals and the general population. Such separate limits may greatly complicate the licensing process and have but a negligible impact on protection of the public.

In the preamble, EPA implies that there is a scientific basis for inclusion of separate ground-water limits in the standards—for example, EPA provides a detailed analysis of approaches to calculating such limits on page 47001-47003. The Board respectfully disagrees and does not believe there is a basis in science for establishing such limits for the reasons described above. The Board recognizes EPA has the authority under the Energy Policy Act to establish separate ground-water limits as a matter of policy, but if it does so it should explicitly state the policy decisions embedded in the proposed standard and ask the public to comment on those decisions.

If EPA wishes to establish such standards on the basis of science, it must make more cogent scientific arguments to justify the need for this standard. EPA should explain, for example, why a separate ground-water standard is required, given that EPA has established a

standard for protection of individuals and has concluded that it does not need to establish a separate standard for protection of the general public. Given that most if not all of the estimated exposure to radiation from the Yucca Mountain repository is estimated to be through consumption and use of contaminated ground water, the proposed ground-water protection standard appears to duplicate provisions of the individual-protection standard. However, because the ground-water standard does not necessarily apply at the same location as the individual-protection standard, its application to Yucca Mountain lacks overall consistency and coherence.

Additionally, the proposed ground-water protection standard and individual-protection standard may be inconsistent scientifically. The individual-protection standard is derived from EPA's latest dosimetry models, whereas the proposed ground-water protection standard[12] is based on a 25-year-old regulation (i.e., the Safe Drinking Water Act), which in turn is based on 40-year-old dosimetry.[13] The use of such outdated standards is contrary to the overarching themes of the TYMS report: namely, the importance of using the best available science in the standards and of designing those standards so that they can be easily modified as scientific knowledge changes.[14]

The use of mixed dose-based units in the proposed ground-water standard (see footnote 12) reinforces an important point made in previous sections of this report: these units give the public no basis on which to compare levels of protection afforded by these standards or to compare these proposed standards with standards already in place for regulation of other hazardous materials. The Board recommends that EPA present such comparisons, preferably in terms of risk, to give the public a firmer basis for understanding and commenting on these proposals.

- **HOW LONG.** The TYMS report noted that "The time scale for long-term geologic processes at Yucca Mountain is on the order of approximately one million years" (TYMS, p. 72), and concluded that "there is no scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value" (TYMS, p. 55). Additionally, the report recommended the application of a risk standard "at times when the peak potential risks might occur" (TYMS, p. 55-56). The report also noted that "Selection of a time scale ... must therefore take into account the scientific basis for the performance assessment itself" and "also involves policy considerations" (TYMS, p. 30) "that we [the TYMS committee] have not addressed" (TYMS, p. 56).

The TYMS report emphasizes that peak releases, doses, and risks at Yucca Mountain are calculated to arise well beyond 10,000 years, and it quotes an earlier National Research Council report[15] which states that a 10,000-year limit "makes compliance rather easy" (TYMS, p. 55). The TYMS report also noted that uncertainties in the non-biosphere part of the analyses do

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[12] EPA is proposing limits of 5 picocuries per liter for combined radium-226 and radium-228, 15 picocuries per liter for gross alpha, and 40 microsieverts (4 millirems) per year for combined beta and photon radiation from man-made radionuclides in a representative volume of ground water.

[13] Specifically, International Commission on Radiological Protection, 1959, Report of Committee II on Permissible Dose for Internal Radiation: New York, Pergamon Press.

[14] Indeed, this flexibility is one of the principal advantages of a risk-based standard.

[15] National Research Council, 1983, A Study of the Isolation System for Geologic Disposal of Radioactive Wastes: Washington, D.C., National Academy Press.

not necessarily increase rapidly beyond 10,000 years; some uncertainties that can dominate at shorter times (e.g., canister failure rates) can become less important at long time scales.

In its proposed standards, EPA asks for comments from the public on two approaches to the time-scale issue. The first is effectively that proposed by the TYMS report, and the second is application of a quantitative dose limit up to 10,000 years, together with a requirement to examine "disposal system performance after 10,000 years ... to see if dramatic changes ... could be anticipated" (EPA, p. 46993). No indication is given of how one judges whether a change is "dramatic." EPA states its preference for the second approach.

EPA notes that the majority of those commenting to EPA on the TYMS report (EPA, p. 46981) stated that quantitative analyses of the disposal system should be carried out for compliance purposes at the time of peak risk, but EPA has nevertheless retained its earlier recommendation for quantitative compliance assessment only up to 10,000 years. EPA has given a series of policy and technical arguments for this choice and has also included a requirement for consideration of the period beyond. The TYMS committee excluded policy considerations from its deliberations on this issue. The TYMS committee had considered all of the technical arguments offered by EPA and concluded that "there is no scientific basis for limiting the time period ... to 10,000 years" (TYMS, p. 55). Clearly, the 10,000-year limit is strictly a policy choice and should be acknowledged as such.

Given that the proposed EPA standard requires that the performance of the disposal system be examined after 10,000 years if the peak dose is calculated to occur then, there <u>may</u> be little practical difference between the TYMS report's recommendations and the proposed EPA standards. The major issue is that EPA provides no guidance on how analyses should be done for the period of geologic stability beyond 10,000 years and gives no indication of how the results should be used in judging acceptability. To mandate that these results become "part of the public record" but to give no indication of how they will be taken into account seems to postpone rather than solve problems associated with licensing and provide no real benefits to protection of the public.

In preparing its final rule, EPA may wish to be more specific in providing guidance on how the analyses beyond 10,000 years should be used in determining compliance with the standard. Alternatively, EPA may choose to explicitly pass to the USNRC the task of establishing such guidance.

- **<u>HUMAN INTRUSION.</u>** The TYMS report described at some length how the EPA standard should address the issue of human intrusion. On the issue of passive and active institutional controls, the TYMS report concluded that "... the repository developer should be required to provide a reasonable system of active and passive controls to reduce the risk of intrusion in the near term" (TYMS, p. 108), even though the TYMS report concluded that it is not possible, using such controls or by any other known means, to preclude such an intrusion, nor is there a way to develop an objective numerical value for the likely future rate of inadvertent intrusions. On this set of institutional-control issues, the EPA's proposed standard adheres closely to the philosophy espoused in the TYMS report.

On the issue of using a risk-based approach to regulating human intrusion, the TYMS report states that "... we do not believe that it is scientifically justified to incorporate alternative scenarios of human intrusion into a fully risk-based compliance assessment that requires

knowledge of the character and frequency of various intrusion scenarios" (TYMS, p. 108). The report continues

> *We do however conclude that it is possible to carry out calculations of the consequences for particular types of intrusion events, for example drilling one or more boreholes into and through the repository. We also believe that calculations of this type might be informative in the sense that they can provide useful insight into the degree to which the ability of a repository to protect public health would be degraded by intrusion.*
>
> *For these reasons, to address the human intrusion issue on an adequate basis, we recommend that ... EPA should specify in its standard a typical intrusion scenario to be analyzed for its consequences on the performance of the repository. Such an analysis will provide useful quantitative information that can be meaningful in the licensing process .... Because the assumed intrusion scenario is arbitrary and the probability of its occurrence cannot be assessed, the result of the analysis should not be integrated into an assessment of repository performance based on risk, but rather should be considered separately. The purpose of this consequence analysis is to evaluate the resilience of the repository to intrusion.* (TYMS, p. 108-109)

After discussing an approach using a single stylized but well-defined scenario, the TYMS report concludes

> *Because the probability is inherently unknowable, we are led to the conclusion that the most useful purpose of this type of analysis is to identify the incremental effects from the assumed scenario .... Our recommendation is that EPA should require that the conditional risk as a result of the assumed intrusion scenario should be no greater than the risk levels that would be acceptable for the undisturbed-repository case.* (TYMS, p. 112-113)
>
> *The key performance issue is whether repository performance would be substantially degraded as a consequence of an inadvertent intrusion ....* (TYMS, p. 121)

The EPA's proposal in draft 40 CFR 197 follows the TYMS reasoning in most of its particulars, specifically insofar as it concludes that only inadvertent intrusion should be covered, specifies a single stylized inadvertent-human-intrusion scenario, requires that the scenario be analyzed using the same methods as used for the undisturbed case, and requires that the doses arising from inadvertent human intrusion meet the same standard as for the non-intrusion case. Specifically,

> *... we* [EPA] *are proposing to adopt the NAS-suggested starting point for a human-intrusion scenario. That scenario is a single, stylized intrusion through the repository to the underlying aquifer based upon current drilling practices. The proposed scenario presumes that the intrusion occurs because of exploratory drilling for water.* (EPA, p. 46999)
>
> *We are proposing to use the same RME* [reasonable maximum exposure] *descriptors for this analysis and scenario as in the assessment for compliance*

> *with the individual-protection standard .... we propose to interpret the NAS-recommended test of 'resilience' to be a longer-term test as measured by exposures caused by releases which occur gradually through the borehole, not suddenly as with direct removal.* (EPA, p. 46999)

> *We also are proposing that the test of the resilience of the repository system be the dose incurred by the same RMEI as determined for the individual-protection standard.* (EPA, p. 47000)

The EPA proposed two alternative forms for its proposed rule, in light of the possibility that an intrusion into the repository using today's drilling technology might not breach an intact canister in relatively early times, before substantial canister degradation will have occurred. The EPA approach here (EPA, p. 47015) is not discussed in the TYMS report, but insofar as it attempts to be realistic about the likelihood of canister breach using today's typical exploratory-drilling technology, it seems to be fully consistent with the TYMS philosophy. In summary, the proposed EPA approach to human intrusion appears to have followed the TYMS recommendations very closely.

- **CONCLUDING OBSERVATIONS.** The Congress recognized the special role of the National Academies in providing scientific advice to EPA for use in establishing radiation protection standards for Yucca Mountain. The text of the conference report (CR page H-12056; reproduced in TYMS, p. 141-143) describes this role:

> *The Conferees do not intend for the National Academy of Sciences, in making its recommendations, to establish specific standards for protection of the public but rather to provide expert scientific guidance on the issues involved in establishing those standards.*

The Board's main objective in writing this letter report is to assist EPA in ensuring that the Yucca Mountain standards reflect the sound scientific thinking embodied in the TYMS report. The Board hopes that EPA finds the information contained in this letter report to be helpful in achieving this end.

As discussed in detail elsewhere in this letter, the Board found that many of the standards proposed by EPA are consistent, either in design or in implementation, with the recommendations in the TYMS report. However, the Board has also noted several significant differences. These differences reflect what the Board believes to be flawed reasoning, the misapplication of science to issues that have a clear policy basis, or a failure to explain fully the policy decisions embedded in the proposed standards. The Board identified problems with the following four issues:

- **Form of the Standard.** The Board finds that EPA's various rationales for proposing a dose-based standard are flawed and that they miss a key point of public policy and public communication. The Board strongly recommends that EPA adopt an explicit risk-based, individual-protection standard for Yucca Mountain and has suggested an approach for doing so that is consistent with both the TYMS report and the Congressional directive to prescribe a "maximum annual effective dose equivalent" for protection of individuals.

- **Level of Protection.** The Board finds that the numeric value proposed by EPA for its individual-protection standard is within the range of starting values suggested in the TYMS report. However, EPA has failed to make clear the underlying risk basis for this proposed level of protection or to present this risk basis in a way that is easily understood by the public.

- **Protection of the General Public.** EPA's requirement that collective dose be estimated and considered is inconsistent with both the TYMS report and with EPA's conclusion that additional standards are not needed to protect the general public. Further, EPA's urging of DOE to seek design alternatives to reduce gaseous carbon-14 releases, even when individual-dose limits have been satisfied, is also without a firm scientific basis and could be interpreted as an attempt to apply ALARA, which was rejected by the TYMS committee because it lacks a scientific basis. The Board recommends that EPA revise the preamble discussion to explain the policy judgments embedded in these requirements, and that EPA explicitly include for public comment the option to exclude from the standard the estimation and consideration of collective dose and design alternatives to reduce gaseous carbon-14 releases for the purpose of protecting the general public.

The Board also finds that EPA's proposal to include a separate ground-water standard lacks a sound scientific basis and will add little, if any, additional protection to individuals or the general public from radiation releases from the repository. If EPA wishes to establish ground-water standards on the basis of science, it must make more cogent scientific arguments to justify the need for this standard. Moreover, such a standard should be based on best-available science, not on 40-year-old dosimetry as EPA has proposed. If EPA wishes to establish a separate ground-water standard on the basis of policy, it should make clear the policy decisions embedded in the proposed standard and ask the public to comment on those decisions.

- **How Long.** The Board finds that there may be little practical difference between the proposed EPA standard and the TYMS report recommendation because of the way that EPA proposes to implement this standard. However, EPA gives no guidance on how analyses should be done for the period of geologic stability beyond 10,000 years and gives no indication of how the results will be considered in judging acceptability. To mandate that these results become "part of the public record" but to give no indication of how they will be taken into account seems to postpone rather than solve problems associated with licensing and provide no real benefit to protection of the public. EPA may wish to provide more specific guidance on compliance determination in its final rule. Alternatively, EPA may choose to explicitly pass to the USNRC the task of establishing such guidance.

Respectfully submitted,

Michael Kavanaugh, Chair
John Ahearne, Vice Chair
Board on Radioactive Waste Management

ATTACHMENT A
BOARD ON RADIOACTIVE WASTE MANAGEMENT

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D. WARNER NORTH, NorthWorks, Inc., Belmont, California
MARTIN J. STEINDLER, Argonne National Laboratory (retired), Argonne, Illinois
JOHN J. TAYLOR, Electric Power Research Institute, Palo Alto, California
MARY LOU ZOBACK, U.S. Geological Survey, Menlo Park, California

NRC Staff

KEVIN D. CROWLEY, Director
TONI GREENLEAF, Administrative Associate

ATTACHMENT B
LIST OF REPORT REVIEWERS

This letter report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their participation in the review of this report:

Jean Bahr, University of Wisconsin
Robert Bernero, U.S. Nuclear Regulatory Commission (retired)
Thomas Graff, Environmental Defense Fund
Frank Parker, Vanderbilt University
Thomas Pigford, University of California, Berkeley (retired)
Jonathan Price, Nevada Bureau of Mines and Geology
Chris Whipple, ICF Kaiser, Inc.
Gilbert White, University of Colorado
Jeffrey Wong, California EPA

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Kai Lee, appointed by the Commission on Geosciences, Environment, and Resources, and Donald Horning, appointed by the Report Review Committee, who were responsible for making certain that an independent examination of this report was carried out in accordance with NRC procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the NRC.

Mr. BARTON. So it doesn't appear to me that there is a lot of support out there among the groups that have shared responsibility or have at least an interest in this issue, supporting the separate standard. And in the face of this, I mean, this isn't a Congressman that is out to make a political statement. These are on-the-record comments by official agencies of the U.S. Government that have the scientific and technical background to comment on this proposed separate groundwater standard. Given that, wouldn't it be at least possible for EPA to consider going back to an all-pathway standard and to back away from this separate groundwater standard?

Mr. PAGE. Mr. Chairman, we will be discussing that in the interagency process. I think you have in this hearing correctly identified the scientific concerns with the groundwater protection policy that EPA proposed. There are other reasons, other policy issues. That is coming up in terms of discussion across the agencies as to why that was done, what the rationale is for it; and, yes, it will be considered or reconsidered, yes.

Mr. BARTON. Now, Mr. Burr talked about in his questions that the science on which the 4 millirem groundwater standard is based is old science. Sometimes old is good. Old is not necessarily bad. I am 50, and I think old is good. But sometimes, in the scientific arena, old is not automatically good. You mention that there is a revision under way in the science. When do you think that might actually come to fruition, that you will have new data on which to look at groundwater standards?

Mr. PAGE. That is handled by another office. I can't say exactly when.

Mr. BARTON. Within EPA.

Mr. PAGE. Yes, sir, within EPA. My sense is that this would be looked at and revised prior to any final decisions on Yucca, the licensing.

Mr. BARTON. Within the next year, next 6 months? Give us some—you are not under oath.

Mr. PAGE. I understand that.

Mr. BARTON. No danger here.

Mr. PAGE. I know in discussions that we have had internally that the Office of Water is aware of the need to update this. They are aware of what the concern is as—specifically as it pertains to Yucca Mountain, and they have committed to getting that under way. I have not seen it, I am sorry to say. I can get back to you as to when that might be, but I have not seen what their schedule is.

Mr. BARTON. Dr.—I may say your name wrong—Knopman. I got it right then. You have been very quiet in this whole thing. But you represent the Technical Review Board, and you actually have a background, as I understand it, in some of this scientific area that is under discussion. What would your committee's recommendation be that you serve on today as to the need for a separate groundwater standard at Yucca Mountain? I think you all are on record that you don't need that separate standard, but I want to give you a chance to correct me if I am wrong about that.

Ms. KNOPMAN. Thank you, Mr. Chairman. I didn't mean to be quiet; nobody called on me.

Mr. BARTON. In this kind of a group, you have got to stand up. You can't just be shy and retiring or they will never let you talk.

Ms. KNOPMAN. I am not shy and retiring.

The Board is very careful to stay on the side of technical judgment as opposed to policy judgment. So the Board has not made a statement on the appropriateness of including a separate groundwater standard. The Board, however, from a technical perspective, does believe that we need a better understanding of what the background levels are at the Yucca Mountain site.

Mr. BARTON. The natural background.

Ms. KNOPMAN. The natural background levels. And it is also, I guess, somewhat a matter of debate now as to what kinds of levels of dilution might occur in the saturated zone, the groundwater that would be likely to be tapped into as a resource. The assumptions made about how much dilution there might affect whether or not that standard—how that standard might be met or not. However, the Board has stayed out of this question as it is, in the end, a policy judgment.

Mr. BARTON. But doesn't the Board, if not have an obligation, wouldn't they want to take a position? Because, you know, some of these things are political. I mean, the Nevada delegation, they are going to be against it for political reasons. The industry—the private utility industry that has the waste stored all over the country, they are generally going to want to be for it just to get it solved. But it is the technical—the country, you know, puts faith in the technical experts. When we talk about science, it is assumed that scientists are not political, that scientists are purely objective, that scientists only make decisions based on hard facts. And you know that is not true. Scientists can be very political.

But in this case the Technical Review Board is tasked with being the least political of the group. So if we are going to have a scientific debate about separate groundwater versus all pathways, I would think the Technical Review Board position would be listened to and given great credibility by all sides.

Ms. KNOPMAN. The Board is, I would say, is most concerned about what is the practical difference between an all-pathways standard and a separate groundwater protection standard. In the context of the overall uncertainty of our estimates, we are talking about a 10,000 year compliance period. The difference between 25 millirem, for example, on the individual pathways standard and the 15 millirem is insignificant relative to the overall uncertainty in our estimate.

Mr. BARTON. I agree with that.

Ms. KNOPMAN. So the question is, how close does a 4 millirem separate groundwater standard end up coming within that same range of or order of magnitude as the individual pathways? The Board will need to, I think, do further analysis to understand better the point that Dr. Paperiello made about how that standard in fact translates at the 10,000 year level, but we have not at present undertaken such analysis.

Mr. BARTON. Let me ask you one more question. Then I will go to Mr. Shimkus.

Has the Technical Review Board taken a position on whether you should have a repository that cannot be reopened, that the material

cannot be retrieved, versus a repository that if the technology changes, if there is a scientific breakthrough, you could go in and a hundred years from now or 200 years from now or 500 years from now use the best science available at the time to control this material?

Ms. KNOPMAN. I think the board has operated on the assumption that virtually any kind of repository will be—waste would be retrievable. It is just a matter of the degree of difficulty.

Mr. BARTON. The current proposal, though, is that it is not.

Ms. KNOPMAN. It is a matter of difficulty. You would mine it out. It might be very hard.

But the Board has spoken before on the need for flexibility in designs and the need for performance confirmation testing, which means that even if a decision is made to proceed with this, with construction and with placement of waste, that there be continuous monitoring, particularly in the time——

Mr. BARTON. You see, I have made comments to local officials in Nevada that I think we should have the flexibility that if we can find better science, find better ways to monitor, whatever we can do that, build that in. So the bill that is going to come out of the subcommittee next year, if I am the chairman still, is going to put that flexibility back in, as opposed to the current situation where we put in there we lock it up, we post it and we walk away from it. So that might be something to have your board take a look at.

Ms. KNOPMAN. It continues to be an open question as to how long the repository would stay open. I believe the document did assume a 50-year closure period or that the repository would be closed after 50 years. I am not sure that——

Mr. BARTON. We want to limit—don't misunderstand me. We want to limit the amount of material that is in this repository. We don't want to leave it open-ended that you could put more material. But to satisfy the concerns that Congresswoman Berkley had, you know, you can't have absolute certainty for 10,000 years, but you should be able to build in flexibility so if we could figure out a better way to maintain it, dispose of it, to control it, we ought to have the ability to use the best available technology a hundred years from now, 200 years from now, whatever. That is my only point.

The gentleman from Illinois.

Mr. SHIMKUS. Thank you, Mr. Chairman.

I just stepped out of the room to call my chief of staff to see if it was—to get his recommendation whether I would be able to stay around for a second period of questioning. He gave me a recommendation. He said yes. The schedule looks like you can do it. No one is at the door.

And, Dr. Itkin, you need to get better at this business. I think most of us find it very incredulous that something as important as a humongous, large contract—that the person in charge did not give a yes or no, I support this. And I don't know—and I don't think anybody in this room believes that you did not give a yes or no—yes, I support them; or, no, I don't. So, I would just respectfully request next time, when we review this again, that we fully vet out this and—and there is responsibility.

It was just a very bad display of the worst problems of bureaucracy is no one wants to be held accountable or responsible.

Mr. ITKIN. Congressman, if I may respond, because since we—I gave my response, I have since learned that, in fact, there was a memorandum written prior to my——

Mr. SHIMKUS. We thought there would be.

Mr. ITKIN. What I am saying is I did not know. I learned now there was a memorandum written several months before my arrival that was from my office and my deputy, recommending a 10-month delay in the recompete. And if I could yield, if it would be appropriate, I could yield to the person who served as the acting director during that time period.

Mr. SHIMKUS. I will let the chairman—I have some important questions that I want to get on to for the record. That satisfies my line of questions and I am glad that we were able to go through the paperwork and get an answer to that question, unless the chairman wants to jump in here.

Mr. BARTON. I was actually in a staff consultation.

Mr. ITKIN. I just want to advise the Chair that since we had that conversation on the decision on the recompete, I have been told that prior to my arrival at the Department, that—in this position—that there was a memo written to the Secretary from the previous director, acting director, to recommend a 10-month delay.

Mr. BARTON. Ten month delay in recompeting the contract?

Mr. ITKIN. Yes, recompeting the contract. As a matter of fact, if I might, may I allow my deputy who served as the acting director to comment at this time?

Mr. BARTON. I tell you what, let's let Mr. Shimkus get all of his questions. I will come back on that because I have a few more questions on that point. So if we will just delay until Mr. Shimkus gets his questions in, and you will have more than adequate opportunity, and I will give you some other opportunities to comment on that.

Mr. SHIMKUS. Thank you, Mr. Chairman. The scientific community that is present here, do we accept the initial premise of the storage site that it would be a permanent geological repository? And if we could go down the table. Obviously, that was put into question by our previous panel. I would like for you all representing the different agencies and scientific community—is the premise still a permanent geological repository?

Mr. PAPERIELLO. That is the Commission's position, a permanent geological repository.

Mr. SHIMKUS. Thank you. Dr. Itkin?

Mr. ITKIN. That is the position of this administration.

Mr. SHIMKUS. Great. Dr. Knopman?

Ms. KNOPMAN. The Nuclear Waste Board oversees the work of the Department of Energy, and if they are working on a permanent repository, so are we. And I would just add, though, that a permanent geologic repository is largely an international consensus among many other countries that have nuclear waste and are also pursuing this.

Mr. SHIMKUS. Thank you. And again, that is the importance of coming and that is new information that I did not know. Mr. Page?

Mr. PAGE. Yes, sir, the standard that EPA will be developing will be assuming that it is a permanent repository.

Mr. SHIMKUS. Dr. Crowley?

Mr. CROWLEY. The Board of Radioactive Waste Management has looked at aspects of the Yucca Mountain repository in the past and it is the Board's understanding that the DOE is working toward a permanent repository.

Mr. SHIMKUS. If I have time I may go back to that, but I want to ask another question. Based upon the history of the transportation of nuclear waste currently, is it the scientific community's view that it can be done safely today?

Mr. PAPERIELLO. Yes.

Mr. SHIMKUS. Dr. Itkin?

Mr. ITKIN. Yes.

Mr. SHIMKUS. Dr. Knopman?

Ms. KNOPMAN. Yup—yes, there have been.

Mr. SHIMKUS. I like "yup." That is a better one.

Ms. KNOPMAN. There have been numerous analyses that have showed low levels of risk under both normal and accident conditions. The safety record has been good to date and corroborates the low risks. And there has been fuel shipped safely for many decades.

However, that does not mean the transportation problem is done with. There are lots of issues relating to emergency response and management and coordination and some further testing that the Board has recommended.

Mr. SHIMKUS. Before I go to Mr. Page, I would have a little comment. I think Congress understands the need to help local communities be prepared to respond, and this whole appropriation issue and the transportation issue is up for debate. But I appreciate that response. Mr. Page?

Mr. PAGE. We believe it can be done safely with the proper——

Mr. SHIMKUS. Dr. Crowley.

Mr. CROWLEY. The national academy doesn't have a position on that, but in fact it is being done safely today.

Mr. SHIMKUS. Mr. Chairman, I would like to go one more, but I will defer if we are out of—Dr. Knopman, in the discussion you mentioned about the science and the possibility of the dilutions of the rem standard, but I did not hear you talk about what Mr. Page had mentioned was a possibility of a re—my terminology is poor and I apologize for that—but the reconcentration of that, of a larger millirem than the initial position. Is that scientifically possible? Is that a criteria that is accepted in the scientific community?

Ms. KNOPMAN. What is—the dilution is the direction in which the plume and the concentration of radionuclide would proceed. However, what Mr. Page was referring to is that depending on how the radionuclides are transported in the groundwater system, they may remain in fairly concentrated plumes even at significant distances from the repository itself. So if you happen to stick a well right into one of these concentrated areas of the plume downstream, you would get a higher concentration than you might closer to the repository, but where there has been more dispersion.

Mr. SHIMKUS. I will finish up with this. Is the real debate, Dr. Itkin, on this millirem standard, the fear of because of the higher standard, there is going to be an increased cost to the facility which, based upon all the budgetary constraints that the ranking member mentioned, could astronomically increase the already tre-

mendous cost burden to the taxpayers, that through the rates have done to provide this location?

Mr. ITKIN. Well, that is a concern, that anytime you have a very difficult standard to meet, that you have to provide additional barriers, additional protections to guarantee that to occur. And so, yes, there are additional costs associated with very demanding standards.

But more of a concern, or at least equal or a greater concern, is the fact that if we have a zero tolerance for leakage, we probably cannot succeed here with the licensing process. And so it would be a killer.

Mr. SHIMKUS. Thank you, Mr. Chairman, I yield back.

Mr. BARTON. Thank you. This is going to be the last question period because we have two pending votes on the floor and you all have been here for 3½ hours, so we will let you go pretty quick. The first thing I will do is ask unanimous consent to include in the record a letter from the Health Physics Society dated November 24, 1999, and it is to the United States Environmental Protection Agency. And I am told this has been cleared by the minority. So I am the only one here so I am not going to object. But obviously, we are not going to do anything that is not in good faith with the minority.

[The information referred to follows:]

HEALTH PHYSICS SOCIETY
November 24, 1999

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Central Docket Section (6102)
ATTN.: Docket A-95-12
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460-0001

SUBJECT: The Health Physics Society's Comments on Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Proposed Rule

DEAR SIR OR MADAM: On behalf of the Health Physics Society (HPS), of which I am President, I am writing with comments and recommendations regarding Environmental Radiation Protection Standards for Yucca Mountain, Nevada, 40 CFR Part 197, promulgated in Federal Register Vol. 64, No. 166, August 27, 1999. These comments and recommendations were prepared by the Society's Legislation and Regulation Committee.

The HPS is a professional organization of approximately 6,000 scientists, educators, engineers, and operational health physicists who are dedicated to developing, disseminating, and applying scientific knowledge of, and the practical means for, radiation safety. The primary objective of the Society is to protect people and the environment from potentially harmful exposure to ionizing radiation. The Society concerns itself with understanding, evaluating and controlling the potential risks from radiation exposure relative to the benefits derived.

The Society's working principle is to keep radiation exposures from justified "beneficial" practices as low as is reasonably achievable. This basic tenet of radiation safety has resulted in an exceptional history of safety and will continue to do so as we address the important issue of high level radioactive waste (HLW) in the Yucca Mountain repository.

In this context, the HPS appreciates the opportunity to comment on the United States Environmental Protection Agency's (EPA) "Standards for Yucca Mountain, Nevada; Proposed Rule". The HPS believes that these standards are precedent-setting and likely to have profound impacts on future activities and standards, not only for radioactive waste, but also for non-radioactive hazardous materials. The HPS also believes that promulgation of the Yucca Mountain Standard (40 CFR Part 197) is fundamental to helping resolve some of the public safety issues being encountered at our nation's nuclear power reactors. With the operation and decommissioning of commercial nuclear reactors, a final repository for spent fuel and other HLW is vital

to the public safety and health from existence of the nuclear fuel cycle. Numerous stakeholders have proposed that allowing indefinite storage of spent nuclear fuel at operating and decommissioned facilities is an option. However, the HPS believes that such an option avoids, rather than offers a solution to the HLW disposal issue. In addition, it ignores the legal obligation of the federal government to take possession of, and provide for safely disposing of spent nuclear fuel, not only from nuclear power reactors, but also from our national defense program.

For these reasons, the HPS encourages the EPA to move forward expeditiously with issuing 10 CFR 197 as a final rule. However, we urge the EPA to consider changes to its proposed rule, as discussed below, to ensure that the final rule is:

1. focused on protection necessary for public health and safety;
2. consistent with applicable recommendations of relevant national and international scientific advisory organizations; and
3. in full compliance with statutory requirements.

The HPS believes that the proposed use of a separate ground-water protection requirement is: 1) not necessary to ensure protection of public health and safety, 2) inconsistent with applicable recommendations of scientific advisory bodies, and 3) contrary to statutory requirements.

Including a separate ground-water provision will detract from the rule's primary purpose and focus on public health and safety. A limit on dose received by an individual from all exposure pathways, as included in the proposed rule, is fully protective of public health and safety. The EPA's stated purpose for use of a separate ground-water provision, i.e., to protect ground water as a resource, does not meet the purpose of the regulation, which is "protection of the public from releases to the accessible environment from radioactive materials stored or disposed of in the repository." [1]

The proposed provision for groundwater protection utilizes maximum contaminant levels (MCLs) from EPA regulations implementing the Safe Drinking Water Act. The MCLs for radionuclides proposed for use in the rule are generally based on an outdated and superceded scientific understanding of radiation risk. The MCLs implied in this rule equate to a wide range of dose values (ranging over more than two orders of magnitude), that will be considerably more restrictive in some cases, and considerably less restrictive in others cases, than the proposed all-pathways individual dose standard. Therefore, the use of the MCLs will effectively over-ride the individual dose standard that is the essential element of the proposed rule.

The use of a separate ground-water provision is not consistent with the recommendations of the relevant national and international scientific advisory organizations, including the National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the International Atomic Energy Agency (IAEA). As endorsed by the EPA's Presidential Guidance of 1987, these organizations unanimously endorse the use of individual dose limits, taking into account all exposure pathways, to assure protection of public health and safety. Further, the use of a separate groundwater provision ignores the recommendations of the National Academy of Sciences (NAS) committee that was established by statute to make recommendations on the scientific basis for a protective radiation standard for the Yucca Mountain repository. The NAS committee specifically did not use a separate groundwater provision because the committee "based our recommendations on those requirements necessary to limit risks to individuals." [2]

Finally, the proposed use of a separate groundwater provision is contrary to statutory requirements. The Energy Policy Act of 1992 requires that the EPA "shall, based upon and consistent with the findings and recommendations of the National Academy of Sciences, promulgate, by rule, public health and safety standards for protection of the public [that]... shall prescribe the maximum annual effective dose equivalent to individual members of the public... and shall be the only such standards applicable to the Yucca Mountain site." The NAS committee found that a health standard based upon doses to individual members of the public will provide a reasonable standard for protection of the health and safety of the general public. Therefore, the use of a separate groundwater standard, as proposed by the EPA, would be in direct conflict with the statutory requirement that an individual dose standard be the only such standards applicable to the Yucca Mountain site.

The HPS believes that a 250 μSv (25 mrem) all-pathways individual dose standard will be fully protective of public health and safety and is con-

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[1] From Section 801 of the Energy Policy Act of 1992.

[2] "Technical Bases for Yucca Mountain Standards," National Research Council Committee on Technical Bases for Yucca Mountain Standards, National Academy Press (Washington, DC 1995)

sistent with recommendations of relevant scientific advisory organizations and national and international regulations.

In its request for public comment, the EPA has noted that "...some countries have individual protection limits higher than we have proposed [and] other Federal authorities have suggested higher individual dose limits with no separate protection of ground water." The EPA has requested comments specifically on the use of an annual Committed Effective Dose Equivalent (CEDE) limit of 250 μSv (25 mrem), rather than the proposed annual CEDE limit of 150 μSv (15 mrem).

International and national scientific advisory organizations, including the NCRP, ICRP, and IAEA, have recommended an annual limit of 1,000 μSv (100 mrem) Effective Dose Equivalent (EDE) as suitably protective to members of the public from exposure to all non-medical, man-made sources combined. (The EDE is inclusive of the CEDE). As stated earlier, this recommendation has been endorsed in Presidential Federal guidance as proposed by the EPA, and has been adopted in federal regulations.

A 250 μSv (25 mrem) CEDE standard for Yucca Mountain would represent a small fraction of the nationally and internationally accepted annual limit of 1,000 μSv (100 mrem) EDE and is consistent with the source-specific limits in other Federal regulations, as well the regulations of many other countries. It also represents a small fraction of the average exposure of 3,000 μSv (300 mrem) per year received by members of the general population in the U.S. from background radiation. For these reasons, the HPS believes that a 250 μSv (25 mrem) standard for Yucca Mountain is fully protective.

The justification provided by the EPA for proposing an annual CEDE limit of 150 μSv (15 mrem) is not convincing. The EPA states that it is based upon a review of various guidance, regulations and standards, as well as the NAS report. However, the majority of the references cited include an EDE of 25 mrem. Further, the EPA compares the proposed standard for Yucca Mountain with the 10 mrem per year limit in the National Emission Standards for Hazardous Air Pollutants (NESHAPS). However, the NESHAPS are used to regulate emissions from a large number of existing sources that represent actual exposures to the general population of the U.S., while the Yucca Mountain standard will be used to set an upper bound for analysis and assessment of hypothetical exposures to a postulated group of individuals over the next 10,000 years.

The EPA clarifies that the existing 25 mrem per year limit for the Uranium Fuel Cycle (40 CFR 190), based on ICRP-2 dose methodology, "is essentially equivalent to the risk associated with [the] proposed limit of 150 μSv (15 mrem)...[which] corresponds approximately to an annual risk of 7 chances in 1,000,000." There is an implication that there a is risk-based distinction between a 25 mrem per year and 15 mrem per year limit. The HPS has taken the position that this type of risk assessment should not be used at the levels of exposure being considered in this proposed rule. We believe that at these levels there is not a scientifically-validated basis for reaching conclusions about differences in implied risk. A copy of the HPS Position Statement, "Radiation Risk in Perspective," is enclosed.

Finally, the EPA has not provided any analysis of the costs associated with meeting a 150 μSv (15 mrem) versus a 250 μSv (25 mrem) standard as balanced against an expected increase in health and safety benefit. Even at the 250 μSv (25 mrem) standard, a number of conservatisms will necessarily have to be introduced in the licensing application to address the uncertainties and limitations in modeling for predicting potential exposures over such long time periods (e.g., 10,000 years). However, the incremental difference in costs associated with incorporation of additional conservatisms for a 40% lower limit could be enormous, without any demonstrated benefit to health and safety.

The HPS believes that the final rule should employ the use of the concept of the "average member of a critical group" for applying the individual dose standard, because it is more consistent with national and international regulatory practice, as well as with specific recommendations of the NAS committee, and will help avoid unnecessary conservatism in dose analysis and assessment for the licensing process.

The NAS committee recommended use of an "average member of a critical group" for applying the individual dose standard. The critical group concept is consistent with the recommendations of the ICRP and reflects standard national and international practice in the area of radiation protection. The EPA justifies its proposed alternative approach, the 44 reasonably maximally exposed individual [RMEI]," as an agency preference that is consistent with its practices in other EPA programs. However, this concept has not been incorporated in an NRC licensing process, which is where the final rule will ultimately be implemented. The HPS believes that it is neither prudent, nor necessary, to invoke this application in this rule, especially

when the EPA has noted that the RMEI "provides a level of protection substantially equivalent to that which would be achieved by the [critical group concept]."

The extensive explanation provided by the EPA in the proposed rule regarding how the concept is to be applied goes well beyond the statutory authority assigned the EPA in the Energy Policy Act, since the implementing authority is reserved exclusively for the NRC. Accordingly, we recommend that the EPA limit the approach provided in the final rule to endorsing the ICRP-based critical group concept as recommended by the NAS committee.

In summary, the HPS believes that adopting these recommended changes will result in a rule that will be more effective in ensuring protection of public health and safety. The HPS also believes it will be more suitable in supporting implementation of the national policy for safe disposal of spent nuclear fuel and high-level waste in a deep geologic repository.

Sincerely yours,

RAYMOND H. JOHNSON, JR., C.H.P., P.E.
President

Mr. BARTON. The Health Physics Society is a professional organization of 6,000 scientists, educators, and engineers and operational health physicists who are dedicated to developing and disseminating scientific knowledge of and the practical means for radiation safety. The Society's principle is to keep radiation exposures from justified—and I quote—beneficial practices as low as is reasonably achievable. So this is 6,000 scientists, educators, and engineers. And they sent this letter to the EPA on November 24th, 1999.

I will put the entire letter in the record but I am going to read the key paragraph. It says the HPS believes that the proposed use of a separate groundwater protection requirement is, one, not necessary to ensure protection of public health and safety; two, inconsistent with applicable recommendations of scientific advisory bodies; and three, contrary to statutory requirements.

So it would seem to me, Director Page, that this is yet one more indication that this policy of EPA to have a separate standard is not supported in the scientific community. Do you have any comment on this—you have not—we did not give you a chance to look at this letter before the hearing. So I am not going to ask you to comment on the specifics of it. But I mean, I would assume that your people are generally aware of this letter. Okay.

You testified earlier in a question, in response to a question that I asked you, that EPA is in the process of updating the science on the maximum contaminant level for the Safe Drinking Water Act requirements, and I thought you told me that EPA was not going to issue a radiation standard for Yucca Mountain until that new science has been assimilated within the EPA. But I want to give you another chance to say that. Did you say earlier that you were going to wait until you get the new science in place before you—if you are going to continue to propose a groundwater standard? Or is the agency going to go ahead and try to promulgate a groundwater standard sooner than that?

Mr. PAGE. Thank you for the opportunity to clarify that. Mr. Chairman, what I did say is that we were in the process of updating the science behind the MCLs. What I also said, which is different from what you were asking——

Mr. BARTON. That is why—I thought I heard you say one thing and the staff heard you say another.

Mr. PAGE. What I said was that I believed that the—when you were asking me a specific time when it was going to be done, it was my confidence that that process would conclude prior to any final

decisions, licensing decisions by the NRC, that they would make so that process would not get in the way.

Can I make one more clarification that I think is important for you to know? Using the only sciences, which is what we did when we developed our proposals, and using certain scenarios that we proposed in the groundwater or in the proposed rule, the assessments that the Department of Energy has done and the viability assessments and subsequent analysis that they have done shows that they can make the licensing. So I think that is an important clarification.

We do intend to update those MCLs and do intend to have larger discussions on groundwater across the Federal agencies, but I just want to tell you—I am getting a sense that you are concerned that we might be in the way or driving costs up unnecessarily and based on the analysis done to date, we are not one of the more important factors in there in terms of what we are——

Mr. BARTON. There was only a veto threat on the bill for this particular standard. I would think that certainly could be construed as being in the way, or at least being a factor, since the President of the United States said if you did not have this 4 millirem groundwater standard he was going to veto the bill. I kind of think that is a factor.

Mr. PAGE. What I understood the veto was, there is an objection taken, among other things, to eliminating the role that the Environmental Protection Agency would play, or a delay. That is my understanding. I don't remember the 4 millirem being part of the Presidential veto.

Mr. BARTON. Well, maybe I misunderstood that. There were only three Presidential veto threats on the House-passed bill. This is one of them.

I want to go back to Dr. Itkin. The dialog that we had about recompete, it would be helpful if the Department of Energy could give to the committee all documents that were prepared before the Secretary of Energy made the decision to recompete. You mentioned one document that the acting director made. If there are other documents—now, we will send you a letter and we are real good in drafting our letters, any and all, la-dee-da-dee-da. I used to be oversight chairman, so I guarantee you that I can get you a letter that covers the bases. Just—you generally said that most of the debate within the Department was more of a verbal nature between the Secretary and various people on the issue. But to the extent there were written documents—you mentioned one—we would like to have that one, plus any other documents before the Secretary made the decision. Is that understood?

Mr. ITKIN. That is understood.

[The response had not been received at time of printing.]

Mr. BARTON. Now, on that point, it is not generally a bad thing to recompete contracts. Competition is good. It is not bad. In this particular contract, since the critical path is critical, it really seems inconsistent to, if you are trying to meet your milestones, to go into a recompetition mode right when it is time to make some of those decisions.

Now, I understand that there are three groups competing. One is the existing group, TRW in conjunction with Parsons Brinckerhoff, I think. You are——

Mr. ITKIN. No, that is true.

Mr. BARTON. I am getting—one the gentleman behind you is shaking his head and you are doing this. There is a little dichotomy there, but that is understandable. Hopefully it will not delay the decision. But—the decision on whether to go ahead or not go ahead and meet these critical path requirements that you have got to meet in the next year and a half.

But I want to be on the record explicitly, if we get some song and dance next year that they are going to have to slip the milestone because of the recompetition, this subcommittee is going to be very, very upset. And I know you share that concern. I know you share that concern; you are just being a real team player here and not being as open as you could be if this was a private conversation as compared to a public conversation.

Here is what I want the Department of Energy to do between now and next year, if at all possible. The subcommittee would like to see a proposal on funding to fully fund the construction phase of the depository. Not just that it needs to be done, but work with the minority, work with the majority, come up with a proposal that we can put into a bill that the Department will support. Okay?

I would like for the entire scientific community, if it is at all possible between NRC and EPA and the technical review committee and everybody else, to let's solve this separate versus all pathways. The average citizen does not understand that from Adam. If, in fact, the scientific community wants to be scientific, we ought to be able to resolve whether you need an all-pathway standard or you need a separate groundwater standard, and it would be very helpful to have a meeting of the minds on that.

And then we would obviously like to make sure that—this is on the technical review board—any outstanding issues that have not been addressed in the review board's opinion, we need to get those explicitly put forward so that the Congress can demand the Department of Energy and EPA and the various Nuclear Regulatory Commission address those issues.

We have been messing with this for 18 years. It is really time to make a decision one way or the other on this. And the timeframe is the next 18 months, which means the next 6 months of the next Congress we are going to have a new President; maybe President Gore, maybe President Bush, but we are going to have a new President. Now is the time to really bring all of this to fruition, make these decisions, and go forward.

And so with that, I am going to adjourn the hearing. I want to thank our witnesses. These are productive. I want to alert our EPA, NRC, and DOE folks we are going to have a very extensive list of written questions and we are going to ask that we get answers within a month of when you get the questions. Okay?

Thank you, gentlemen, and thank you, lady, and this hearing is adjourned.

[Whereupon, at 1:25 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows:]

THE NATIONAL ACADEMIES
BOARD ON RADIOACTIVE WASTE MANAGEMENT
August 18, 2000

The Honorable JOE BARTON
Chairman
Subcommittee on Energy and Power
Committee on Commerce
U.S. House of Representatives
Room 215 Rayburn House Office Building
Washington, D.C. 20515-6115

DEAR CHAIRMAN BARTON: In response to your letter dated July 20, 2000, I am enclosing responses to your follow-up questions from the June 23, 2000 hearing on radiation protection standards for Yucca Mountain. Please do not hesitate to contact me if you need additional information.

Sincerely yours,

KEVIN D. CROWLEY
Director, Board on Radioactive Waste Management

RESPONSE TO QUESTIONS REGARDING THE JUNE 23, 2000 HEARING ON YUCCA MOUNTAIN RADIATION PROTECTION STANDARDS

NOTE: THE FOLLOWING THREE REFERENCES ARE CITED IN THIS DOCUMENT:

1. Environmental Protection Agency [EPA], 1999: Environmental Radiation Protection Standards for Yucca Mountain, Nevada, Proposed Rule: 64 Federal Register 46976-47016 (August 27, 1999). This document contains EPA's proposed radiation-protection standard for Yucca Mountain.
2. National Research Council [NRC], 1995: Technical Bases for Yucca Mountain Standards: Washington, D.C., National Academy Press. This report was written for EPA at the request of the U.S. Congress and contains the National Academies' findings and recommendations on radiation-protection standards for Yucca Mountain. This report is referred to as the "TYMS report" in this document.
3. National Research Council [NRC], 1999: Comments on Proposed Radiation Protection Standards for Yucca Mountain, Nevada by the Board on Radioactive Waste Management: Washington, D.C., National Academy Press. This report provides a comparison of the proposed EPA standards with the findings and recommendations in the TYMS report. It is referred to as the "BRWM report" in this document.

Question 1: Please elaborate on the reasons for the Board's opposition to EPA's proposed separate 4 millirem groundwater protection standard.

Response: The Board on Radioactive Waste Management [BRWM] has not taken a position either in favor of or in opposition to EPA's proposed groundwater standard for Yucca Mountain. Rather, the BRWM has stated (NRC, 1999, p. 11) that it "does not believe there is a basis in science for establishing such limits" to protect public health. The TYMS report (NRC, 1995) concluded that an individual-protection standard would be sufficient to protect public health from a repository at Yucca Mountain.

In my written testimony to the subcommittee, I explained why there is no scientific basis for the proposed groundwater standard. EPA made what appear to be several arbitrary modifications in applying its safe drinking water regulations (40 CFR 141) to Yucca Mountain. In particular, the groundwater standard in EPA's safe drinking water regulations applies to water delivered at the tap through a public water system, whereas the proposed groundwater standard for Yucca Mountain will be applied to a volume of groundwater in an aquifer some 2,000 feet below the Earth's surface at some as-yet undetermined distance from the repository. Second, the groundwater standard is based on a different level of risk than the individual-protection standard and, for some radionuclides, may actually provide more protection to groundwater than the individual-protection standard provides to people.

In my written testimony I also suggested how EPA could justify a separate groundwater standard for Yucca Mountain based on science: namely, by adopting the risk-based approach recommended in the TYMS report (NRC, 1995). I noted that if EPA based its Yucca Mountain standards on a *single value of acceptable risk,* it could express that risk in terms of two elements, one for radiation exposures through the groundwater pathway (a groundwater standard) and one for exposures through all pathways (an all-pathways standard). These two elements would be scientifically consistent so long as they are based on a single value of acceptable risk. To implement this approach, however, EPA would have to modify the dose limits for the all-pathways and groundwater standards that currently exist in its proposed rule so that they represent the same value of acceptable risk.

Question 2: I understand that one of the first radionuclides that could be released from the repository would be iodine-129. What is the health risk associated with a 4 millirem dose from iodine-129? Is this within the risk range recommended by the National Academy of Sciences? Are there other radionuclides that would fall outside the NAS's recommended risk range under EPA's proposed groundwater standard?

Response: I cannot provide the subcommittee with a direct answer to this question. The BRWM has not performed a detailed examination of the health risks associated with a 4 millirem dose from iodine-129 or any other radionuclides associated with EPA's groundwater standard. Moreover, given that the groundwater standard proposed by EPA is based on outdated dosimetry, as noted in the BRWM report (NRC, 1999, p. 12) and in my written testimony (p. 10), the risk values calculated by EPA may not be representative of actual risks.

Question 3: The Conference Report accompanying the 1992 Act read as follows: "The Conferees do not intend for the National Academy of Sciences, in making its recommendations, to establish specific standards for protection of the public but rather to provide expert scientific guidance on the issues involved in establishing those standards." The National Academy was not intended to usurp the EPA's rulemaking authority, but the direction to EPA is very clear in the 1992 law—the EPA Administrator is to set generally applicable standards for the Yucca Mountain site "based upon and consistent with the findings and recommendations of the National Academy of Sciences." Mr. Page suggested in his testimony the "EPA was to consider technical recommendations from the National Academy of Sciences." However, the law says "*based upon and consistent with*." In your view, are the proposed EPA standards based upon and consistent with the findings and recommendations of the National Academy of Sciences?

Response: As noted in NRC (1999) and in my written testimony to the subcommittee, many important elements of EPA's proposed standards are, either in design or implementation, based upon and consistent with the findings and recommendations contained in the TYMS report (NRC, 1995). These are discussed on pages 4-5 of my written testimony to the subcommittee and include *who is protected,* the *level of protection* for the individual-protection standard, *human intrusion,* and *exposure scenarios.* My written testimony also identified three elements of EPA's proposed standards that are not based upon and consistent with the recommendations in the TYMS report: (1) use of a dose-based standard; (2) the inclusion of a separate groundwater standard; and (3) the time period over which the standard should be applied. My written testimony explains the nature of these inconsistencies (see especially pages 6-13). The BRWM considers the first two of these inconsistencies to be very significant. The third inconsistency is less significant, as explained in my response to the last question in this document.

Question 4: The National Academy recommended that EPA adopt a *risk-based* standard for the protection of individuals, yet EPA proposed a *dose-based* standard. I recognize that the 1992 Act directed EPA to "prescribe the maximum annual effective dose equivalent to individual members of the public. That statutory language could be interpreted to merely dictate the final form of the standard, and certainly does not prevent EPA from using risk, as the National Academy recommended, to derive a final dose equivalent. Is EPA, in fact, using a risk level to determine the final dose?

Response: The BRWM noted (NRC, 1999, p. 4) that EPA did not use risk to establish dose limits for its individual-protection standard. Instead, EPA used dose-based standards that were carried over from existing regulations (40 CFR 191 and 40 CFR 141) and derived equivalent risk values through arithmetic conversion.

As noted in both the TYMS (NRC, 1995) and BRWM (NRC, 1999) reports, there is no scientific basis for setting a level of protection for either a dose- or risk-based standard. Rather, protection levels are a public policy decision, best established through rulemaking, based on the risk the public is willing to bear from radiation releases from a repository at Yucca Mountain. The TYMS report recommended (NRC, 1995, p. 64-65) that the Yucca Mountain standard be based on risk because (1) it would not have to be revised in subsequent rulemaking as scientific knowledge advances, and (2) risk is more readily understood by the general public than dose, and it provides a convenient way to compare hazards to public health from different sources.

The BRWM recognized (NRC, 1999, p. 6) that establishing a risk-based standard would be a major departure from current EPA practice and that it would be far more difficult for EPA to ask the public about acceptable risk than follow established precedents. Nevertheless, the BRWM strongly recommended (NRC, 1999, p. 7) that EPA adopt a risk-based individual-protection standard precisely because it requires public involvement in what is, fundamentally, an important public-policy decision.

Question 5: Could you please elaborate on the Board's concerns about the time period over which the radiation standard must be applied?

Response: In its proposed rule, EPA has asked for comments on two alternative standards for the period of compliance. The first alternative is essentially that proposed in the TYMS report (NRC, 1995) in which the period of compliance extends to the time of peak risk from repository releases. The BRWM has no concerns about this alternative, and in fact believes that its adoption would be consistent with the recommendations in the TYMS report (NRC, 1995).

The second alternative applies a quantitative dose limit for a period of 10,000 years, but it also imposes an additional requirement that repository performance be examined after 10,000 years to see if dramatic changes could be anticipated. The BRWM recognizes that EPA can choose, as a matter of policy, to adopt the 10,000-year limit in the second alternative. Nevertheless, the BRWM is concerned about this alternative because EPA provides no guidance on how the required analyses are to be carried out beyond 10,000 years or how the results are to be used in judging the acceptability of the repository. The BRWM noted (NRC, 1999, p. 13) that "to mandate that these results become 'part of the public record' but to give no indication of how they will be taken into account seems to postpone rather than solve problems associated with licensing and provide no real benefits to protection of the public." This is especially true given that peak doses from repository releases are likely to occur after 10,000 years.

The BRWM recommended (NRC, 1999, p. 13) that EPA either be more specific in providing guidance on how the analyses beyond 10,000 years should be used in determining compliance, or else explicitly pass the task for developing such guidance to the U.S. Nuclear Regulatory Commission, which is responsible for establishing regulations consistent with the final EPA rule.

Testimony for the Record

Statement of Joe F. Colvin
President & Chief Executive Officer
Nuclear Energy Institute

July 7, 2000

U.S. House of Representatives
Commerce Subcommittee on Energy and Power

My name is Joe Colvin. I am the President and Chief Executive Officer for the Nuclear Energy Institute. NEI sets policy for the U.S. nuclear energy industry, including 275 member organizations with a broad spectrum of interests, including every U.S. utility that operates a nuclear power plant. NEI also counts among its members nuclear fuel cycle companies, suppliers, engineering and consulting firms, national research laboratories, manufacturers of radiopharmaceuticals, universities, labor unions and law firms.

On behalf of the Nuclear Energy Institute, I would like to commend you, Chairman Barton, Ranking Member Boucher and the members of this subcommittee for focusing your attention on the Department of Energy's responsibility to manage our nation's used nuclear fuel and the nuclear byproducts of defense activities and evaluation of the suitability of locating a geologic disposal facility at Yucca Mountain, Nevada. America's program to manage high-level radioactive waste has tremendous implications on our energy policy as well as policy for environmental protection, national security, and economic development.

Nuclear energy generates 20 percent of the nation's electricity—enough energy to supply 65 million homes. Our nation's 103 nuclear power reactors have proven to be efficient, reliable and economical. They provide stability to the nation's power grid and produce about 70 percent of our emission-free electricity. The United States has the largest commercial nuclear power program in the world, with over 100,000-megawatts of generating capacity. U.S. companies are the global leaders in the development of nuclear power technology, including advanced reactor designs being built in Asian markets.

The nuclear energy industry has consistently improved the operation and efficiency of the nation's nuclear power plants. In it's more than 2,400 reactor-years of operation, the industry has compiled a safety record that is unparalleled. In 1999, nuclear power plants produced a record 728 billion kilowatt-hours of electricity, 53 billion kilowatt-hours more than the previous year. During the 1990s, the increase in electricity output from U.S. nuclear power plants was equivalent to adding nineteen 1,000-megawatt power plants to our nation's electricity grid. Last year's record performance capped the best decade in the industry's history, including a dramatic increase in nuclear plant average capacity factor—from 67.5 percent in 1990 to 86.8 percent in 1999. The result has been a growing number of policymakers, financial analysts and consumers who are rediscovering the benefits of nuclear energy.

The world population is likely to reach 10 billion people by the middle of this century. Three separate studies—by the World Energy Council, the International Energy Agency and the Department of Energy—predict that world energy demand may increase as much as 44 percent in the next decade, and by up to 98 percent by 2020. These same projections show that most of the increased electricity demand is likely to be met by power plants burning fossil fuels. The World Energy Council recently recommended expanding nuclear energy around the world because it is a clean source of energy.

Domestically, the digital age, with its rapid growth in the use of technology, will consume more and more electricity. Our ability to remain leaders in this age of information depends upon our ability to meet increasing energy demands.

Population growth and economic expansion have created a major dilemma for world leaders. We must simultaneously address both the burgeoning demand for electricity and a growing awareness of the need to provide energy in ways that will protect our air quality. Nuclear energy is the most effective method of protecting our air quality while producing massive quantities of electricity at a competitive price.

Nuclear energy's environmental and economic benefits cannot be fully realized unless Congress actively supports federal programs that will resolve the few remaining public policy challenges confronting the nuclear energy industry. One important outstanding issue—and unfortunately also a most intransigent one—is development of a federal disposal system for used nuclear fuel.

For the members of this subcommittee who may not be familiar with the operation of a commercial nuclear facility, used fuel from these plants consists of solid ceramic uranium pellets encased in zirconium alloy tubes called fuel rods. A typical nuclear power plant produces about 20 metric tons of solid used fuel each year. All of the used fuel produced by the nuclear energy industry in more than 30 years of operation—if stacked end to end—would cover an area the size of a football field to a depth of about four yards. This is not a physically huge problem. There is approximately 40,000 tons of used nuclear fuel being safely stored in temporary on-site facilities, but these facilities were not designed for permanent disposal.

Unlike many public policy matters, used nuclear fuel management is an issue on which there is a broad consensus. As has been the case since the 1950s, scientists today understand that deep geologic disposal of used nuclear fuel in an underground repository is the safest means of permanent disposal. Federal policymakers, scientists, state regulators, state legislators, governors, the nuclear energy industry, labor unions, business and the American people—all agree on the nature of the Energy Department's responsibility and on what must be done to ensure the successful development of a repository as soon as possible. That action must be taken now.

This year, Congress passed the Nuclear Waste Policy Amendments Act of 2000 by large bipartisan majorities. Although the industry is disappointed that President Clinton vetoed the legislation, we will continue to pursue public policy changes that will ensure that the Department of Energy fulfills its responsibility to manage used nuclear fuel safely and without further delay.

Congress Must Provide Accountability to Meet Yucca Mountain Milestones

This subcommittee is well aware of the history of the used fuel management program. Used nuclear fuel has been safely stored at nuclear power plant sites for decades with no impact on public health or the environment. However, the Department of Energy's program to manage used nuclear fuel is a chronicle of missed milestones and broken promises. The federal government has been responsible for permanent disposal of used nuclear fuel since Congress established the commercial use of nuclear energy in the Atomic Energy Act of 1954. In 1982, Congress passed the Nuclear Waste Policy Act, which assigned responsibility for management of used nuclear fuel from nuclear power plants to the Department of Energy. Congress was told by DOE that permanent disposal facilities

would be ready in 1998, and that date was written into the law. Electric companies were required to sign contracts with DOE for management of fuel in order to continue to operate their nuclear power plants.

The legislation also created the Nuclear Waste Fund to fully cover the costs of disposing of commercial used nuclear fuel. Since then, consumers of electricity from nuclear power plants have paid a surcharge of one-tenth of a cent per kilowatt-hour of electricity into this fund. To date, utility customers have committed more than $14.7 billion (including earned interest) for federal used fuel management. The federal government also has an obligation to pay its share of the cost of the repository. Radioactive byproducts from U.S. defense applications will account for approximately 10 percent of the material by weight and 30 percent by volume to be disposed at Yucca Mountain. Through 1999, $1.2 billion in defense funding had been appropriated for the Yucca Mountain project, but the defense commitment to the fund remains $1.5 billion in arrears. Significant increases in annual defense appropriations for Yucca Mountain in the near term will be needed to make up this shortfall.

Despite recent progress at Yucca Mountain, the Energy Department's program for developing a repository historically has been beset by chronic delays. And, despite a majority of Congress that supports legislation to reform this program and allow acceptance of used fuel at Yucca Mountain as early as 2007 if the site is licensed, the White House consistently has blocked these sensible efforts. The Department of Energy now says that a repository will be ready in 2010 at the earliest—12 years later than the law requires.

According to DOE's draft environmental impact statement for a Yucca Mountain repository, leaving used fuel at reactor sites is more expensive and less environmentally responsible than building the repository. Electricity consumers are being forced to pay twice to manage used nuclear fuel—once for expanding storage facilities at plant sites and again for the federal repository program. Moreover, the federal government could face a multi-billion-dollar liability for defaulting on its legal obligation to begin managing nuclear fuel in 1998. DOE delay could also result in used fuel and nuclear waste from America's defense programs continuing to be stored in 40 states rather than at a single, federal repository, where it would be more efficiently managed.

The completion of a federal disposal facility is one of the nation's top environmental priorities. Congress must ensure that the Energy Department meets the current schedule milestone for a July 2001 recommendation to the President on whether Yucca Mountain is suitable for a repository. Moreover, Congress should appropriate the necessary funding from the Nuclear Waste Fund to ensure that a repository is built and licensed to meet the scheduled milestones.

Scientific Studies Indicate Yucca Mountain Is Suitable Repository Site

The Energy Department has spent approximately $6.5 billion from the Nuclear Waste Fund to conduct world-class scientific research at Yucca Mountain. The result of this monumental research project is an impressive database that indicates that the site can be safely developed and operated for thousands of years. In a letter to President Clinton in December 1998, Energy Secretary Bill Richardson said: "Based on the results of the

viability assessment, the Department (of Energy) believes that scientific and technical work at Yucca Mountain should proceed." Richardson added that the viability assessment—a "road map" for work necessary to support a 2001 decision on whether to recommend that the President approve a repository at Yucca Mountain—"reveals no showstoppers."

The assessment noted: "Over 15 years of extensive research has validated many of the expectations of the scientists who first suggested the remote, desert regions of the Southwest were well suited for a geologic repository." The DOE analysis states that engineered barriers can be designed to contain used fuel for thousands of years, and that natural barriers, such as the geological makeup of Yucca Mountain, can delay movement and dilute radioactive material.

In 1999, DOE released the findings of a draft environmental impact statement on Yucca Mountain. As with the viability assessment, the results provided strong support for Yucca Mountain as the site for a federal repository. The Energy Department did not find any environmental factors that would disqualify Yucca Mountain as a site for a permanent repository or prevent the engineered facility from safely containing high-level radioactive waste for thousands of years. DOE's draft environmental impact statement concluded that the environmental impacts associated with building and operating a repository would be small—so small that it would have virtually no adverse impact on public health and safety. Radiation exposure thousands of years into the future is projected to be no more than one percent of natural sources.

Interim Steps Crucial To Keeping DOE Site Recommendation on Schedule

There are specific interim steps necessary to ensure that DOE remains on schedule to make a formal site suitability recommendation to the President in 2001. DOE repeatedly has stated that it will meet these program deadlines. For example, on June 23rd, Dr. Ivan Itkin, Director of DOE's civilian waste management program, told Congress that it should hold the agency accountable for maintaining the DOE timetable for building a repository at Yucca Mountain.

Among DOE's interim milestones are the following:

- **Siting Criteria:** By this fall, DOE is to specify the criteria it plans to use to make a recommendation to the President on whether to proceed with the development of Yucca Mountain as a federal repository.

- **Site Recommendation Considerations Report:** By December, DOE is to present the latest scientific information regarding Yucca Mountain to policymakers and the public to give adequate time for public input. This report will be essential to informing the public policy deliberations leading to the presidential site recommendation.

- **Inter-Agency Collaboration:** It is essential that DOE continue cooperative information sharing with the Nuclear Waste Technical Review Board, the Nuclear Regulatory Commission (NRC) and with the Environmental Protection Agency

(EPA). DOE will garner vitally important regulatory, scientific and technical input from these three groups. Frequent dialogue must be maintained throughout the course of this project.

- **Public Hearings on DOE's Site Recommendation Considerations Report:** Obtaining public input on this project is vitally important. Public hearings on the Site Recommendation Considerations Report must be scheduled and conducted in a timely manner to be completed by April 2001. It is DOE's responsibility to obtain public comments regarding Yucca Mountain so that they may be given full and complete consideration before the agency makes a formal site recommendation to the President.

- **Environmental Impact Statement (EIS):** DOE must address the voluminous public comments the agency received on its draft environmental impact statement, thoroughly review all input and issue a comprehensive, scientifically sound final EIS and record of decision on the Yucca Mountain project by July 2001.

- **Site Recommendation:** No later than July 2001, DOE must submit a scientifically sound recommendation from the Secretary of Energy to the President recommending whether to proceed with the repository project.

The scientific evidence to date strongly supports a decision to develop a repository at Yucca Mountain. However, if the agency's decision is to recommend against the site—it still is essential that the decision not be delayed. Should such a determination be the case, DOE must also inform Congress and recommend an alternative approach for the federal government to manage the disposal of civilian used nuclear fuel, as required by Section 113(c)(3)(f) of the Nuclear Waste Policy Act. We should not continue to spend billions of dollars on the Yucca Mountain project unless there is a reasonable expectation that it will be a safe, suitable site.

In the midst of this important phase of the Yucca Mountain project, DOE has chosen to "re-compete" the management and operations contract for the Civilian Radioactive Waste Management program, including the Yucca Mountain project. This decision by DOE should not be allowed to adversely affect the timely completion of DOE's work toward a site recommendation. Congress must provide continued oversight to ensure that DOE makes a transition in Yucca Mountain management and operation contractors in a manner that retains current milestones.

Ongoing congressional oversight is essential to prevent additional slippage in the schedule. The not-in-my-backyard opponents of the repository or those organizations seeking to eliminate nuclear energy welcome continued delay. It truly is ironic that some of the very same organizations expressing concern over greenhouse gases and global warming also are opposed to the one affordable, large-scale energy source that does not produce air pollutants—nuclear energy.

No matter how much scientific research has been completed, no matter how promising the results, it will always be possible to study and test more. Scientists are forever inquisitive, for every answer that their inquiries provide, new questions inevitably arise. That

scientists will continue to raise new questions is not problematic. Congress planned for this when it designed the deliberative approval process for Yucca Mountain in 1982. The presidential decision on the site recommendation is not the final decision. It merely moves the process to the next step.

At Yucca Mountain, the congressionally mandated process requires four major steps:

- First, the president must make a decision, based on the recommendation of the Secretary of Energy, on whether to proceed with the repository at Yucca Mountain.
- If this recommendation is favorable, DOE would apply to the Nuclear Regulatory Commission (NRC) for a construction permit for building the repository.
- Third, once construction is completed, DOE would request a license to operate a repository from the NRC. Repository operation is scheduled to begin in 2010.
- Fourth, in order for DOE to close the Yucca Mountain repository when the facility reaches its capacity and ongoing scientific testing is completed (projected to occur about 2050). DOE must obtain NRC authorization.

There will be ample opportunity for additional research and evaluation during each phase of repository construction and operation, and even after it closes. For example, before used nuclear fuel is permanently sealed in tunnels 1,000 feet under the surface of Yucca Mountain, it is possible that scientific advances could identify an improved technology for managing used nuclear fuel. DOE has discussed the possibility of extending the period before sealing the repository up to 300 years. However, this possibility should not be used as an excuse to delay the Yucca Mountain project.

After industry technical and scientific experts exhaustively reviewed the thousands of pages of documentation supporting DOE's Yucca Mountain viability assessment and draft environmental impact statement, and after many hours of discussion with DOE officials, the industry believes that there is sufficient data to justify moving to the next step in the process—a DOE site recommendation to the president in 2001. Congress should fully expect and ensure that a site recommendation is sent to the President by the 2001 deadline. This committee's leadership is needed to assure that this $6 billion repository project is completed in a timely and quality manner.

EPA's Proposed Radiation Standard Rejected by Scientists, Other Federal Agencies

The Energy Policy Act of 1992 requires the Environmental Protection Agency (EPA) to establish public radiation protection standards for a used nuclear fuel disposal facility at Yucca Mountain.. The law says the standard must protect health and safety of the public living in the vicinity of Yucca Mountain for at least 10,000 years. The law further requires the Nuclear Regulatory Commission (NRC) to implement the standard by incorporating it into licensing requirements for a repository.

Establishing a radiation protection standard is an essential component of safely and responsibly managing used nuclear fuel. However, in developing the standard for Yucca

Mountain, it is imperative that EPA adheres to specific instructions from the Congress and abide by the recommendations of credible scientific bodies. Unfortunately, this is not the case. Congress must ensure that EPA establishes scientifically sound radiation protection standards that protect public health and safety.

There is widespread disagreement between EPA and other federal agencies and between EPA and the National Academy of Sciences (NAS), about the appropriate level for a Yucca Mountain radiation safety standard. In the 1992 Energy Policy Act, Congress required EPA to "prescribe the maximum annual effective dose equivalent to individual members of the public as the only such standard applicable to the Yucca Mountain site," thereby excluding from consideration a separate groundwater limit. Scientists typically refer to this method of standard setting as an "all-pathways" approach—meaning potential radiation exposure from all sources (air, groundwater, the food chain, etc.) are calculated to determine the total public health and safety risk to those citizens most likely to be affected. This law also mandated that EPA's Yucca Mountain radiation safety standard be based on and consistent with the findings and recommendations of the NAS. However, EPA ignored both Congress and the NAS, and proposed a highly controversial and scientifically unjustifiable separate groundwater limit taken from the Safe Drinking Water Act. This was in addition to the EPA's proposed 15 millirem overall standard. By using an all-pathways standard, the groundwater can be protected at Yucca Mountain.

The NAS published its recommendations—*"Technical Bases for Yucca Mountain Standards"*—in 1995. NAS recommended a health-based individual protection standard without separate groundwater limits. The country's leading scientists felt that placing constraints on a single factor—such as groundwater—would detract from an all-pathways approach, which the NAS believes best protects public health and safety. If the EPA adopts its proposed groundwater standard for Yucca Mountain, the agency would ignore the advice of America's scientific experts and violate the Energy Policy Act. In formal comments to EPA, the NAS said the agency's recommendation to establish a groundwater standard for Yucca Mountain is not based on sound science. The NAS added that EPA ignored its opinion that a separate groundwater standard was redundant given the protection provided by a 15 millirem all pathways standard. "EPA's groundwater proposal will add little, if any, additional protection to individuals or the general public from radiation releases from the repository," the NAS scientists said.

The NRC recommends an all-pathways standard of 25-millirem as fully protective of public health and safety and the environment, and also questioned the EPA's use of a groundwater limit.

Consistent with radiation protection standards at other disposal facilities, including at the Nevada Test Site, NEI supports a 25-millirem all-pathways radiation protection standard for Yucca Mountain. The industry strongly believes that EPA's proposed separate groundwater standard could result in less, not better, overall protection of public health and safety. By arbitrarily forcing the focus on a single factor, the design of the repository could actually allow more radioactivity to be released into the air in order to meet the groundwater limit.

The 25 millirem standard proposed by health and science professionals, other federal agencies and the industry is four times more protective than the state of Nevada's 100-millirem safety standard for industrial, research and medical users of nuclear materials in the state.

Conclusion

Industry's expectation that DOE should be held accountable for maintaining the schedule and scope of work at Yucca Mountain is based on a decade of unparalleled scientific scrutiny at the site. In fact, Yucca Mountain is one of the most studied pieces of property in the world. A deep geologic repository, located at an isolated, arid location, remains the cornerstone of the nation's used fuel management policy. There is no scientific basis for concluding that Yucca Mountain cannot fulfill the role of being a safe, environmentally responsible facility for commercial used nuclear fuel, and for the high-level radioactive waste from defense and other national programs that is stored in 40 states. The recent opening of the Waste Isolation Pilot Plant (WIPP) for disposal of transuranic nuclear waste demonstrates that an underground disposal facility is feasible and can be developed in concert with protecting the environment.

Based on repeated promises from the federal government, electric utilities that built nuclear power plants expected used fuel to be stored for a short period of time at these plants, then shipped for disposal at a federal government facility.

Fuel storage facilities at nuclear power plants were never intended to provide long-term storage capacity. Because of Department of Energy delays in developing a federal repository, electricity consumers have been forced to pay twice for used nuclear fuel storage. Several hundred million dollars has been spent on developing additional on-site storage facilities at nuclear power plants since the late 1980s, and more are in the planning process. Meanwhile, electricity consumers continue to pay an additional $700 million every year into the Nuclear Waste Fund for DOE to manage used nuclear fuel. To date they have committed more than $16 billion for the program.

In some cases, building a temporary storage facility has subjected companies to unacceptably high political and financial costs. As difficult as they are today, these issues will only get more complex with further delay.

Establishing a radiation protection standard is an essential component of safely and responsibly managing used nuclear fuel. However, in developing the standard for Yucca Mountain, it is imperative that EPA adhere to specific instructions from the Congress and abide by the recommendations of credible scientific bodies, in establishing a radiation limit to protect public health and safety. The industry urges the EPA to adopt a 25-millirem all-pathways standard without a separate groundwater limit.

The facts before this subcommittee and this Congress are clear and simple: America's 103 nuclear power plants provide 20 percent of our electricity in a manner that produces no harmful air pollution. It is up to us, who enjoy the benefits of that electricity, to manage the byproducts of those facilities safely and responsibly. We simply cannot defer this problem to future generations. The time for promises has long passed—now is the time for action. Unparalleled scientific study at Yucca Mountain should be sufficient for DOE to make a site recommendation to the President in 2001. The industry fully expects them to do so without further delay. Congressional leadership is essential to hold DOE accountable for completing its critically important tasks and breaking the cycle of perpetual delay that has been the unfortunate history of this program.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 28, 2000

The Honorable Joe Barton, Chairman
Subcommittee on Energy and Power
U.S. House of Representatives
Committee on Commerce
Washington, DC 20515-6115

Dear Chairman Barton:

I am pleased to respond to your July 20, 2000 letter containing ten questions from Members of the Energy and Power Subcommittee. The enclosed responses to the Subcommittee's questions amplify on issues addressed in testimony before the Subcommittee at the June 23, 2000 hearing. We appreciate the opportunity to provide the views of the Nuclear Regulatory Commission on these important issues.

Sincerely,

Dennis K. Rathbun, Director
Office of Congressional Affairs

Enclosures:
As stated

cc: The Honorable Rick Boucher

QUESTION 1. Please elaborate on the reasons for NRC's opposition to EPA's proposed separate 4 millirem groundwater protection standard.

ANSWER.

The NRC disagrees with EPA's proposed criteria for protection of groundwater for the reasons that follow:

(1) The EPA's proposed groundwater protection criteria do not exhibit a sound scientific and technical basis.

The EPA's maximum contaminant levels (MCLs) may have appeared to be reasonable standards when they were developed around 1975. In view of what is known today, the MCLs for individual radionuclides provide levels of protection that vary significantly (risk values for nuclides significant to a high-level waste repository vary by as much as 200 fold -- see the answer under question 4 for specific examples). We strongly object to the application of concentration limits that correspond to such non-uniform risk levels. The proposed approach would create confusion and unnecessary public concern about the level of risk that is acceptable and attainable, and could undermine confidence that the health and safety of the public are being protected. There exists no sound scientific or technical basis for the arbitrary range of protection afforded by EPA's proposal. The EPA acknowledges that its current MCLs are based on obsolete methods. A more appropriate approach would be to set the MCLs at a consistent risk level, such as 4 millirem per year total effective dose equivalent (TEDE, a methodology for converting an organ dose to an equivalent whole body dose recommended by the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements).

(2) The EPA's proposed criteria cannot be justified on health and safety grounds.

The EPA's proposal needlessly establishes limits that are more conservative than needed to adequately protect public health and safety. We consider MCLs based on a dose level as low as 4 millirem per year to any organ (which can be as low as one hundredth of a millirem per year TEDE) to be needlessly conservative, given the current understanding of radiation effects on humans and the fact that the variability of doses attributable to natural background radiation significantly exceeds this limit. In reality, EPA's criteria address very low levels of exposure that do not present any serious adverse health concern. For purposes of comparison, living in a brick or stone house as opposed to a wooden home corresponds to an increased dose to the occupant of 10 millirem per year. The NRC staff does not believe that such a choice of residential building materials represents a serious public health risk, any more than we believe it necessary to constrain exposure from drinking water to less than 4 millirem per year to any organ.

Methods do exist for making very precise estimates of individual doses and concentrations of radionuclides in drinking water; however, the corresponding costs and uncertainties dramatically increase when calculations must demonstrate compliance with smaller values. Application of EPA's proposed criteria (e.g., 4 millirem per year to any organ) to Yucca Mountain would likely significantly increase the complexities and costs for evaluating a potential repository without a discernable increase in the level of protection of public health and safety.

(3) The EPA's proposed criteria will be applied inappropriately to NRC and Agreement State licensees in the absence of an appropriate and comprehensive cost-benefit analysis.

Although the EPA MCLs were developed under the EPA's Safe Drinking Water Act (SDWA) authority, where the standards are to be applied for monitoring and testing public water systems at-the-tap, EPA acknowledges that EPA offices use the obsolete MCLs for setting standards for environmental clean up at hundreds of sites that fall under NRC, DOE, and DOD authority. The NRC staff believes it is fundamentally

incorrect to apply requirements that were developed under the SDWA for monitoring and testing of public water systems, to address groundwater clean up more generally. If MCLs are applied to clean up sites and at waste disposal facilities to address untreated groundwater that is not used or is not likely to be used as a source of drinking water, significant costs could be incurred without commensurate benefit to public health and safety and the environment.

An NRC licensing determination regarding waste disposal requires that the applicant use models to estimate or project doses as far as hundreds or thousands of years into the future. These estimated doses are typically a result of potential radionuclide releases to groundwater. Conservative dose estimates are made on the assumption that humans will be present to use contaminated groundwater without monitoring or benefit of the water-treatment measures that are routinely applied to most public water systems. Both EPA and NRC staffs support such an approach for evaluating sites where compliance with individual protection standards is based on estimating or projecting future doses. However, the EPA applies the requirements of the SDWA (i.e., MCLs intended to be used as "at-the-tap" standards) to assess compliance. The NRC considers application of "at-the-tap" standards inappropriate because: 1) the overly conservative and obsolete MCLs are much more stringent than nationally and internationally accepted standards for radiation; and 2) MCLs are intended for application in the context of drinking water that is actually being supplied to real consumers rather than hypothetical users for which routine water treatment, as a remediation measure, cannot be considered because of the hypothetical nature of the analysis. In the absence of an appropriate and comprehensive cost-benefit analysis, the EPA should not require the expenditure of potentially significant resources without commensurate benefit to public health and safety and the environment.

QUESTION 2. Has NRC evaluated the background level of radioactivity in groundwater at the Yucca Mountain? In other words, could existing background radiation "use up" a significant portion of the 4 millirem groundwater standard before the repository is ever built?

ANSWER.

No. However, the NRC has followed DOE's site characterization activities at Yucca Mountain. Most recently DOE published background concentrations of radioactivity in groundwater at a variety of locations in the Yucca Mountain region in its Draft Environmental Impact Statement (1999, Volume 1, pg. 3-58). At this time the published concentrations are more than ten times below EPA's standard for the radionuclides relevant to the Yucca Mountain repository.

QUESTION 3. It seems that EPA is at least allowing some flexibility in this matter of how groundwater compliance is measured, both with the "point of compliance" and with the "representative volume" concepts.

(a) In your discussions with staff from EPA headquarters, have they been reasonable in their proposed application of the point of compliance and representative volume alternatives?

(b) Has the Region Nine office of EPA been equally reasonable and flexible on these issues?

ANSWER.

(a) Since the publication of the National Academy of Sciences report on Technical Bases for Yucca Mountain Standards in 1995, the NRC and EPA headquarter staffs have held numerous discussions on appropriate standards for Yucca Mountain. These discussions have led to a better understanding of the differences between the agencies. However, despite the flexibility for the application of groundwater protection standards proposed in EPA's standards (64 FR 47016, August 27, 1999), the NRC staff continues to be troubled by EPA's discussion regarding the "representative volume" and the "point of compliance" concepts. The EPA continues to invite comment on unrealistic alternatives that are not representative of groundwater conditions at Yucca Mountain, and that further increase the conservatism in applying the EPA's separate, obsolete groundwater requirements.

For example, the preamble to the proposed standard (64 FR 47002, August 27, 1999) requests comment on alternative dilution volumes that are extremely small (e.g., 10 and 120 acre-feet). These dilution volumes do not reflect the groundwater resource to be protected (the EPA states the representative volumetric flow is 4000 acre-feet per year for the sub-basin in which the proposed repository is located). Similarly, the alternative compliance point of 5 kilometers is inconsistent with what is known about the groundwater resource. In the preamble to the proposed standards, the EPA explained that compliance locations for individual protection should not be closer than 20 kilometers because "the rough terrain and increasing depth to groundwater nearer to Yucca Mountain would likely discourage settlement by individuals because access to water is more difficult" (64 FR 46989, August 27, 1999). Nonetheless, the EPA identified the 5 kilometer location as an alternative compliance location for the proposed groundwater standards.

(b) With respect to issues of groundwater protection, the NRC staff has not interacted with the Region Nine office of EPA.

QUESTION 4. I understand that one of the first radionuclides that could be released from the repository would be iodine-129.

(a) What is the health risk associated with a 4 millirem dose from iodine-129?

(b) Is this within the risk range recommended by the National Academy of Sciences?

(c) Are there other radionuclides that would fall outside the NAS's recommended risk range under EPA's proposed groundwater standard?

ANSWER.

(a) Because iodine-129 is a beta/photon emitting radionuclide, the EPA's corresponding groundwater protection standard is 4 millirem to any organ per year. The limiting risk from ingestion of drinking water contaminated with iodine-129 is exposure to the thyroid. Because the thyroid is somewhat resistant to radiation the corresponding, overall risk from a 4 millirem per year exposure to the thyroid is an annual risk of developing fatal cancer of approximately 1 in ten million (10^{-7}). EPA's MCL value for iodine-129 equates to an annual TEDE dose of 0.2 millirem per year. This becomes the de facto standard for the Yucca Mountain repository under the proposed EPA rule. This is less that one thousandth of annual background radiation, less than one tenth of the radiation from a single Washington, D.C. to Las Vegas, NV, plane flight, and less than one hundredth of the annual radiation from working in the granite and marble halls of the United States Capitol.

(b) The National Academy of Sciences (NAS) recommended, as a starting point for the EPA , an annual risk of between one in one hundred thousand and one in one million (10^{-5} to 10^{-6}). The EPA groundwater protection standard for iodine-129 corresponds to a risk that is ten times lower than the lowest value of the NAS-recommended risk range.

(c) The only other radionuclide associated with a high-level waste repository that is of significance and falls outside the NAS risk range is neptunium-237. Because neptunium-237 is an alpha emitting radionuclide, the EPA's corresponding groundwater protection standard is 15 picocuries per liter. Ingestion of drinking water, which contains 15 pCi/liter of neptunium-237, results in an annual risk of approximately 2 in one-hundred thousand ($2x10^{-5}$). The neptunium-237 risk is approximately twice as high as the highest value of the NAS-recommended risk range.

QUESTION 5. In NRC's view, can DOE comply with the proposed EPA standards and can NRC license a repository based on those standards?

ANSWER.

Current DOE estimates of repository performance suggest that a potential repository at Yucca Mountain could meet the proposed EPA standards. However, the DOE bases these estimates

on a series of assumptions (for example, regarding waste package performance) for which the DOE is still collecting supporting information. Moreover, the DOE estimates have not been submitted to the NRC in a license application and have not undergone review in the NRC licensing process. The NRC's licensing decision will depend on the nature, amount, and quality of supporting information available at the time of licensing, as well as on the final EPA standards.

QUESTION 6. Do you agree with DOE, that it is desirable to maintain design flexibility through the licensing phase?

ANSWER.

The NRC recognizes DOE's need for flexibility to consider alternative designs that better protect public health and safety and the environment. Although the DOE safety case ultimately will need to be developed around a single reference design, the NRC licensing process provides flexibility that allows DOE to keep its design options open while ensuring the NRC has sufficient information to make its regulatory decisions (see the answer to Question 8).

QUESTION 7. When does the radiation standard have to be finalized for purposes of the licensing process?

ANSWER.

We estimate that final EPA standards need to be in place at least two years prior to submittal of a license application, assuming Yucca Mountain is recommended as a site for a geologic repository. Once final EPA standards are issued, the NRC is required within one year, under Section 801 of the Energy Policy Act of 1992, to modify its technical requirements and criteria, if necessary to conform to the EPA standards. If NRC identifies the need for and completes a conforming rulemaking, we anticipate that the DOE will require at least a year to prepare a license application consistent with the final standards and implementing regulations.

The NRC explained when it published its proposed implementing regulations, at 10 CFR Part 63, in February 1999, that it had decided to proceed, even in the absence of EPA standards, because of the very short time period allotted to NRC to conduct its own rulemaking to modify its licensing criteria. We also explained NRC's need to proceed in advance of the EPA's proposal, on the grounds that the NRC's proposed regulations contain many requirements involving compliance determination and implementation that are beyond EPA's standard-setting authority and responsibility and are squarely within NRC's licensing authority and responsibility. These requirements go well beyond the health-based standards required of EPA and are matters that must be addressed in NRC's regulations (e.g., licensing procedures, records and reporting, monitoring and testing programs, performance confirmation, quality assurance, personnel training and certification, and emergency planning).

We believe that the development of our proposed requirements in advance of final EPA standards will greatly simplify the NRC's conforming rulemaking after EPA publishes its final standards. Obviously, to the extent that EPA's final standards are the same, or similar to those assumed in NRC's regulations proposed in February 1999, NRC's task in conducting a conforming rulemaking will be lessened. However, as we have noted repeatedly, in the supplementary information accompanying our proposed regulations, and elsewhere, the NRC recognizes under current law that it is required to conform its regulations, if necessary, to final EPA standards when they become effective.

QUESTION 8. Can NRC even license the repository if DOE insists on keeping its design options open into the licensing phase?

ANSWER.

The NRC licensing process allows DOE to keep its design options open while ensuring the NRC has sufficient information to make its regulatory decisions. However, the DOE must provide sufficient information regarding its repository design to allow the Commission to evaluate repository performance. The regulations do not require that the DOE design remains unchanged, but rather provide for a process that allows DOE to alter its design.

First, NRC's proposed regulations (10 CFR Part 63) provide for a multi-staged licensing

process that affords the Commission the flexibility to make decisions in a logical time sequence that provides for the DOE's continuing collection and analysis of additional information over the construction and operational phases of the repository. Four major decisions by the Commission comprise this multi-staged approach: (1) construction authorization; (2) license to receive and emplace waste; (3) license amendment for permanent closure; and (4) termination of license. The time allowed to complete all four stages of this process (including 50 years for operation and at least 50 years for monitoring) is extensive and will allow for the generation of much additional information before permanent closure. However, at each stage, DOE must provide sufficient information to support the requisite Commission decision for that stage. This is reflected in the requirement at proposed 10 CFR Part 63.24(a) that the application be as complete as possible in light of information that is reasonably available at the time of docketing.

Second, the proposed regulations anticipate that changes to the design could occur and specify criteria to be used by DOE in identifying those changes that must be submitted to the NRC for approval. The intent of the proposed regulations is to permit DOE to make changes, without prior NRC approval, provided that the changes do not have a significant impact on the DOE's compliance demonstration or the conditions of the NRC's licensing decision. Design changes, that do have an impact on the DOE's compliance demonstration or on conditions of NRC's licensing decision are permissible but are subject to NRC review and approval. We note that the NRC's reactor licensees frequently modify their designs using a similar amendment process.

QUESTION 9. Does the NRC allow private licensees to maintain such flexibility, or does NRC require that the licensee applications reflect the final design decisions?

ANSWER.

The licensing of a high-level waste repository is unique, in part because of the need to reach decisions about safety over the considerable time required to construct the repository and emplace waste, as well as over an unprecedented compliance period lasting thousands of years. Because of the unique nature of the determinations required of the NRC, the Commission established the multi-staged licensing approach described in the answer to question 8. The Commission has sought to establish a uniform policy regarding the criteria to be used in identifying design changes that must be submitted to the NRC for approval. When proposing new regulations at 10 CFR Part 63, the Commission specifically sought comment on whether it should adopt criteria that were being considered for other licensees (e.g., nuclear reactors, holders of a certificate of compliance for a spent fuel storage cask).

The Commission is currently considering the public comments received on this and other aspects of the proposed rule, and is evaluating the merits of adopting alternative criteria. The intent of these alternative criteria is to provide flexibility similar to that afforded other NRC licensees.

QUESTION 10. (a) Is the NRC concerned that funding constraints are causing DOE to take shortcuts or postpone critical technical work?
(b) Will this have an impact on repository licensing?

ANSWER.

(a) The DOE has recently alerted the NRC staff that approximately 200,000 potentially relevant licensing documents, comprising an estimated 4 million pages of material, has not yet been screened by DOE to determine if the material must be entered into the "Licensing Support Network" LSN. Any material that qualifies as "documentary material" would then need to be formatted according to NRC requirements at 10 CFR Part 2, Subpart J, and placed on the DOE web site. Due to possible budget constraints, DOE may not be able to screen and format this material for entry onto the DOE web site in time to meet the compliance requirements of the LSN (thirty days after DOE's submission of its site recommendation to the President).

(b) This may have a severe impact on the repository licensing process. In order to meet the Congressionally mandated date for NRC decision on the repository license application, NRC adopted a requirement that all parties provide electronic access to all documentary material via the "Licensing Support Network" (LSN), which will substitute for document discovery in the license adjudicatory process. If the DOE documentary material is not made available in a timely manner as required under the rule, the conduct of the hearing will be delayed.

UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD
2300 Clarendon Boulevard, Suite 1300
Arlington, VA 22201-3367

August 31, 2000

Honorable Joe Barton
Chairman
Subcommittee on Energy and Power
Committee on Commerce
U.S. House of Representatives
Room 2125, Rayburn House Office Building
Washington, DC 20515-6115

Dear Mr. Barton:

Enclosed are responses to the questions posed in your letter of July 20, 2000, to Dr. Debra Knopman following her appearance before the Subcommittee on Energy and Power on June 23, 2000. The Board provides independent advice on the technical issues associated with the management of the country's commercial spent nuclear fuel and defense high-level radioactive waste. The Board offers its technical views to help inform the larger consideration of issues that faces the Department of Energy and the Congress in their evaluation of the suitability of the Yucca Mountain candidate repository site.

The Board is keenly aware that many of the issues that must be considered in making decisions in this policy area are technical ones, but others are not. Regarding site suitability, we believe that Congress and the Secretary will find it useful to have our views on the adequacy of current information to technically support a possible site recommendation. As noted in our responses, a site recommendation can be made at any time, depending in part on how much uncertainty policy-makers are prepared to accept.

Please let me or the Board's staff know if we can provide you or your staff with any additional information on the enclosed responses.

Sincerely,

Jared L. Cohon
Chairman

Enclosure

con140v1

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NUCLEAR WASTE TECHNICAL REVIEW BOARD RESPONSES TO QUESTIONS FOR THE RECORD FROM MR. BARTON AUGUST 31, 2000

1. Is the Technical Review Board concerned that funding constraints are causing DOE to postpone or skip critical technical analyses necessary to support the site recommendation and licensing decisions? If so, please identify the specific areas that are not being addressed adequately by DOE.

The Board's congressional mandate is statutorily limited to reviewing the technical and scientific validity of Department of Energy (DOE) activities. Therefore, the Board has not examined the details of DOE's budget for Yucca Mountain research or its funding allocations for program operation, management, procurement, and contracting. Consequently, the Board cannot judge the extent to which the Yucca Mountain site characterization and repository design activities have been or will be constrained by budget limitations. What is clear, however, is that the Board's present understanding of a potential repository located at Yucca Mountain is affected by many policy-related factors, including congressional appropriations, DOE's research and program priorities, and statutory and administrative deadlines, as well as the significant challenge of undertaking a first-of-a-kind activity.

Because less than a year remains before the scheduled site-recommendation decision in July 2001, the amount of additional scientific and technical work that can be completed by that date is very limited. Thus, the information available in July 2001 for a site recommendation will in all likelihood not be appreciably affected by whatever budget Congress passes for FY 2001. However, funding constraints in DOE's budget for FY 2001 and beyond could limit ongoing and new work that might support a DOE license application for repository construction.

The Board reviews the scientific and technical program as it is and makes its technical judgments accordingly. On the basis of information it has reviewed to date, the Board believes that the technical basis for DOE's current long-term projections of repository performance has critical weaknesses. These projections and their associated weaknesses reflect in part the DOE's "base-case" (above-boiling) repository design. Although the site may, in fact, merit a positive site recommendation, DOE has not yet demonstrated—for the base-case design—a firm technical basis for that conclusion.

Some of the current large uncertainties about waste package and repository performance are directly or indirectly related to the high (i.e., above-boiling) repository temperatures associated with DOE's current base-case design. High temperatures increase the level, extent, and significance of the combined, or "coupled," effects of thermal, hydrologic, mechanical, and chemical processes. Furthermore, the waste packages may be more vulnerable to corrosion at higher temperatures if water is present. The Board believes that it will be very difficult for the DOE to improve substantially its current understanding of these high-temperature effects during the next year or two. However, it may be possible over the next several months to reduce some uncertainties, for example, by developing a defensible technical basis for a lower-temperature repository design.

In addition to the effects of high temperatures, some uncertainties are related to a lack of fundamental understanding about physical processes that will extend over thousands of years; realistic predictions are therefore very difficult to make. For example, the performance of the waste packages over thousands of years has been extrapolated from a few years of corrosion data and too limited an understanding of fundamental corrosion processes. Finally, the characterization of the hydrogeology below the repository horizon, although supported by some data, continues to rest largely on inadequately supported hypotheses. As a result, for example, the flow and transport of radionuclides in the unsaturated and saturated zones from the repository to the accessible environment are poorly understood.

The Board believes that significantly improving the fundamental understanding of these natural features and engineered barriers during the next year or two will be very difficult. However, the Board believes that work in these areas is important and should continue. Because of the complexity of the Yucca Mountain site and the challenges involved in extrapolating data over long time periods, gaining such an understanding of these basic processes will take time. Continued adequate funding of these long-term studies will be important.

2. Is it correct that the Technical Review Board is concerned that DOE is not paying enough attention to the uncertainties inherent in the repository's long-term performance, especially with respect to the "hot" repository design?

The persistence of substantial uncertainties has led the Board over the last few years to recommend strongly that DOE develop a more technically defensible basis for making design, site-recommendation, and licensing decisions. In particular, the Board has recommended initiation of fundamental studies on long-term corrosion, evaluation of alternative repository designs, improved characterization of rock formations in the vicinity of Yucca Mountain, examination of radionuclide retardation in the unsaturated and saturated zones below the repository horizon, evaluation of colloidal transport, and investigation of the effect of structures and heterogeneities on water movement above and below the water table. DOE has responded to many of the Board's suggestions, but it has not yet completed all of those studies. Although the Board is encouraged by the level of attention DOE is now giving to the quantification and characterization of uncertainty in estimating repository system performance, the Board also continues to have concerns in this area.

The Board realizes that projecting long-term performance of a potential repository at Yucca Mountain, or anywhere else for that matter, is inherently associated with uncertainty. Eliminating all the uncertainties will never be possible (although they can be reduced). In fact, the Board has noted that a site recommendation can be made at any time, depending in part on how much uncertainty policy-makers are prepared to accept. The timing of the site recommendation, of course, is clearly beyond the Board's charge.

As noted in the answer to question #1, on the basis of information reviewed to date, the Board believes that the technical basis for DOE's current long-term projections of repository performance has critical weaknesses. These projections and their associated weaknesses reflect in part the DOE's base-case (above-boiling) repository design. The Board explicitly raised this concern about above-boiling repository designs in a July 9, 1999, letter to DOE's Office of Civilian Radioactive Waste Management. Although the site may, in fact, merit a positive site

recommendation, DOE has not yet demonstrated—for the base-case design—a firm technical basis for that conclusion.

Adopting a lower-temperature repository design for commercial spent fuel might mitigate some of the weaknesses associated with projections of long-term repository performance, such as problems associated with coupled processes. A lower-temperature repository design could make projections of performance less dependent on areas where scientific understanding is incomplete. Therefore, DOE should augment its current design evaluations with a rigorous and persuasive evaluation of the performance of, and trade-offs associated with, alternative repository designs, including assessing the effects of the following factors on performance and uncertainty: age of waste at emplacement, spacing between waste packages, ventilation rates and efficiencies, and time before repository closure. It is possible, but not certain, that a cooler, drier, and simpler design than the current base-case design would lower the technical hurdles that DOE now faces in projecting long-term waste package and repository performance.

DOE, however, has not yet carried out a sufficiently thorough evaluation of low-temperature repository designs. By carrying out such an evaluation, DOE would develop a much better understanding of how the thermal characteristics of different designs may affect critical uncertainties (e.g., those associated with coupled processes, the stability of the passive layer of Alloy 22, and the waste package environment). But the magnitude of other uncertainties, such as those associated with the saturated zone under the repository, are very likely to be independent of the facility's design.

3. How would the Board suggest that DOE should take these uncertainties into account—is this a matter of DOE actually changing its repository design, or merely a matter of presenting this uncertainty information to the decision-makers?

DOE intends to base its site-recommendation decision primarily on the results of a total system performance assessment (TSPA), a complex computer model that estimates repository performance many thousands of years into the future. The technical soundness of DOE's site-recommendation decision will therefore depend to a large extent on the technical validity of its TSPA. Put another way, policy-makers' confidence in performance assessment reflects in many ways the level of uncertainty associated with estimates of performance: the greater the uncertainty, the lower the confidence in repository performance may be.

There are several internationally recognized strategies for managing or reducing uncertainties. One strategy involves using "conservative" assumptions and parameters throughout the performance assessment. Thus, if the assessment is in error, the long-term performance of the repository is underestimated, not overestimated. A second strategy involves using multiple lines of evidence independent of performance assessment in developing a "repository safety case." A third strategy involves making repository design choices that minimize uncertainties.

DOE has made progress in implementing each of these three strategies, but it can—and should—do more. For example, it is difficult to know whether the assumptions and parameters used in DOE's performance assessments are truly conservative or how the combination of conservative, optimistic, and realistic estimates affects overall dose calculations and the uncertainties associated with those calculations. As noted in the response to question #6, DOE has not yet

completed the evaluation of independent lines of evidence—an evaluation that is needed to increase confidence in the conclusions of its safety case derived from performance assessment. Finally, as noted in the answer to question #2, DOE has not yet performed a rigorous and persuasive analysis of how uncertainty in repository performance varies with repository design.

Regardless of what strategies are used to manage or reduce uncertainty, the Board believes that DOE's projections of repository performance will be incomplete unless DOE also provides a description and a meaningful quantification of the level of uncertainty associated with its predictions. DOE then will be in a better position to make important decisions, including choosing waste package and repository designs having acceptable predictions of performance, and decision-makers will be able to make technically informed choices related to the DOE's work at Yucca Mountain.

4. When does the decision on hot versus cool repository design have to be made? Can DOE leave this decision open into the licensing phase?

For DOE to make a positive site recommendation, the Board believes that DOE would need to make a technically defensible argument that at least one repository design concept, including firm operational assumptions, will perform satisfactorily for thousands of years. Such an argument would presumably consider the associated levels of uncertainty in repository performance. Therefore, the Board assumes that DOE would describe for the site recommendation at least one design concept and a set of operational assumptions with sufficient specificity so that sound and complete assessments of performance can be developed.

The Nuclear Regulatory Commission, of course, will determine whether the particular detailed design or designs used in DOE's license application will, in fact, provide reasonable assurance of satisfactory performance to warrant constructing a facility.

5. A recent GAO report on radiation standards suggested that the cooler repository design favored by the Board could add $2 billion to the cost of the repository. What is the basis for that statement by GAO, and is that estimate correct?

The statements in the GAO report are misleading in two respects. First, although the Board noted in July 1999 that the technical basis supporting any above-boiling repository design was, in its opinion, not strong enough, the Board is not in a position to *recommend* a specific design alternative. In fact, in its June 23, 2000, testimony before the Subcommittee, the Board explicitly stated, "... more thorough analysis is needed before any judgment is made about the optimal thermal conditions for repository operation."

Second, at the Board's meeting in May 2000, DOE presented some preliminary results and cost estimates related to alternative thermal designs. That analysis suggested that the incremental discounted cost of implementing a below-boiling (as opposed to an above-boiling) design may be as low as $600 million. If, for example, different assumptions were adopted about the distance between repository tunnels, the incremental cost might be reduced even more. This type of result, stimulated by a Board recommendation, is likely to help DOE understand better the technical and economic trade-offs associated with alternative repository designs. Such an

understanding is essential for making a sound decision, regardless of what regulatory standard is ultimately established.

6. Please identify any other outstanding technical issues with the repository design that, in the Board's view, are not being addressed adequately by DOE. Explain these concerns fully, and make recommendations on actions that DOE and the Congress should take to resolve these issues.

Unfortunately, DOE's models are not well enough developed or supported by sufficient data to differentiate between the performance of below-boiling and above-boiling repository designs over the next several thousand years. To develop the tools necessary for evaluating these differences, DOE would have to increase substantially its understanding of the coupled thermal, hydrologic, mechanical, and geochemical processes taking place within the repository; the mechanisms and paths by which radionuclides could be transported from the repository tunnels into the unsaturated and saturated zones below; and the data and fundamental knowledge used to project the long-term corrosion susceptibility of waste packages.

Although the Board has endorsed the use of TSPA, in an April 1999 report the Board noted the limits of TSPA calculations and expressed doubt that relying "solely on [performance assessment] to demonstrate repository safety" will ever be possible. Therefore, the Board recommended in this report that DOE develop multiple lines of evidence that can supplement performance assessment.

DOE is working on a repository safety case that is designed to increase confidence that a repository at Yucca Mountain is likely to perform as predicted. The strategy currently rests on six "pillars": performance-assessment calculations, safety margins, analysis of disruptive events, defense-in-depth, natural analogs, and performance confirmation during and after waste emplacement. On the surface, these pillars may appear to satisfy the Board's recommendation that DOE develop multiple lines of evidence that can supplement performance assessment. A closer look suggests otherwise.

To begin with, four of the pillars—performance-assessment calculations, safety margins, defense-in-depth, and analysis of disruptive events—as currently presented are not independent of each other. They are all dependent on performance assessment. Thus, if one lacks confidence in DOE's performance assessment, one is not likely to have much confidence in any of the four pillars. The last two pillars of the repository safety case—natural analogs and performance confirmation—*are* independent of performance-assessment calculations. However, DOE's evaluation of natural analogs so far has been minimal, and performance confirmation is simply a plan of activities that will be subject to future budget and time constraints.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 18 2000

OFFICE OF
AIR AND RADIATION

The Honorable Joe Barton
Chairman
Subcommittee on Energy and Power
Committee on Commerce
U. S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed for insertion into the hearing record are the U.S. Environmental Protection Agency's (EPA) responses to follow-up questions submitted by Members of the Subcommittee from the June 23, 2000, hearing on the status of the Department of Energy's program to develop a permanent geologic repository at Yucca Mountain, Nevada, for spent nuclear fuel and high-level radioactive waste before the Subcommittee on Energy and Power. I hope this information will be useful to you and Members of the Subcommittee.

Thank you for providing EPA the opportunity to testify on this important issue.

Sincerely,

Stephen D. Page, Director
Office of Radiation and Indoor Air

Enclosure

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EPA Responses to Follow-up Questions
from June 26, 2000 Hearing on Yucca Mountain
Subcommittee on Energy and Power

1. **EPA has already proposed an individual protection standard to protect human health. Is a separate groundwater standard also necessary to protect human health, or is the purpose of the groundwater standard to protect groundwater as a resource?**

   The purpose of the ground water standard is to protect groundwater as a resource. Ground water is one of our nation's most precious resources because of its many uses. This is especially true in the vicinity of Yucca Mountain, where ground water is currently used as drinking water, as a resource to support a diverse agricultural economy, and as an ecological habitat supporting sensitive ecosystems. The Agency is protecting ground water at Yucca Mountain to protect the significant ground water resource in the vicinity of Yucca Mountain.

2. **The Department of Energy, the Nuclear Regulatory Commission, and the National Academy's Board on Radioactive Waste Management have each stated that they do not support a separate groundwater protection standard for the Yucca Mountain repository. How does the EPA justify a separate groundwater standard in light of the criticisms from these other technical experts?**

   Our differences with DOE, NRC and NAS, regarding ground water protection, are based on policy, not science. The NAS has even commented that, under the Energy Policy Act, EPA has the authority to set a separate ground water standard as a matter of policy. EPA's proposal (64 FR 46976, August 27, 1999) included separate ground water protection standards to protect the significant ground water resources around Yucca Mountain. We proposed these ground water protection standards to be consistent with EPA's mission and long-standing Agency policy, as discussed further in response to questions 5 and 13 below.

3. **Apparently, EPA's proposed 4 mrem ground water standard is derived from the Maximum Contaminant Levels established under the Safe Drinking Water Act. To quote the Board on Radioactive Waste Management, EPA is basing this ground water standard "on a 25-year old regulation which in turn is based on 40-year old dosimetry."**

   (a) Please explain how EPA has used the best available science when it has relied on an old standard based on even older science.

   We based our MCLs on the best scientific knowledge regarding the relationship between radiation exposure and risk that existed in 1975 when we developed the MCLs. Scientific

understanding has evolved since 1975. We are working to update the existing MCLs based on a number of factors, including the current understanding of the risk of developing a fatal cancer from exposure to radiation; pertinent risk management factors (such as information about treatment technologies and analytical methods); and applicable statutory requirements.

(b) Where is EPA in the process of updating the Safe Drinking Water MCLs for radionuclides? Will those updates be incorporated into the final rule for Yucca Mountain? If not, why not?

EPA is planning to update the MCLs for radionuclides. It is unlikely that the MCLs will be revised at the time EPA issues a final Yucca Mountain standard. If EPA's final standard for Yucca Mountain contains a ground water protection standard, the standard will incorporate the MCLs that are in effect at the time. If the MCLs are revised after the standard is finalized, EPA could amend the final rule to include the updated MCLs.

(c) Does the EPA intend to issue a final rule for Yucca Mountain incorporating a groundwater protection standard that it acknowledges is based on old science? If so, what is the reason for such a decision?

EPA is in the process of finalizing the standards for Yucca Mountain and therefore cannot speak to the specifics of the final rule. However, if EPA finalizes a standard for ground water protection, EPA will fully explain the rationale for this decision. EPA has received comments that are concerned with the science behind the SDWA MCLs, therefore EPA will be fully responding to these comments in the Response to Comments document that will accompany the final rule.

4. **What is the scientific basis for the old Safe Drinking Water MCLs? Please provide the Committee with the technical foundation that supports the selection of the original 4 millirem standard.**

The MCL was set at a *uniform dose* of 4 mrem to the whole body or the critical organ for any nuclide or combination of nuclides. This necessarily resulted in a range of health *risks* because a combination of nuclides resulting in 4 mrem dose does not produce the same effects on all parts of the body. It depends on the nuclides involved. Two nuclides at 4 mrem dose do not produce the same effects. This is not arbitrary or capricious, it is a function of radiobiology.

Different ingested nuclides emit radiation of various energies, and produce doses to nearby tissues, are transported to various locations in the body or are excreted, decay to other elements, and the process results in various risks of cancer in the body depending on the tissue affected. Had EPA regulated on the basis of uniform risk, it would mean there will be a different picoCuries, and doses to different organs. Uniform picoCurie concentrations means different doses and different risks. Concentration, dose, and risk are

not simply interchangeable. The practical expression of the 4 mrem dose limit selected was in concentration (picoCurie) units that are measurable in the water. Each beta/photon emitter had an associated picoCurie concentration associated with 4 mrem.

How the current standard is arrived at is less important now, twenty five years later, than the fact that the standard is currently providing a level of protection which legally must be maintained, or increased with the aid of better science.

5. **DOE commented last fall that the EPA is not properly applying the Maximum Contaminant Levels (MCLs) from the Safe Drinking Water Act, which were designed to apply at the tap and after treatment. Instead, EPA seems to be proposing that this 4 millirem standard apply at the groundwater source, in the aquifer. Please explain EPA's rationale for applying the MCLs from the Safe Drinking Water Act to water in the aquifer, before treatment. Is this a policy decision or a science-based decision?**

EPA first published a ground water protection strategy in 1984 and it advised protecting ground water according to its use, value and vulnerability. Although this was a valuable first step, more specific guidance was needed. In 1991, EPA developed a more comprehensive ground water protection strategy ("Protecting the Nation's Ground Water: EPA's Strategy for the 1990s," 21Z-1020, July 1991) to guide Agency programs where contamination of ground water is of concern. Among other things, this strategy presents a clear statement of policy, emphasizes pollution prevention, and clearly identifies Federal and State roles. This strategy was developed based on significant input from State and local governments, other Federal agencies, environmentalists, industry, and public interest groups, among others. The resulting Strategy has guided the course of EPA and State efforts with a clear priority on preventing ground water contamination.

A significant inventory of long-lived radioactive materials may be disposed in a deep geologic repository directly over aquifers presently supplying ground water resources to populations in the vicinity of Yucca Mountain. Part D (Agency Policy on EPA's Use of Quality Standards in Ground-Water Prevention and Remediation Activities) of the Agency's strategy referenced above clearly indicates that in the case of pollution prevention, allowing contamination of the ground water that is a source of drinking water to equal or exceed the appropriate MCLs would be a failure of prevention. Should this situation occur, future generations will have to decide whether to forego use of the ground water resource or to expend resources to clean up contaminated ground water. This would violate one of the primary principles in radioactive waste management, accepted nationally and internationally, that radioactive waste disposal should place no undue burdens upon future generations. (See, for example, Principle 4: Protection of Future Generations in the IAEA's "The Principles of Radioactive Waste Management, Safety Series No. 111-F", 1995).

6. (a) **Has EPA evaluated the background level of radioactivity at the Yucca Mountain site?**

Yes, the Agency has examined available information on the background levels of radioactivity in ground waters downgradient of the repository site and in ambient air quality information around the site, and we have examined data concerning radiation exposures around the Nevada Test Site. We are also aware of estimates of background radiation levels for the general population around the Nevada Test Site (see below).

(b) **How does the 15 millirem all-pathways individual protection standard compare to the background level of radioactivity at the Yucca Mountain site?**

The 15 mrem/yr individual protection limit is not tied to ambient background levels, but rather to a consideration of minimizing additional exposures above background levels from these "practices". Potential doses from a waste repository cannot be considered as part of the ambient background, but rather an exposure from the "practice" of waste disposal. The international consensus on radiation protection, as reflected by the positions of national and international expert groups (see the NAS Report, pg. 40), is that exposures to members of the public from all "practices" should be limited to 100 mrem/yr, with any specific practice expected to contribute only a portion of the recommended limit. Radiation exposure limits both in the United States and abroad share that fundamental approach. The 15 mrem/yr standard is consistent with the NAS recommended risk level for the repository (see the preamble to the proposed rule), and is consistent with other Agency applications for waste disposal. This 15 mrem/yr standard is also particularly appropriate for residents around the Test Site since they could also be exposed to radiation from the past and present activities at the site (such as radionuclides entering ground waters from the hundreds of underground nuclear detonations at the site and eventually migrating off the Test Site and into ground waters outside the site). Table 8-55 of DOE's Draft Environmental Impact Statement lists sources of radiation exposure from activities on the Nevada Test Site, including waste disposal operations such as the Greater Confinement Disposal facility.

(c) **How does the proposed 4 millirem ground water protection standard compare to the background level of radioactivity at the Yucca Mountain site?**

As discussed above, the 4 mrem limit applies to man-made radionuclides only and does not include natural beta/photon emitters, and therefore has no relation to background levels of naturally occurring beta/photon emitters in ground waters at Yucca Mountain.

(d) **How do the 15 all-pathways and 4 millirem ground water standards compare to background radiation levels throughout Nevada?**

See previous responses.

(e) How do the proposed standards compare to the national average, and to levels in populated areas such as Denver, CO?

Once again, the Yucca Mountain radiation protection standards are not tied to background levels, but rather to the principle of determining the acceptable exposure levels above background from "practices" that result in radiation exposures, i.e., to the widely accepted 100 mrem/yr limit for the sum of all "practices". This approach of minimizing exposures from any and all "practices" is a cornerstone of all radiation protection standards accepted nationally and internationally.

7. **Does the rest of the country, from public drinking water systems to hazardous waste disposal sites to mine sites, meet this 4 mrem ground water standard? In other words, is this standard applied uniformly for all facilities in all parts of the country?**

It should be clarified at the outset that the standards are set for drinking water under the authority of the SDWA. Their application in cleanup situations is a result of CERCLA. Section 121(d) of CERCLA requires the attainment of the maximum contamination level goals (MCLGs) and drinking water standards (e.g., MCLs) under SDWA when relevant and appropriate. The National Contingency Plan (NCP) (40 CFR 300.430(e)(2)(I)(B) clarifies that MCLs or non-zero MCLGs established under SDWA will typically be considered relevant and appropriate cleanup levels for ground waters that are a current or potential source of drinking water. In addition states, rely on the Underground Injection Control (UIC) program and Comprehensive State Ground Water Protection Program to protect ground water.

8. **There is apparently some flexibility in the "point of compliance" where the groundwater standard must be met. EPA has proposed four possible points of compliance in the draft rule: 5 kilometers from the repository, 18 km, 20 km, and 30 km.**

(a) What is the significance of these different compliance points?
(b) What is the population center at each of these proposed distances from the repository site?

EPA has proposed four different compliance points for public comment. EPA chose these alternatives to provide a range of possible options for consideration in light of various site-specific factors such as: (I) geologic conditions; (ii) hydrologic conditions; (iii) historical record of water use; (iv) likelihood of future drilling for water or other resources; (v) depth to groundwater; (vi) soil conditions; (vii) presence of existing communities; and (viii) patterns of water use of existing communities in the greater Amargosa Valley area.

It should be noted that in the proposal, EPA proposed two conceptually different types of points of compliance for the groundwater standard. EPA solicited comments on two alternatives based upon a "controlled area" approach that contemplate specific geographic areas that would have specifically designated boundaries on all sides. These were Alternative 1 (a controlled area 5 km from the repository footprint in all directions) and Alternative 4 (a controlled area that combines 5 km from the repository to the north and west, but allows a larger unspecified area within the existing Nevada Test Site to the east and south, not to exceed the southwest corner of the Nevada Test Site 18km from the repository in the direction of Lathrop Wells). This location is significant because it represents the farthest southern boundary of federally controlled land in the direction of the predicted repository releases. EPA also solicited comments on two alternatives based upon a modified approach that would require compliance at a specific geographic location, instead of along all boundaries of a designated controlled area. These were Alternative 2 (a point 20 km from the repository at the northern edge of Lathrop Wells) and Alternative 3 (a point to be chosen by DOE within a geographic area 30 km from the repository in the vicinity of Lathrop Wells).

The current population at each of these locations for the alternatives proposed by EPA is as follows. At 5 kilometers from the repository, there is currently no population center. The repository and much of the surrounding area is restricted federal land and people currently do not reside there. Under the so-called 18 km alternative, EPA has likewise proposed a controlled area that would not include any current population center because the area would encompass land that is presently federal land with restricted access.

The 20 km and 30 km alternatives proposed by EPA would use a specific geographic point as the place at which DOE will demonstrate compliance with the groundwater standard in the licensing process. The 20 km point of compliance would be at the northern edge of Lathrop Wells which has a current population of approximately 10-15 permanent residents. This population center is a community that has grown up around businesses located at the crossing of two major roads. Local government projections indicate that the population in this area of Lathrop Wells may expand to approximately 150 people in the relatively near future. The 30 km point of compliance would be in the middle of an area with a current population of approximately 1200 permanent residents. This population is not located in a densely inhabited population center, but rather spread across a larger, less densely populated, area more typical of rural residential communities.

9. **The proposed individual protection standard of 15 millirem apparently translates to an annual cancer risk of 7 in 1 million, which falls within the risk range recommended by the National Academy.**

   (a) **What is the annual risk of fatal cancer that is associated with the 4 millirem groundwater standard?**

In 1976 EPA's "reasonable estimate" of the fatal cancer risk associated with lifetime ingestion of drinking water at the beta/photon MCL of 4 mrem/year was about 1 per million per year (see page 132, Appendix B, "National Interim Primary Drinking Water Regulations," EPA-570/9-76-003). This estimate was based on the 1972 National Academy of Sciences report which presented two different risk projection models and a range of individual fatal cancer risks, from 0.4 to 2 per million per year. EPA stated that the risks would be proportionately smaller for ingestion of water containing lesser amounts of radioactivity or for partial body irradiation.

EPA now estimates the fatal cancer risk at the MCL to be about 2 per million per year, based on its current risk models.

(b) Is that risk the same for all radionuclides? Please explain fully.

No, the risk is not the same for all radionuclides because the beta/photon MCL is based on a dose limit, not a uniform risk limit. Specifically, the MCL limits the *critical organ dose* from ingested beta/photon emitters to 4 mrem/y. For many radionuclides, this type of dose limit leads to non-uniform, partial body irradiation and variable cancer risks.

For partial body irradiation, which is not uncommon for ingested radionuclides since the radioactivity may be largely concentrated in a particular organ or group of organs, the estimated risk is somewhat less than for total body exposure where all the organs are irradiated. [p. 132]

For example, I-129 concentrates predominately in one organ, the thyroid gland, whereas tritium (H-3) distributes fairly uniformly throughout the body. In the case of I-129, the thyroid gland is the designated critical organ, and the derived activity concentration corresponding to the 4 mrem/y limit is 1 pCi/L (see Table IV-2A in EPA-570/9-76-003). For H-3, the total body is the critical organ, and the derived activity concentration at the MCL is 20,000 pCi/L. The table below presents EPA's current estimates of the individual lifetime excess fatal and total cancer risks associated with ingestion of these I-129 and H-3 activity concentrations, assuming a drinking water intake rate of 2 liter/day, 365 d/y, for 70 y, and using radionuclide-specific mortality and morbidity coefficients from Federal Guidance Report No. 13 (EPA 402-R-99-001, September 1999).

Table of EPA estimates of the annual and lifetime fatal cancer risks associated with ingestion of I-129 and H-3 at activity concentrations corresponding to the 4 mrem/y beta/photon MCL.

Isotope	MCL (pCi/L)	Lifetime Excess Fatal Cancer Risk	Lifetime Excess Total Cancer Risk
I-129	1	8×10^{-7}	8×10^{-6}
H-3	20,000	4×10^{-5}	5×10^{-5}

10. **I understand that one of the first radionuclides that could be released from the repository would be iodine-129. What is the health risk associated with a 4 millirem dose from iodine-129.**

See response to question 9(b).

11. **You mentioned that these same ground water standards were applied at the Waste Isolation Pilot Plant (WIPP) in New Mexico. Please explain the relevance of applying a drinking water standard to WIPP, given that the water in the vicinity of those salt deposits is not potable.**

EPA developed a generic standard for the management and disposal of high-level and transuranic radioactive waste (40 CFR part 191), which include separate ground water protection provisions. These standards apply to any and all deep geologic disposal facilities, except Yucca Mountain. EPA was directed by the WIPP Land Withdrawal Act to certify, by informal rulemaking, whether the WIPP will comply with the waste disposal regulations at 40 CFR Part 191.

12. **Mr. Page mentioned in his written testimony that EPA is protecting the ground water resource as a matter of policy. In fact, he referenced a formal Agency policy of protecting ground water which dates back to 1990. Did EPA follow the notice-and-comment rulemaking procedures under the Administrative Procedures Act when it adopted this policy? Does this policy have any legal-binding effect?**

In 1984, the EPA issued a ground water protection strategy. Later in the decade, EPA established a ground water task force to address comprehensive protection of the ground water resource. Extensive input was provided by state and local governments, other Federal agencies, environmentalists, industry and public interest groups in developing the published policy report ("Protecting the Nation's Ground Water: EPA's Strategy for the 1990s"). EPA did not use APA, notice-and-comment rulemaking to develop this policy. This policy led to development of Comprehensive State Ground Water Protection Programs.

13. **In the 1991 document, "Protecting the Nation's Ground Water: EPA's Strategy for the 1990s," EPA states that it "*will also consider the use, value, and vulnerability of the resource, as well as social and economic values.*" Which of these factors did EPA consider before proposing to apply the 1976 Safe Drinking Water Act MCLs to Yucca Mountain, and where is that consideration to be found in the record for the rulemaking?**

EPA's 1991 ground water protection strategy ("Protecting the Nation's Ground Water:

EPA's Strategy for the 1990s,") advises consideration of the use, value, vulnerability of the resource, as well as social and economic values. Part D of the Strategy, for example, advises the use of the Maximum Contaminant Levels under the Safe Drinking Water Act as "reference points" for water resource protection efforts when the ground water in question is a potential source of drinking water.

14. **How is the separate groundwater standard consistent with the direction of the 1992 Energy Policy Act that the Yucca Mountain standards prescribing the maximum annual effective dose to individual members of the public *"shall be the only such standards applicable to the Yucca Mountain site?"***

Section §801(a) of the EnPA directs EPA to promulgate "public health and safety standards for the protection of the public from releases from radioactive materials stored or disposed of in the Yucca Mountain site." The provision includes two express instructions to the Agency: (I) that the standards "shall prescribe the maximum annual effective dose equivalent to individual members of the public" from the waste in the repository; and (ii) that the standards shall be "based upon and consistent with" the findings and recommendations of the NAS.

EPA interprets this provision as authority to develop the standards that the Agency, in its technical and policy judgment, considers necessary and appropriate to protect the public and ground water resources from exposure to the waste in the repository. EPA believes that it has promulgated standards that comply with the two requirements of the statute. EPA's proposed individual protection standard does include a [maximum annual effective dose equivalent] to individuals. EPA's proposed regulations are also based upon and consistent with the NAS findings and recommendations.

15. **The Conference Report accompanying the 1992 Act read as follows: *"The Conferees did not intend for the National Academy of Sciences, in making its recommendations, to establish specific standards for protection of the public but rather to provide expert scientific guidance on the issues involved in establishing those standards."* The national Academy was not intended to usurp EPA's rulemaking authority. On the other hand, the direction to EPA is very clear in the 1992 law – the EPA Administrator is to set generally applicable standards for the Yucca Mountain site "based on and consistent with the findings and recommendations of the National Academy of Sciences."**

    (a) **That does not say, as Mr. Page suggested in written testimony, that "EPA was to <u>consider</u> technical recommendations from the National Academy of Sciences." The law says "<u>based upon and consistent with</u>." Yet, at least in part, EPA's proposed standard is not based on and consistent with the National Academy's recommendations. How does EPA justify deviating**

from the legislative mandate of the 1992 Act?

EPA does not believe that the language of Section 801(a)(2) mandates that EPA promulgate a standard that effectively codifies, unchanged, the recommendations of the National Academy of Sciences panel. Rather, EPA believes that the actual intent of Congress was explicitly set forth in the Conference Report that accompanied the Energy Policy Act. In that report, the Conference Committee stated quite clearly that the role of the NAS panel was to provide "expert scientific guidance," but that Section 801 is not intended to limit EPA's discretion in the exercise of its regulatory authority:

> "The Conferees do not intend for the National Academy of Sciences, in making its recommendations, to establish specific standards for protection of the public but rather to provide expert scientific guidance on the issues involved in establishing those standards. Under the provisions of section 801, the authority and responsibility to establish the standards, pursuant to rulemaking, would remain with the Administrator, as is the case under existing law. The provisions of section 801 are not intended to limit the Administrator's discretion in the exercise of his authority related to public health and safety issues." (H.R. Rep. No. 1018, 102nd Cong., 2d Sess. 391 (1992)).

Moreover, EPA's interpretation of the EnPA as not limiting the Agency's regulatory authority in this rulemaking is consistent with the views EPA expressed to Congress during deliberations over the legislation. The Chairman of the Senate Subcommittee on Nuclear Regulation requested EPA's views of the bill reported out of conference. The Deputy Administrator of EPA indicated that the NAS Report would provide helpful input. The Deputy Administrator pointed to the language, cited above, stating the intent of the conferees not to limit our rulemaking discretion, and assured Congress that any standards for radioactive materials that we ultimately issue would be the subject of public comment and involvement. (138 Cong. Rec. S33,955 (daily ed. October 8, 1992)).

EPA's interpretation also is consistent with the role that both NAS and Congress understood NAS would fulfill. During the Congressional deliberations over the legislation, NAS informed Congress that while it would conduct the study, it would not assume a standard-setting role because that is properly the responsibility of government officials. (138 Cong. Rec. S33,953 (October 8, 1992)). Therefore, EPA does not believe that its proposal deviated in any respect from the legislative mandate of the EnPA.

(b) The National Academy did not define specific standards that EPA must follow, but it did recommend certain methodologies and risk levels that are based on sound science. EPA has chosen to deviate from those National Academy recommendations. That now places a greater burden on EPA to convince the Congress and the public that EPA does, in fact, have a sound scientific basis for the standards it

proposed. What does EPA intend to do between now and the time it plans to issue a final rule that will demonstrate that there is a sound scientific basis for EPA's proposed radiation standards?

Firstly, EPA's proposed standard is mostly consistent with the NAS recommendations or the intent of the recommendations. For example, although the NAS recommended a risk based standard, EPA's dose based standard of 15 mrem falls within the NAS recommended risk range. The NAS also stated that EPA's RMEI is broadly consistent with their recommendations and the we followed their recommendations on human intrusion very closely.

As a matter of routine procedure in Agency rulemakings, a number of supporting documents are prepared to accompany a final rule which will document the information and rationales for the Agency's decisions. There are four major supporting documents as described below.

- A lengthy preamble is published in the Federal Register along with the final rule regulatory language, i.e., the standard itself. The preamble explains the reasons for the Agency's decisions on the form and content of the rule itself. The preamble discusses the technical, scientific and policy considerations that were used in making decisions and the most salient points raised in the public comment.
- A Background Information Document (BID) is also being prepared. The BID serves as a resource to document much of the factual information we used in developing the standard. The BID is effectively a technical reference focused around the substantive information used to address rulemaking issues.
- The Response to Comments Document (RCD) contains detailed responses to all the comments we received during the public review period for the proposed standard. This document is a major resource for in-depth discussion of specific issues involved in the final standard.
- The Economic Impact Analysis (EIA), which will present our analysis of the economic impact of the rulemaking on the repository program.
- In addition to these four major sources for explanation of the rule's form and content, we have established a public docket for the rulemaking (EPA Air Docket # A-95-12) which contains copies of other documents used in developing the rule, including such items as studies to address specific regulatory issues (such as comparisons of potential dose receptor alternatives for the site). These reports and publications in the docket are also referenced in the four major support documents described above and the docket serves as a reference library for the rulemaking.

In developing the standards we gave very serious consideration to the recommendations of the NAS, and where we chose not to adopt specific aspects of their recommendations (as given in the NAS report, "Technical Bases for the Yucca Mountain Standards") we are developing discussions of the rationales we used in making these decisions for presentation in the rule preamble and the RCD. As the NAS recognized in its

recommendations, many of the decisions necessary in this rulemaking involve both scientific and policy questions and considerations. The NAS Report also stated in many places that the Agency might elect not to follow the panel's recommendations exactly because of policy considerations or other reasons. The documents we are preparing will present the total explanation of the scientific and policy considerations that will determine the form and content of the final rule.

16. **The National Academy recommended that EPA adopt a risk based standard for the protection of individuals, yet EPA proposed a dose based standard. While the 1992 Act directed EPA to *"prescribe the maximum annual effective dose equivalent to individual members of the public,"* that statutory language could be interpreted merely to dictate the final form of the standard, and certainly does not prevent EPA from using risk, as the National Academy recommended, to derive a final dose equivalent.**

(a) Is EPA, in fact, using a risk level to determine the final dose?
(b) If so, why doesn't EPA follow the recommendation of the National Academy and present the standard in terms of risk with a derived value of dose? Please explain fully.

Yes, EPA did use the level of risk of fatal cancer from exposure to radiation in order to select the appropriate dose for the individual protection standard. Moreover, EPA did select a risk level within the range recommended by NAS and translated that into the corresponding dose. In accordance with the statute, EPA expressed the individual protection standard in terms of maximum annual effective dose.

17. **Mr. Page's testimony at page 3 refers to technical discussions regarding environmental protection standards for Yucca Mountain held between EPA and NAS, DOE, NRC, OMB and OSTP during the period between 1995 and 1999. Please list the date and substance of each technical or policy discussion held between EPA and these other entities and identify all participants in those discussions.**

Date	Participants	Subject
6/22/98	EPA: Larry Weinstock, Frank Marcinowski OSTP: Art Bienenstock, Beverly Hartline, Fran Sharples, Martin Offutt, Gerald Kiernan, Elaine Podovani DOE: Lake Barrett, Alan Brownstein NRC: Malcolm Knapp, Michael Bell OMB: John Pfeiffer	Draft Standard

6/29/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli, Ken Czyscinski OSTP: Art Bienenstock, Beverly Hartline, Martin Offutt, Elaine Podovani DOE: Lake Barrett, Alan Brownstein, Abraham Van Luik NRC: John Greeves, Michael Bell, Tim McCartin LANL: Bruce Robinson	Ground water, modeling, reasonable expectation
7/14/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli, Ken Czyscinski, Brian Littleton DOE: Alan Brownstein, Steve Brocum, Abraham Van Luik, Wendy Dixon NRC: Michael Bell, Tim McCartin, Keith McConnell USGS: Dwight Hoxie DOE Contractors	Ground water, individual protection
7/28/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli OSTP: Art Bienenstock, Beverly Hartline, Fran Sharples, Martin Offutt, Gerald Kiernan, Elaine Podovani DOE: Lake Barrett, Alan Brownstein, Steve Brocum NRC: Malcolm Knapp, Michael Bell, Tim McCartin	NAS recommendations on risk range, critical group, compliance period, human intrusion
9/25/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli, Ken Czyscinski, Bill Diamond, Phil Metzger OSTP: Art Bienenstock, Beverly Hartline, Fran Sharples, Martin Offutt, Gerald Kiernan, Elaine Podovani DOE: Lake Barrett, Alan Brownstein, Steve Brocum NRC: Carl Paperiello, Michael Bell, Tim McCartin	Ground water standard, reasonably maximally exposed individual
10/1/98	EPA: Frank Marcinowski, Al Colli, Ken Czyscinski, Ray Clark, Wendy Melgin, Phil Berger OSTP: Beverly Hartline DOE: Alan Brownstein, Steve Brocum, William Boyle NRC: Malcolm Knapp, John Greeves, Michael Bell, Tim McCartin USGS: Ray Wallace, Claudia Faunt EPA Contractors DOE Contractors	Ground water flow and modeling

10/23/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli, Ken Czyscinski, Ray Clark, Wendy Melgin, Phil Berger OSTP: Beverly Hartline DOE: Lake Barrett, Alan Brownstein, Steve Brocum NRC: Carl Paperiello, Tim McCartin EPA Contractors DOE Contractors	Ground water modeling
11/2/98	EPA: Larry Weinstock, Frank Marcinowski, Al Colli, Mike Bandrowski OSTP: Art Bienenstock, Beverly Hartline, Fran Sharples, Martin Offutt, Bruce MacDonald DOE: Lake Barrett, Alan Brownstein NRC: Carl Paperiello, Tim McCartin, Mike Bell	Ground water withdrawal amounts and modeling
12/21/98	EPA: Bob Perciasepe, Steve Page, Larry Weinstock, Frank Marcinowski DOE: Lake Barrett, Alan Brownstein	Overview of DOE radioactive waste management program
1/15/99	EPA: Larry Weinstock, Frank Marcinowski, Geoffrey Wilcox, Ken Czyscinski, Jim Taft, Mike Bandrowski DOE: Alan Brownstein, Steve Brocum EPA Contractors DOE Contractors	Draft standard
1/22/99	EPA: Larry Weinstock, Frank Marcinowski, Ken Czyscinski, DOE: Alan Brownstein, Steve Brocum, Nancy Slater DOE Contractors	Draft standard
5/11/99	EPA: Larry Weinstock, Frank Marcinowski, Ken Czyscinski, Ray Clark DOE: Alan Brownstein, Steve Brocum DOE Contractors	Yucca Mountain design alternatives presented by DOE
5/20/99	EPA OMB Council of Economic Advisors OSTP	Preproposal draft standard

18. Please list the date and substance of each technical or policy discussion regarding EPA's Yucca Mountain standards between EPA and NAS, DOE, NRC, OMB and OSTP held after August 27, 1999. Please identify all participants in those discussions.

Date	Participants	Subject
12/17/99	EPA: Frank Marcinowski, Mary Kruger, Ray Clark, Ken Czyscinski, Elliot Foutes, Geoffrey Wilcox, Sharon White OMB: Erik Godwin	Economic Impact Analysis
1/21/00	EPA: Frank Marcinowski, Mary Kruger, Ray Clark, Ken Czyscinski, Elliot Foutes OMB: Art Fraas, Erik Godwin DOE: Lake Barrett, Alan Brownstein	Economic Impact Analysis
5/11/00	EPA: Bob Perciasepe, Frank Marcinowski, Mary Kruger OSTP: Art Bienenstock, Pat Gallagher	OSTP comments on proposal
5/18/00	EPA: Bob Perciasepe, Frank Marcinowski, Mary Kruger NRC: Dick Meserve, Carl Paperiello	NRC comments on proposal
6/27/00	EPA: Bob Perciasepe, Steve Page, Frank Marcinowski DOE: Ernie Moniz, Ivan Itkin, M.L. Wagner, Alan Brownstein	DOE comments on proposal

19. **Please cite each peer-reviewed scientific study that was considered by EPA in its decision to include a separate groundwater protection standard based on Safe Drinking Water Act maximum contaminant levels. Please explain how each scientific study supports EPA's proposed groundwater standard.**

EPA did not base its decision to include a separate ground water standard on any specific scientific studies. As discussed in response to question 2 above, EPA included ground water protection standards in its proposal, and is considering such standards for inclusion in the final rule, primarily for consistency with Agency policy.

20. **Please cite each international standard for nuclear waste disposal which includes a separate groundwater protection standard. Please describe how the maximum contaminant levels in each international standard compare to those proposed by EPA for the Yucca Mountain repository.**

In the international arena, protection of the environment is an emerging issue. International standards typically contain the more traditional dose limit to human beings but more recent standards include provisions to address environmental protection. In 1995, the International Atomic Energy Agency, through a consensus of its member States (including the United States), issued "The Principles of Radioactive Waste Management" (Safety Series No. 111-F). Principle 2: Protection of the environment states that "Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment....Radioactive waste disposal may have adverse effects on

the future availability or utilization of natural resources, for example, land, forests, surface waters, ground waters and raw materials, over extended periods of time. Radioactive waste management, therefore, should be conducted in such a way as to limit, to the extent practicable, these effects." More recently, Sweden's proposed regulations for the final management of spent nuclear fuel or nuclear waste contain a separate section devoted to environmental protection. In this case, the concern is to limit the harmful effects to ecosystems and the resources that support them, among which, ground water is a primary sustaining resource. While different international organizations and countries may take alternative approaches to protecting the environment, the common goal is to maintain the integrity of those resources, such as ground water, supporting both human and non-human ecosystems.

21. **Is there any statutory requirement to promulgate a final rule on the Yucca Mountain environmental protection standards this summer? Please explain why EPA plans to promulgate a final rule this summer when EPA will not have completed updating the 1976 maximum contaminant levels used in the groundwater protection standard.**

There is no statutory mandate to promulgate a final rule on the Yucca Mountain environmental protection standards in the summer of 2000. Actually, Section 801(a)(1) of the EnPA mandates that EPA promulgate public health and safety standards for protection of the public from releases from radioactive materials disposed in the repository at the Yucca Mountain site "not later than 1 year after the Administrator receives the findings and recommendations" of the NAS. The reason we had planned to finalize our standards during the summer of 2000 is that it seemed like a reasonable time frame to complete our analyses of public comments, undergo the interagency review process, and make appropriate revisions to the final rule and supporting documents.

22. **Will the update to the 1976 MCLs reconsider and/or change the MCL for each of the radioisotopes covered by the proposed Yucca Mountain environmental protection standard? Please list the radioisotopes for which the MCLs will remain unchanged. For any radioisotope-specific MCL that is not being changes, is this because there has been no additional relevant scientific study on that radioisotope? If there has been relevant scientific study since 1976 on any radioisotope for which the MCL id not being updated, please provide the cite and conclusions of each study regarding the risks of exposure to the radioisotope in question. How does the conclusion of each study support the decision not to update the relevant MCL?**

See responses to questions 3(a) and 3(b).

23. **Please cite each peer-reviewed study that supports EPA's ongoing efforts to update the MCLs for radioisotopes. For each study cited, please explain how the study was used by EPA and to which specific MCLs the study applies.**

Please see the Notice of Data Availability and the technical support document accompanying it. In addition for man-made beta/photon emitters, the FGR-13 cited above is the source of revised information.

24. **Please explain how the scientific basis for establishing MCLs changed between ICRP Publication 2 and ICRP Publication 30, between ICRP Publication 30 and ICRP Publication 60, and between ICRP Publication 60 and ICRP Publication 72. Which of these publications will be relied upon after the MCLs are updated (as described in Mr. Page's testimony at page 12)? Will the same ICRP methodology be applied to all radioisotopes MCLs? If not, please explain on a radioisotope by radioisotope basis which ICRP methodology will be applied in setting each MCL. Please explain how and why the updates in the ICRP methodology either were or were not applied in setting each MCL.**

40 CFR §141.16, *Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water system*, stipulates:

> (b) Except for the radionuclides listed in Table A [tritium and Sr-90], the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

NBS Handbook 69 contains dose conversion factors taken from ICRP Publication 2. Appendix B of EPA-570/9-76-003 provides guidance for using the NBS Handbook 69/ICRP Publication 2 dose factors to derive radionuclide-specific activity concentrations (in picoCuries per liter, pCi/L) yielding an annual dose of 4 millirem. Tables IV-2A and IV-2B of the appendix list the derived activity concentrations.

On July 18, 1991, EPA proposed a revised MCL for beta particle and photon emitters (56 FR 33050). Appendix B of the proposed rule included a look-up table of radionuclide-specific activity concentrations (in pCi/L) corresponding to an annual effective dose equivalent of 4 millirem, the proposed revised MCL. To derive this table, EPA used its RADRISK computer code which incorporated dose conversion factors from ICRP Publication 30.

EPA's current radiation risk assessment methodology is based on ICRP Publication 60 and ICRP Publication 72. This methodology applies state-of-the-art methods and models

that take into account age and gender dependence of intake, metabolism, dosimetry, radiogenic risk, and competing causes of death in estimating the risks to health from internal or external exposure to radionuclides. EPA has incorporated these methods and models in its calculations of radionuclide-specific cancer mortality and morbidity risk coefficients. EPA uses these risk coefficients, which are provided in Federal Guidance Report No. 13 (EPA 402-R-99-001), to estimate the fatal and total cancer risks associated with radionuclide MCLs.

On April 21, 2000, EPA published a Notice of Data Availability (NODA) to inform the public and the regulated community of new information concerning radionuclides in drinking water and to solicit comments on possible risk management decisions on MCL revisions (65 FR 21576). The Agency is under a court agreement to publish final regulations by November 2000. Since this process is ongoing—EPA is currently responding to comments received on the NODA and is finalizing decisions on the regulations—ORIA cannot comment at this time on radionuclide MCL revisions or on what ICRP publication or publications will be used to establish the MCLs.

25. **For each radionuclide which EPA proposes to regulate via a specific MCL under a separate groundwater protection standard, please provide the following specific information:**

    (a) **What level of cancer risk does this MCL equate to?**
    (b) **On what scientific analysis does EPA base this determination of the risk level?**
    (c) **Does such analysis represent the latest available science?**
    (d) **What is EPA's basis for concluding that the selected MCL represents an appropriate risk level for Yucca Mountain groundwater?**
    (e) **Is this risk level consistent with the risk level recommended by the National Academy of Sciences and incorporated in the 15 millirem all-pathways standard? If not consistent, what is EPA's justification for the varying risk levels?**
    (f) **How does the risk level specified for this radioisotope compare to the risk levels represented with the proposed MCLs for other radioisotopes?**

(a) The following tables present EPA's estimates of lifetime excess fatal and total cancer risks associated with the current radionuclide MCLs:

Fatal Cancer Risks

	Maximum Contaminant Level		
Statistic	Ra-226/Ra-228	Gross Alpha	Beta/Photon
Average	1×10^{-4}	2×10^{-5}	4×10^{-5}

Total Cancer Risks

Statistic	Maximum Contaminant Level		
	Ra-226/Ra-228	Gross Alpha	Beta/Photon
Average	2×10^{-4}	3×10^{-5}	6×10^{-5}

(b) EPA uses its current radiation risk assessment methodology to estimate the fatal and total cancer risks associated with radionuclide MCLs. Specifically, EPA calculates these risks using the cancer mortality and morbidity risk coefficients provided in Federal Guidance Report No. 13 (EPA 402-R-99-001), assuming a 2 L/d drinking water intake rate, 365 d/y, for 70 y.

(c) Yes. EPA's radiogenic risk methodology applies state-of-the-art methods and models from ICRP Publications 60 and 72. These methods and models take into account age and gender dependence of intake, metabolism, dosimetry, radiogenic risk, and competing causes of death in estimating the risks to health from internal or external exposure to radionuclides.

(d) EPA incorporated the existing MCLs in its proposed Yucca Mountain standards (64 FR 46976, August 27, 1999). This proposal acknowledged that the MCLs might change in the final rule but that, for the radionuclides of concern at Yucca Mountain, the concentration values for those MCLs are not likely to change significantly. (See 64 FR 47000.) Should the MCLs applied to Yucca Mountain be equal to or similar to those of the existing MCLs (40 CFR 141.15 and 141.16), the risk level associated with the existing 4 millirem/yr beta particle and photon radioactivity MCL results in concentration limits with risks that fall within the Agency's lifetime risk range goal of 10^{-6} to 10^{-4}. (See 65 FR 21581, April 21, 2000.) This risk range has guided numerous Agency actions, including the establishment of the MCLs, and provides consistency among a wide variety of programs with differing legislative mandates.

(e) As noted in our proposed rule (at 64 FR 46985, August 27, 1999), the range of annual risk of fatal cancer suggested by NAS was 1 chance in 100,000 to 1 chance in 1,000,000. This corresponds to a range of 20 to 2 millirem/year. The 4 millirem/year MCL for man-made beta and photon emitting radionuclides falls at the lower end of this range and is therefore consistent with the NAS suggested risk range.

(f) As indicated by both the Viability Assessment (Figure 4-12) and the Draft Environmental Impact Statement (DEIS) for Yucca Mountain (Tables 8-42, 8-46, and 8-50), the primary radionuclides of concern during a 10,000 year regulatory period are carbon-14 (C-14), technetium-99 (Tc-99), and iodine-129 (I-129). These are all beta emitting radionuclides that fall under the 4 millirem/year MCL limitation. When this level

was derived in 1976, the cancer risk associated with whole body irradiation (as is the case for C-14 and Tc-99) at 4 millirem/year equated to a lifetime cancer risk of 5.6×10^{-5}, assuming a 70-year lifetime. A recent re-evaluation, using EPA's Federal Guidance Report 13, of the risk associated with each of the 1976 MCL concentration levels corresponding to the 4 millirem/year limit indicates that the risk associated with each of these radionuclide concentration limits falls within the Agency's lifetime risk range goal of 10^{-6} to 10^{-4}. (See 65 FR 21581, April 21, 2000.)

26. Are there radioisotopes which EPA does not propose to regulate under the ground water protection standard? What is the scientific basis for making such a determination?

At this time, EPA is not planning to regulate potassium-40, or lead-210. These were not listed with separate limits in the original rule and EPA did not propose to regulate them in its 1991 proposal. K-40 is naturally occurring as a part of all potassium in the environment and in the human body and accounts for a large part of the radiation dose to the body. The amount of potassium in the body is controlled by homeostatic mechanisms. A large amount of potassium-40 would be needed to change the ratio of nonradioactive to radioactive potassium. EPA must determine a limit from other than natural sources which would provide an unacceptable incremental increase in risk above the natural exposure before regulating. Lead-210 is naturally occurring and EPA placed it in the unregulated contaminant monitoring rule for further study to determine if regulatory limits would result in significant risk reduction.

27. Please explain fully the impact of the issuance of the Notice of Data Availability (NODA) will have on the proposed Yucca Mountain environmental protection standards.

The NODA updates information relevant to the Agency's review of the radionuclide MCLs established under the SDWA. The NODA itself will have no impact on the proposed Yucca Mountain standard. However, should the Agency issue revised radionuclide MCLs, different from those referenced in the proposed Yucca Mountain standard, we could amend the final Yucca Mountain standard to reflect those revised MCLs.

28. Mr. Page's testimony indicates that, once EPA's internal review process is completed for the final rule on Yucca Mountain, EPA will begin an interagency review process administered by the Office of Management and Budget, in which the DOE and NRC will participate. Please describe the process that EPA will use to resolve any differences that might remain at the end of this interagency review process.

The Agency is required by Executive Order to submit its final rulemaking to OMB for review and approval. It is OMB's decision as to which agencies it wants to have participate in that process. However, it is reasonable to assume that DOE and NRC will participate since they were involved in the process preceding the proposed rule. During the "interagency review process," it is OMB's role to facilitate discussions among the participants and to decide what is acceptable for inclusion in the final rule. The Agency will be a full and willing participant in those discussions.

29. Mr. Page's testimony states that EPA staff has traveled to local communities to hold public hearings and meetings to discuss the proposed standards? Please list the date and substance of each such public hearing or meeting.

Following is a list of public meetings and hearings, in chronological order.

Date	Location	Substance
9/20/1995	Amargosa Valley, NV	Public meeting on EPA's role and process for setting environmental standards for the proposed Yucca Mountain repository, and to receive comments on the NAS Report. Format: EPA presentation, public testimony, question and answer. (Docket A-95-12, II.E.1)
9/21/1995	Las Vegas, NV	Public meeting on EPA's role and process for setting environmental standards for the proposed Yucca Mountain repository, and to receive comments on the NAS Report. Format: EPA presentation, public testimony, question and answer. (Docket A-95-12, II.E.1)
10/19/1999	Las Vegas, NV	Meeting with Las Vegas Mayor's Office. Discussion of need for separate ground water protection standard, EPA's rulemaking process; plans to submit written comments. (Docket A-95-12, II.E.18)
10/20/1999	Las Vegas, NV	Meeting with Nevada Legislative Counsel Bureau. Discussion of differences in the dose standard proposed by EPA and NRC; the need for a separate ground water standard; alternatives for disposal; EPA rulemaking process. (Docket A-95-12, II.E.17)

10/20/1999	Las Vegas, NV	Meeting with Nevada Governor's office. Meeting with State Legislature. Discussion of need for stringent standard, point of compliance, regulatory time frame, definition of disposal and engineered barriers. (Docket A-95-12, II.E.19)
10/13/1999	Washington D.C.	Public Hearing. Testifiers presented oral testimony regarding EPA's proposed radiation protection standards for Yucca Mountain. (Docket A-95-12, I (Docket A-95-12, IV.F.1)
10/19/1999	Amargosa Valley, NV	Public Hearing. Testifiers presented oral testimony regarding EPA's proposed radiation protection standards for Yucca Mountain. (Docket A-95-12, IV.F.2)
10/20-10/21/1999	Las Vegas, NV	Public Hearing. Testifiers presented oral testimony regarding EPA's proposed radiation protection standards for Yucca Mountain. (Docket A-95-12, IV.F.3)
10/28/1999	San Francisco, NV	Public meeting with Nevada Indian tribes. Discussion of EPA's role and proposed standard, and concerns of the tribal representatives in attendance. (Docket A-95-12, IV.E.1)
11/22/1999	Reno, NV	Workshop session on EPA's proposed standard at the Inter-Tribal Council of Nevada Annual Convention. (Docket A-95-12, IV.E.3)

30. **Mr. Page testified that *"EPA's proposed Yucca Mountain standards are based on and consistent with the recommendations of the NAS. Where our proposed rule departed from a strict reading of the NAS report, we made a special effort to explain our reasoning."* Where EPA departed from the recommendations of the NAS with respect to a separate groundwater standard, is EPA contending that a "special effort to explain [its] reasoning" is sufficient to comply with the requirements of the Energy Policy Act of 1992? Please explain fully how EPA believes it is satisfying both the intent and the letter of the Energy Policy Act.**

As discussed above in response to question 15, the legislative history of the Energy Policy Act of 1992, including specific testimony by the National Academy of Sciences on the legislation that was to become the Energy Policy Act of 1992, made abundantly clear that the role of the NAS was not to dictate the standard. Nor is it the role of EPA, under that

Act, to simply codify unchanged, unexamined, and unrevised the recommendations of the NAS. In its comments on the proposed rule, the NAS stated: "The Board recognizes EPA has the authority under the Energy Policy Act to establish separate ground-water limits as a matter of policy, but if it does so it should explicitly state the policy decisions embedded in the proposed standard and ask the public to comment on those decisions." NAS Comments at 11 (Docket No. IV-D-31). Thus, NAS made no recommendation concerning a separate groundwater standard, so EPA's proposal of such a standard could not be inconsistent with an NAS recommendation. Further, in commenting on EPA's proposed standard, NAS stated that EPA (1) clearly has authority under the EnPA to establish such a standard to protect a valuable resource, but (2) should clearly state that it is doing so as a matter of policy. If EPA promulgates a final rule containing a separate groundwater standard, the Agency will clearly articulate its rationale for doing so - whether, as the NAS recommended, this is clearly a decision based solely on a very important policy of protecting a valuable resource, or if the Agency determines that there are technical as well as policy reasons for doing so.

31. **Mr. Page's testimony at page 6 states that "*The annual risk associated with EPA's proposed 15 millirem standard and 4 millirem standard for groundwater fall within this [NAS-recommended] annual risk range.*" If 15 millirem to an individual from all sources is acceptable, why is it not acceptable for more than 4/15ths of that exposure to be attributable to groundwater?**

See Response to Question 50.

32. **Mr. Page's testimony at page 7 states that "*EPA has proposed the groundwater standard as an implementation of policy which we plan to articulate more clearly in the final rule.*" Given that this policy has not been sufficiently clearly articulated in the proposed rule on Yucca Mountain standards, does EPA plan to reissue the proposed rule to allow legally sufficient opportunity for notice and comment under the Administrative Procedure Act?**

The legal obligations that an administrative agency must satisfy when conducting informal rulemaking pursuant to Section 4 of the Administrative Procedure Act (APA) do not include articulation of potential policy decisions or technical determinations in a notice of proposed rulemaking in form and substance requisite for promulgation as a final rule. Section 4 of the APA (5 U.S.C. § 553) requires, except in certain circumstances not relevant here, publication in the *Federal Register* of a "[g]eneral notice of proposed rulemaking". Such notice must include (1) a statement of the time, place, and nature of public rulemaking proceedings; (2) a reference to the legal authority under which the rule is proposed; and (3) either the terms and substance of the proposed rule or a description of the subject and issues involved. The specificity with which issues must be set forth in a notice of proposed rulemaking to meet the requirements of the APA has been elucidated by reviewing courts: "The test of adequacy of a Notice of Proposed Rulemaking

("NPRM") is whether it 'fairly apprise[d] interested parties of all significant subjects and issues involved.'" *Heckler v. St. James Hosp.*, 579 F. Supp. 757, 763 (N.D. Ill. 1984) (*quoting American Iron and Steel Inst. v. EPA*, 568 F.2d 284, 291 (3rd Cir. 1977)), *aff'd*, 760 F.2d 1460 (7th Cir. 1985); *see also*, *Rybachek v. U.S. EPA*, 904 F.2d 1276, 1287 (9th Cir. 1990) ("The EPA's failure to propose in advance the actual wording of the BMPs does not make the BMPs invalid. The EPA need not 'publish in advance every precise proposal which it may ultimately adopt as a rule.' *California Citizens Band Ass'n v. United States*, 375 F.2d 43, 48 (9th Cir), *cert. denied*, 389 U.S. 844 (1967). Instead, the EPA is only required to publish in this context the 'terms or substance of the proposed rule or a description of the subjects and issues involved.' 5 U.S.C. § 553(b)(3) (1988));" *accord*, *Spartan Radiocasting Co. v. F.C.C.*, 619 F.2d 314, 321 (4th Cir. 1980). EPA's proposed rule for public health and safety standards for protection of the public from releases from radioactive materials disposed in the Yucca Mountain repository discusses all of the issues and subjects relevant to this rulemaking in detail. EPA has more than met its obligations under the APA to fairly apprize interested parties of all significant subjects and issues involved.

33. **Please list the dates, locations, and substance of all other applications of this EPA ground water policy.**

This policy has been applied in numerous superfund sites where ground water is contaminated or threatened. The record of decision for each site is publically available and explains how CERCLA mandate to clean up to drinking water standards applies in that particular situation.

34. **Does EPA contend that ground water at Yucca Mountain site needs to be protected to ensure that the ground water does not interfere with the attainment of the surface water quality standards? Please explain your answer fully.**

That consideration has not been voiced with respect to Yucca Mountain deliberations. Ground water not surface water has been the focus of concern.

35. **Mr. Page's testimony at page 8 states that EPA believes ground water is a resource needing special protection and, as such, proposed a level of protection for ground water at Yucca Mountain at the same level as the MCLs for radionuclides established under the Safe Drinking Water Act. What is the statutory basis providing EPA with authority to designate ground water as a resource requiring special protection? Has such a designation been subject to notice and comment by the public? Is so, please provide citation to the relevant Federal Register notice(s), the identity of the commenters, and the substance of their comments.**

A number of Federal statutes provide EPA with the authority to prevent and control sources of ground water contamination, for example, the Safe Drinking Water Act

(SDWA), the Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), and Comprehensive Environmental Response Compensation and Liability Act (CERCLA). During the early 1980's EPA recognized that these authorities were fragmented among many different statues. As a result, in 1984, EPA issued a ground water protection strategy to articulate both the problem and EPA's role in a national ground water protection program.

In 1989 a ground water task force was established to address comprehensive protection of the ground water resource. EPA did not use notice and comment rulemaking to develop this policy, however, significant input was provided by state and local governments, other Federal agencies, environmentalists, industry, and public interest groups in developing the published policy report ("Protecting the Nation's Ground Water: EPA's Strategy for the 1990s"). This strategy has guided the course of EPA and State efforts with a clear priority on preventing ground water contamination.

36. Please define "reasonably expected drinking water supplies" as used in Mr. Page's testimony at page 8.

This is not a technical or legal term. Mr. Page used this terminology to refer to groundwater resources that are probable sources of drinking water, now or in the future. In the case of groundwater in the vicinity of Yucca Mountain, EPA believes that the aquifer is of a size and character sufficient to support a significant population both currently and in the future.

In addition, the groundwater resources in the vicinity of Yucca Mountain are a potential source of water for more distant communities. Although the growing communities in the Las Vegas metropolitan area may not extend to the vicinity of Yucca Mountain in the near future, it is possible that those communities may seek to tap the aquifer as a resource to support those communities.

37. To the extent that EPA's proposed groundwater protection standard is designed to protect individual groundwater users, when is the groundwater at issue likely to be used by individuals. Please explain full [sic] in your answer and provide any documents related to this determination of future groundwater use in the Yucca Mountain vicinity.

The ground water downgradient from Yucca Mountain is currently being used to support a population of approximately 1500 residents of the Town of Amargosa Valley, Nevada. In addition, it is being used to support agricultural activities, e.g., several hundreds of acres of alfalfa and the largest dairy farm in the State of Nevada. The same source of ground water also supports the businesses in Amargosa Valley.

Given that the ground water is being used now, there is no reason to believe that it will not be used in the future. This is not documented because it would be the same for any existing ground water supply which is currently being used and did not appear in danger of being totally drained in the foreseeable future -- there is no indication that the ground water supply for Amargosa Valley is in danger of being mined to "extinction." As to setting the standards using the assumption that the ground water will be used in the future, on page 122 of its report to EPA, NAS stated:

> "In view of the almost unlimited possible future states of society, and of the significance of these states to future risk and dose, both EPA and we have recommended that a particular set of assumptions be used about the biosphere (including, for example, how and from where people get their food and water) for compliance calculations. Both EPA and we recommend the use of assumptions that reflect current technologies and living patterns."

In concert with this recommendation, we have proposed using the current technology and living patterns, the so-called "fixed biosphere," for Yucca Mountain. The NAS recommended this approach to avoid unlimited speculation regarding factors which were not directly related to the performance of the disposal system. Since we agree with that approach and since the ground water is being used today, we have proposed that it will be used in the future in a similar manner.

38. **Mr. Page's testimony at page 8 contains the following statement: "We frequently require compliance with the MCLs in our regulations." Please list each regulation in which EPA has required compliance with radionuclide MCLs in protecting ground water and explain the basis for including the MCLs. Also list every instance where EPA has not required compliance with these MCLs and explain the basis for not including the MCLs.**

See response to question 7.

39. **In August 1999, EPA released a report entitled "Evaluation of the Potential Economic Impacts of 40 CFR Part 197: Environmental Radiation Standards for Yucca Mountain, Nevada." This report provided a largely qualitative analysis of the potential economic impacts of the proposed rule. Does EPA intend to produce a more thorough and quantitative economic analysis prior to the issuance of the final rule? Does EPA believe it has complied with the APA notice and comment requirements if it does not release a quantitative economic analysis prior to issuance of the final rule? Please explain fully the basis for your answer.**

The EIA shows, that, based on the current repository design, DOE will meet our proposed standard. We do not believe it is our role to examine the performance and costs of other

repository designs. To the extent that there is any obligation under the APA to provide the opportunity for comment on the economic impact document produced in conjunction with this rule, for the reasons set forth above in response to question 32, EPA believes that it has fully complied with all applicable notice and comment requirements of that Act. Moreover, EPA does indeed intend to produce a more thorough economic impact of the proposed rule. This EIA will accompany the final rulemaking as it makes its way through the review process.

40. **In the August 1999 economic evaluation, EPA proposes a worst case scenario wherein the Yucca Mountain Site is disqualified and DOE must spend another $2 billion to identify and characterize an alternative site. Why did EPA not evaluate a true worst case in which the proposed standard invalidates any repository in the U.S., requiring a continuation of on-site storage at reactors around the country? Please provide and documentation relating to the evaluation of the worst case scenario as described in the August 1999 report, as well as any other alternative worst case scenarios which were not included in the at report.**

A scenario in which EPA's proposed standard "invalidates any repository in the U.S." is not valid. EPA was not in possession of any information at the time of the original EIA (or now, for that matter) that suggested that the true worst case for the proposed standard would be the invalidation of any repository site and the continuation of storage. Instead, it seemed more prudent and reasonable, then and now, to assume that if the Yucca Mountain facility were to be found unacceptable that it would be relocated and the characterization costs experienced up until that time, reincurred at the relocated site.

The impact of EPA's rulemaking is premised on the rationale the DOE has provided for its own design changes and upon it own performance assessments. These performance assessments have suggested a degree of containment such that the possibility of relocation would seem to be remote.

41. **In his testimony, Mr. Page referred to DOE's 1998 Viability Assessment in support of EPA's contention that the costs of complying with EPA's proposed radiation standards would not be significant. Please provide references to those portions of the Viability Assessment used by EPA in support of this contention. Specifically, identify those portions of the Viability Assessment which address the subject of compliance with a separate groundwater protection standard.**

EPA has examined DOE's results of detailed performance assessments for the Yucca Mountain site in two documents, the "Viability Assessment of a Repository at Yucca Mountain", (DOE/RW-0508, vol. 3, 1998, abbreviated here as the DOE/VA), and the "Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County,

Nevada", (DOE/EIS-0250D, 1999, abbreviated here as the DEIS). Information in both these documents is relevant to fully answering this question about Mr. Page's statements.

The performance analyses presented in the VA and DEIS documents are closely related. In the Viability Assessment, the basic framing, underlying assumptions and analytical approaches to the repository assessments are presented along with total system results, i.e., all-pathways total dose estimates to a down gradient receptor - a farmer, at 20 km from the repository, with characteristics similar to the receptor proposed by the Agency in the proposed rule (the reasonably maximally exposed individual or RMEI). These results are what we used for comparison with our proposed individual protection standard (15 mrem/yr). Volume 3 of the DOE/VA documents, presents the results of these analyses, and from an inspection of the information it can be seen that for the 10,000 year period the mean dose is 0.1 mrem/yr and the median dose is 0.02 mrem/yr - well below the 15 mrem/yr individual protection standard. This is a total all-pathways dose, not a drinking water dose alone, which would be significantly lower. EPA has carefully examined the framing of the base case performance scenario and the assumptions described in the DOE/VA assessments and EPA believes that these analyses are in fact very conservative. Assumptions were made that are very unrealistic for the sake of simplifying the analyses, and which are in fact highly conservative, i.e., they act to significantly overestimate projected releases. The results given in the DOE/VA documents should be considered "worst case" situations rather than expected case behavior.

The DEIS presents additional variations on the VA analyses, along with results for radionuclide concentrations in ground waters at various distances from the repository. These radionuclide concentrations in ground water can be compared directly with MCL limits for specific radionuclides as an indication of compliance with our ground water standards. The framing and assumptions for the DEIS assessments are essentially the same as used in the DOE/VA. In Chapter 5 of the DEIS, results are tabulated for radionuclide concentrations in ground waters downgradient from the repository at distances of 5, 20, 30 and 80 km. DOE's assessments show that the radionuclides reaching these distances during the regulatory time period (10,000 years) are technetium-99 (Tc), iodine-129 (I) and a small percentage of carbon-14 (C). From inspection of tables 5-7, 5-11 and 5-15 in the DEIS, it can be seen that the MCL concentration limits (in picoCuries per liter (pCi/l)) for Tc (MCL for Tc = 900 pCi/l), I (MCL for I = 1 pCi/l) and C-14 (MCL for C-14 = 2000 pCi/l) are not exceeded at any distance. These results indicate that the repository system as modeled (remembering that the assessments are very conservative, i.e., they over estimate releases) can meet the ground water standards. These data from DOE's own assessments, coupled with DOE's move to a more durable waste package, are the reasons for Mr. Page's statements that we have not seen evidence that the repository design planned for the Yucca Mountain site cannot meet the standards in the proposed rule.

42. **Mr. Page's testimony at page 13 states that EPA is still considering options and alternatives for the final Yucca Mountain standards. Please provide a description of all options and alternatives that are still under consideration, as well as those options and alternatives that were previously considered but subsequently dropped. Please identify the EPA individual who is responsible for deciding the disposition of these past and current options and alternatives.**

EPA's proposal included options and alternatives on many aspects of the standards. Some of these alternatives were offered in the rule language itself, while others were discussed in the preamble, with EPA's preferred alternative included in the rule language. EPA offered alternatives, and requested public comment, on:

• EPA described four alternatives for identifying the RMEI:
1. Subsistence (low technology) farmer
2. Commercial farmer
3. Rural-residential individual
4. Community domestic use of an underground source of drinking water

• EPA described three broad subarea alternatives for the location of the RMEI:
1. Including the area between Yucca Mountain and the Town of Amargosa Valley
2. Including the northern part of the Town of Amargosa Valley
3. Including the remainder of the Town of Amargosa Valley

• EPA described two alternatives for the period of regulatory compliance with the individual-protection standard (the RMEI):
1. A specified time period of 10,000 years during which compliance must be demonstrated
2. A compliance period that extends to the time of peak dose to the RMEI

• EPA described two alternatives for the period of regulatory compliance with the human-intrusion standard:
1. A specified time period of 10,000 years during which compliance must be demonstrated
2. A compliance period that extends to the earliest time of possible intrusion (if less than 10,000 years, analyses covering longer time periods must be placed in the Environmental Impact Statement for Yucca Mountain)

• EPA described four alternatives for the representative volume of ground water:
1. 4,000 acre-feet/year, corresponding to the perennial yield of the aquifer
2. 1,285 acre-feet/year, corresponding to an average alfalfa farm
3. 120 acre-feet/year, corresponding to a community of 150 people
4. 10 acre-feet/year, corresponding to domestic use for a family of four

• EPA described four alternatives for the point of compliance for ground water:

1. A controlled area extending no more than 5 km from the repository in any direction
2. A point roughly 20 km from the repository
3. A point roughly 30 km from the repository
4. A controlled area that may include the Nevada Test site

• EPA described two alternatives for the period of regulatory compliance with the ground-water standard:

1. A specified time period of 10,000 years during which compliance must be demonstrated
2. A compliance period that extends to the time of peak concentration

• EPA also explicitly requested public comment on other aspects of the proposal and encouraged commenters to provide information to support approaches other than those proposed by EPA. The significant issues EPA asked for public comment on include:

1. Whether EPA's proposed 15 mrem/year individual-protection standard is appropriate
2. Whether EPA should use the critical group approach instead of the RMEI
3. Whether EPA should include qualitative assurance requirements in its rule
4. Whether EPA should specify an all-pathways standard with no separate ground water protection
5. Whether EPA should issue guidelines for DOE's elicitation of expert opinion

EPA received a significant amount of public comment on these and other issues, and is considering those comments, and the latest information available from DOE and NRC, in developing the final standards. While EPA made its preferred positions clear in its proposal, it would be accurate to say that, until the rule is final, none of these alternatives has been definitively eliminated. The EPA Administrator will make the final decisions.

43. **Given that the National Academy of Sciences has taken the position that a risk-based standard would promote consistency between the Yucca Mountain standards and standards applied to other hazards, such as toxic chemicals, please explain EPA's basis for not using a risk-based standard in the proposed rule.**

See response to question 16.

44. **EPA proposes to require the repository performance beyond 10,000 years to be examined to see if "dramatic changes" could be anticipated. Please define "dramatic changes" in this context and state the statutory basis for proposing such a requirement. Please quantify the benefit to the public from this aspect of the proposed standard.**

The rationale for making repository performance projections for periods beyond the 10,000-year regulatory compliance period is to provide a more comprehensive picture of anticipated behavior of the waste containment and isolation performance over the range of natural conditions that can be expected at the site consistent with the recommendations of the NAS. The 10,000-year time frame is fully consistent with the generic disposal regulations, the WIPP certification rulemaking, and NRC licensing criteria. The assumption behind deep geologic disposal is that the combination of engineered and natural barriers will contain radionuclides in the repository proper for long periods of time, and limit any eventual releases to small amounts of radionuclides that reach the environment. Over time periods of thousands to tens of thousands of years it is expected that a gradual degradation of the repository engineered barrier system (EBS) will occur from the effects of the site conditions on the EBS integrity, e.g, even extremely small quantities of ground water contacting waste packages would eventually result in sufficient corrosion to breach the waste container. The intent of the post-10,000 year performance projections is to examine how the repository system is expected to perform as the EBS system degrades as a function of changes in conditions at the site over the long term (beyond 10,000 years). By examining repository performance over very long time frames, the analyses can assess the effects of natural processes and events whose effects may not become manifest until time periods after the 10,000 year regulatory period. This context "dramatic changes" would imply large increases in repository releases.

The 10,000 year upper limit is fundamentally a policy decision that balances two considerations: the uncertainty in long-term performance projections and the degree of confidence necessary to conclude the licensing process. It is generally recognized that uncertainties in projecting the performance increase with time; however, this should not be interpreted to mean that a performance projection for year 10,000 is reliable, but the result for year 10,001 is completely unreliable for regulatory decisions. Projecting performance beyond 10,000 years offers a more comprehensive picture of the site's anticipated performance for decision making. As discussed in the preamble to the proposed rule, the 10,000 year regulatory period: has precedence in previous rulemakings and applications for radioactive as well as hazardous wastes; is a reasonable compromise between scientific uncertainties and licensing processes; and represents a consensus on this issue as seen by the occurrence of the 10,000 year regulatory performance period in the many radioactive waste disposal programs abroad. The NAS commented on our proposed treatment of performance calculations, saying "there may be little practical difference between the TYMS report's recommendations and the proposed EPA standards", but also suggesting that we be more specific about how the post-10,000 year calculations are to be treated in licensing or pass the task to the NRC. We will address this aspect in the final rule.

45. **What is the risk level associated withe EPA's MCL for arsenic? How does this risk level compare with the risk levels associated with the radionuclides MCLs proposed**

for Yucca Mountain? How does the arsenic risk level compare to the risk level associated with the proposed 15 mrem all-pathways standard? What is the scientific basis for the EPA's arsenic MCL?

For Arsenic, at the proposed MCL of 5 parts per billion (ppb), the risk for the 90th percentile person is 6×10^{-5} to 1.1×10^{-4} for community water consumption, or 7×10^{-5} to 1.2×10^{-4} for total water consumption (Tables X-2A & B of the arsenic proposal). The National Research Council (NRC) noted that the current MCL of 50 ppb could have a risk of 1 to 1.5×10^{-3}, using one of their risk analyses.

As stated earlier, the risk for beta/photon emitters at a 4 mrem dose varies between about 10^{-4} to 10^{-6}. The range of risk at the MCL for the different alpha emitting nuclides at the alpha MCL or the uranium proposed MCL is also in that range. The risk of a 15 mrem all-pathways is approximately 6×10^{-4}. This could be internal or external radiation.

EPA derived U.S. population risks from arsenic exposure from four risk estimates derived by the NRC of the National Academy of Sciences. Estimated risk reductions for bladder cancer at different MCL options were input into a Monte Carlo model of population risks to arsenic exposure. EPA's risk characterization is fully discussed in the June 22, 2000 FR proposed rule (65 FR 38888).

46. **Please identify all assumptions made by EPA regarding the lifestyle of the hypothetical Reasonably Maximally Exposed Individual (RMEI) considered in EPA's 15 millirem all-pathways radiation standard, including the amount of groundwater such an individual consumes per day. Please identify all lifestyle assumptions made in deriving each of the radionuclide MCLs in the proposed groundwater standard. Please explain fully the rationale for any differences in these two sets of lifestyle assumptions.**

In order to calculate all-pathway dose estimates for repository releases from Yucca Mountain, assumptions about the characteristics of the exposed individuals must be made because variations in these characteristics significantly affect the calculated dose, e.g., the amount of contaminated drinking water consumed or the kinds and amounts of consumed food produced with the contaminated water. For the Reasonably Maximally Exposed Individual (RMEI) proposed in the draft standard, we made the following assumptions.

- The RMEI should have a lifestyle patterned after current residents living downgradient from the repository - we proposed a "rural-residential" RMEI which is consistent with the current population at the nearest location to the repository where there are currently people in residence (the Lathrop Wells area mentioned in §197.21a).

- In order for the RMEI to be reasonably maximally exposed, at least one or more of the parameters that strongly control dose must be assumed to be at a high value - we chose to set drinking water consumption to 2 liters per day - a high-end value but not unrealistically high for someone living in an arid location. We also consider the location to be a high-end value.

- We assumed that the remainder of the RMEI's intake of food would be consistent with the eating habits of the general population in the area -as determined by surveys of that population (see §197.21 of the proposed standard).

- We assumed that the RMEI would also have a lifestyle representative of people currently living in the Town of Amargosa Valley- this would include growing some portion of the RMEI's own food, including grazing of livestock.

We believe the exact specifics, or ranges of variation, for some of these food consumption and lifestyle characteristics to be used in actual dose assessments are implementation details to be decided between the DOE and the NRC, as long as they are consistent with the general assumptions given above. We have only made general assumptions about the characteristics of the RMEI (except for the 2 l/day drinking water assumption), because we believe that the DOE and the NRC should have the flexibility to assess reasonable variations in RMEI characteristics so that the dose estimates are more representative of potential exposures and not artificially and unrealistically constrained to rigid limits.

The drinking water consumption rate assumed in the development of the 4 mrem/yr MCL limit for beta/photon emitters was 2 liters/day (EPA-570/9-76-003, National Interim Primary Drinking Water Regulations), which is the same drinking water intake level assumed in the description of the RMEI characteristics for the individual protection standard in §197.20 of the Yucca Mountain standard.

47. Given the abundance of criticism EPA has recently received for failing to incorporate sound science into its regulatory decision-making, how can EPA persist in disregarding the recommendations of the National Academy of Sciences, the Department of Energy, the Nuclear Regulatory Commission, and others, in setting standards for Yucca Mountain?

With respect to the recommendations of the National Academy of Sciences, as contained in the National Research Council report "Technical Bases for Yucca Mountain Standards," EPA is consistent with the major recommendations, except for regulatory time frame, the form of the standard, and ground water protection, as discussed in the November 26, 1999 comments from NAS on EPA's proposed Yucca Mountain standards. With respect to regulatory time frame, NAS is recommending an unprecedented position. With respect to the form of the standard, while the NAS advocated risk, EPA chose a dose standard based on a risk level in order to be consistent with the language in the

Energy Policy Act. This risk level is consistent with the NAS recommended range of risk.

As discussed in response to question 2 above, the inclusion of separate ground water protection standards in our proposal (64 FR 46976, August 27, 1999) was primarily a policy decision to protect the significant ground water resources around Yucca Mountain. Such standards would provide consistency with other Agency programs to protect ground water and would assure that the geologic disposal of spent nuclear fuel, high-level and transuranic waste anywhere in this country would meet comparable standards. At the same time, EPA is sensitive to the technical issues associated with establishing such standards and has taken comment on scientific issues related to assuring such standards can be implemented.

48. **EPA has publically acknowledged that its current MCLs are based on obsolete methods. Why does EPA feel constrained to rely on dosimetry modeling that is 40 years out-of-date ans that results in standards that provide levels of protection that vary significantly and arbitrarily?**

See response to question 3(a).

49. **Why does EPA continue to mislead the public by portraying its proposed groundwater limits for Yucca Mountain as a single numerical limit (i.e., 4 millirem per year) when, in fact, implementation of its proposed standards would prescribe risk levels that vary over several orders of magnitude depending on the radioisotope?**

EPA is not misleading the public. The 4 millirem per year is the regulatory limit that applies to man-made beta and photon emitting radionuclides. While the risk associated with that dose limit does vary depending on the radionuclide, the risks are consistent with the Agency's acceptable risk range of 10^{-4} to 10^{-6} for regulating such contaminants.

50. **Can EPA explain what policy basis it uses to justify providing different levels of protection for different radioisotopes that vary arbitrarily over such a wide range?**

It must be noted that the levels of protection developed for different radioisotopes has evolved over decades under a wide variety of Congressional mandates. For example, under the Atomic Energy Act, EPA has established radiation standards that typically consider the cost and effectiveness of different treatment options (e.g., 40 CFR Part 190). The Clean Air Act (section 112) requires a different approach for public health protection. EPA first determined "acceptable risk" that considers all health information. A second step follows in which the actual standard is set below the acceptable risk level while providing "an ample margin of safety". The Safe Drinking Water Act requires a different two-step process. First, the Maximum Contaminant Level Goals (MCLGs) must be established

based only on the available health effects information. For radiation, which is a carcinogen, the MCLG is zero. The second step is to define Maximum Contamination Levels (MCLs), which are enforceable, at levels as close as practicable to the MCLGs, taking into account health-effects information, feasibility of treatment, and costs of removing contaminants from drinking water. Given these different regulatory frameworks, the protection levels associated with a given radionuclide may indeed vary. While this may be the case, EPA traditionally has endeavored to limit lifetime risks to individuals from a wide variety of pollutants to a range of 10^{-6} to 10^{-4}. While the risk associated with that dose limit does vary depending on the radionuclide, the risks are consistent with the Agency's acceptable risk range of 10^{-4} to 10^{-6} for regulating such contaminants.

51. **Why has EPA elected to abandon the critical group concept recommended by the National Academy of Sciences, an approach widely accepted by state and other government regulators, as well as by regulatory authorities in the United Kingdom, Sweden, Switzerland, and Canada?**

Although NAS recommended using a CG approach to achieve a group that is "homogeneous in risk", they recognized that a non-CG approach could accomplish the same purpose. In its report, NAS stated "[i]t is essential that the scenario that is ultimately selected be consistent with the critical-group concept that we have advanced" (NAS Report p. 10, emphasis added). We chose to use an approach involving limiting exposure to a defined "reasonably maximally exposed individual", the RMEI. The NAS recognized that EPA did not "abandon" the recommended approach, stating that the RMEI approach is "broadly consistent with the TYMS report's recommendations" (NAS comments on proposed 40 CFR part 197). In fact, there are significant similarities between the CG and RMEI approaches, including the overall goal of evaluating potential doses to more highly-exposed segments of the population. EPA prefers an approach tp exposure assessment consistent with EPA programs, that is, the RMEI.

52. **Does EPA have any current scientific evidence showing that water with radioactivity levels corresponding to a dose above 4 millirem per year, but less than EPA' proposed all-pathway limit of 15 millirem per year, is in any way harmful to human health or the environment?**

Due to the limitations of epidemiologic studies, it has been—and probably will always be—impossible to directly demonstrate any harmful effects of radiation at dose levels corresponding to small percentage increments above natural background. Nevertheless there is an extensive body of laboratory data, supported by strong theoretical arguments, indicating that the probability of inducing "stochastic effects" such as cancer is, at low doses, proportional to dose with no threshold. In particular, there is strong evidence that even a single track of ionizing radiation can cause permanent damage to the cell's DNA. The assumption of low dose linearity for radiation protection purposes has been repeatedly

endorsed by distinguished panels organized nationally and internationally by such bodies as the National Academy of Sciences (NAS), the National Council on Radiation Protection and Measurements (NCRP), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the International Commission on Radiation Protection (ICRP), and the National Radiation Protection Board of the United Kingdom (NRPB), and is implicitly utilized by nearly every government agency involved in radiation protection worldwide.

Our knowledge of the mechanisms of induction of effects by low dose radiation is incomplete. Further research may help to illuminate these mechanisms and allow us to project low dose effects with more confidence, but at this point, the general consensus of experts is that the linear no-threshold assumption is the only prudent basis for assessing the deleterious effects of low dose radiation.

53. Does EPA know of any community that has spent resources to "clean up" groundwater that is naturally radioactive at levels below 15 millirem, but above 4 millirem, to achieve the 4 millirem limit?

The "4 millirem limit" does not apply to naturally occurring radionuclides; it applies to man-made beta and photon emitting radionuclides. The technical support document for the Agency's Notice of Data Availability regarding radionuclides in drinking water (65 FR 21576, April 21, 2000) provides information on the number of public water systems exceeding each of the applicable MCLs. From 1976 through 1998, only ten of the 10,159 public water systems reporting levels exceeding the MCLs did so because they exceeded the beta-photon limit of 4 millirem/yr. By far, most exceedences of the MCLs are related to naturally occurring radionuclides such as Ra-226, Ra-228 and other alpha-emitting radionuclides. (See Table II-2, "Radionuclides Notice of Data Availability Technical Support Document," Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency, March 2000.)

54. Please describe in detail the methodology used to obtain the 4 mrem ground water standard and identify opportunities for public input as well as peer review prior to finalization of the standard.

The methodology used to derive the picoCurie levels for man-made nuclides which correspond to 4 mrem is detailed in National Bureau of Standards Handbook-69, incorporated by reference into the standard. It did not use effective dose equivalent factors. The 1976 rule had a maximum risk in mind. It targeted one excess death in a million persons per year as the ceiling of risk. A dose of 4 mrem was selected as the closest approximation to that risk. 4 mrem to the whole body was then calculated to actually result in a risk of 0.8 deaths per million persons per year, just below the upper limit of 1.0 deaths envisioned. That risk was 5.6×10^{-5}, and pertained to the whole body dosers. Risks for organ-specific nuclides was lower. For each nuclide, a picoCurie limit

was established corresponding to the 4 mrem dose. Federal Guidance Report-13 now allows us to check the level of protection afforded to see if the rule provides adequate safeguards to public health or not. The beta/photon emitters fall in round numbers between 10^{-4} and a10^{-6} risk.

The standard was proposed in December 24, 1975 and after public comment, promulgated July 9, 1976. Our Notice of Data Availability, which supplements the 1991 proposal, was published in the Federal Register on April 21, 2000, and we are responding to comments received. The Federal Guidance Report-13 was peer reviewed and published as interim in January, 1998 and as final in September, 1999.

NWTRB

Summary of EPA Responses To Questions from Rep. Joe Barton

Much of EPA's response is verbatim (or paraphrased) restatement of information published in the *Federal Register* explaining the proposed Yucca Mountain standards.

The tone of many responses, especially to questions about the proposed groundwater protection standards, hints that the final Yucca Mountain standards will be very similar to the proposed standards, i.e.,

> Individual protection standard of 15 mrem/yr (effective whole body dose)
> Groundwater protection standard limiting concentrations to the existing maximum concentration limits (MCLs) for drinking water (roughly 4 mrem/yr for most radionuclides, but less than 0.1 mrem/yr for I-129, both effective whole body dose)[1].
> Both standards probably apply at 20 km from the repository (intersection of highways 95 & 373.
> Both standards limited to the first 10,000 years.

Some "answers" don't answer the questions. For example,

> EPA refuses to compare its proposed standards to natural background radiation at Yucca Mountain, saying that the standards are not derived from or related to background. (Background at Yucca Mountain is over 300 mrem/yr.)
> EPA implies that its MCLs correspond to levels of risk consistent with other EPA regulations, but EPA glosses over the extraordinarily low risk level associated with the MCL for I-129.

The most significant answer might be the response to a question about the cost of complying with the proposed standards. EPA cites the 1998 Viability Assessment as evidence that a Yucca Mountain repository can meet the proposed standards. EPA characterizes the VA base case performance assessment scenario as "very conservative," and states that "[t]he results given in the DOE/VA documents should be considered 'worst case' situations rather than expected case behavior." Noting that DOE has since adopted a more durable waste package, EPA concludes "we have not seen evidence that the repository design planned for the Yucca Mountain site cannot meet the standards in the proposed rule."

[1] The MCLs are based on an old system of radiation protection that established separate dose limits for "whole-body doses" and for doses to individual body organs. Using the old system, the MCLs limit doses from beta-emitting radionuclides to 4 mrem/yr for either a whole-body dose or a dose to any individual organ. The modern system of radiation protection uses weighting factors, based primarily on cancer risk, to convert both whole-body doses and individual organ doses to an "effective whole-body equivalent" dose, which approximates cancer risk. Since the thyroid gland is not very susceptible to cancer, a 4 mrem/yr thyroid dose from I-129 is equivalent to an effective whole-body dose of slightly less than 0.1 mrem/yr. For alpha-emitting radionuclides, smaller, but still significant variations in effective whole-body risk are seen in the MCLs where a single concentration limit applies to all radionuclides except radium. The wide variations in risk corresponding to the MCLs has been a long-standing source of friction between EPA and the NRC (and, to a lesser degree, the DOE).