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MINUTES OF THE 82ND ACNW MEETING
MARCH 27-29, 1996

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MINUTES OF THE 82ND MEETING OF THE
ADVISORY COMMITTEE ON NUCLEAR WASTE
MARCH 27-29, 1996
ROCKVILLE, MARYLAND

The 82nd meeting of the Advisory Committee on Nuclear Waste was held at Two White Flint North Building, 11545 Rockville Pike, Rockville, Maryland, on March 27-29, 1996. The purpose of this meeting was to discuss and take appropriate actions on the items listed in the attached agenda. The entire meeting was open to public attendance, except for a portion that dealt with organizational and personnel matters.

A transcript of selected portions of the meeting was kept and is available in the NRC Public Document Room at the Gelman Building, 2120 L Street, N.W., Washington, D.C. [Copies of the transcript are available for purchase from Neal R. Gross and Co. Inc., Court Reporters and Transcribers, 1323 Rhode Island Avenue, N.W., Washington, D.C. 20005.]

Dr. Paul W. Pomeroy, Committee Chairman, convened the meeting at 8:30 a.m. and briefly reviewed the schedule for the meeting. He stated that the meeting was being conducted in conformance with the Federal Advisory Committee Act. He also stated that the Committee had not received any requests from persons or organizations desiring to make an oral statement during the meeting. However, he did invite members of the public, who were present and had something to contribute, to inform the ACNW staff so that time could be allocated for them to make oral statements.

ACNW members, Drs. B. John Garrick, William J. Hinze and Martin J. Steindler were present. [For a list of other attendees, see Appendix III.]

I. CHAIRMAN'S REPORT (Open)

[Note: Mr. Richard K. Major was the Designated Federal Official for this part of the meeting.]

Dr. Pomeroy identified a number of items that he believed to be of interest to the Committee, including:

- Greta J. Dicus began her duties as a Commissioner of the Nuclear Regulatory Commission on February 15, 1996. Ms. Dicus succeeds former Commissioner James Curtiss, and her appointment will extend through June 30, 1998. Ms. Dicus previously served as the Director of the Division of Radiation Control and Emergency Management for the Arkansas Department of Health, and as the State of Arkansas' liaison to the Nuclear Regulatory Commission.

  Ms. Dicus also represented Arkansas as its Commissioner to the Central Interstate Low-Level Radioactive Waste Commission, serving as this commission's chairman from 1991 to 1993. In 1993, she was elected as Chairman of the Conference of Radiation Control Program Directors, Incorporated, and was appointed by President Clinton to the Board of Directors of the United States Enrichment Corporation for a term which ended in March 1995.

- In a press release on February 16, 1996, California Governor Pete Wilson declared the current Low-Level Waste Policy Act (LLWPA) of 1980 unworkable and stated that the federal government should be responsible for storage of waste. Under the

LLWPA the states are assigned the responsibility for disposal of low-level waste generated within the state. Pursuant to the LLWPA, the California Department of Health Services selected the Ward Valley site which is owned by the federal government for California's disposal site. California has requested transfer of the property to the state. Recently Interior Secretary Bruce Babbitt announced that the Department of Interior will require additional radionuclide migration studies and a supplemental environmental impact statement prior to land transfer. In various letters to members of Congress, Governor Wilson requested prompt transfer of the Ward Valley land to the State of California or a legislation which would relieve California and other states from responsibilities assigned to them in the Low-Level Waste Policy Act.

- In the March 1996 issue of the Health Physics Society (HPS) newsletter, the Society published its position on how radiation risks should be expressed. The position states, in short, that health risks should not be quantified for radiation doses exceeding background doses by less than 5 rem, or 5,000 millirems per year, or 10 rem during a lifetime. According to the HPS because the health risks in this range are so small, only qualitative expressions of risk are appropriate and should emphasize the "inability to detect any increased health detriment from exposure at these levels."

A joint subcommittee meeting of the Advisory Committee on Reactor Safeguards and the Advisory Committee on Nuclear Waste held on March 26, 1996, began its consideration of this general subject and expects to take further action on this matter in the future.

- A DOE contractor at Hanford had found Cesium-137 in the ground below waste tanks at depths greater than first reported. Shaft monitoring by Russ Geotech found the gamma emitting isotope at depths up to 125 feet. Tests done much earlier by Westinghouse-Hanford put Cesium at 68 to 70 feet. State officials have found this news unsettling, stating that it could indicate a downward migration of the material to the groundwater, and that the groundwater beneath the Hanford tank farm is at the 210-foot level.

- On February 9, 1996, the Environmental Protection Agency (EPA) issued its final rule on compliance criteria for the Waste Isolation Pilot Plant's (WIPP) proposed disposal of transuranic radioactive waste. EPA's action, 40 CFR Part 194, applies to WIPP's certification and recertification to be performed every five years after the initial acceptance of waste. WIPP must comply with EPA's radiation requirements and land disposal restrictions under the Resource Conservation and Recovery Act, the Clean Air Act to the Toxic Substance Control Act, and the Comprehensive Environmental Response Compensation and Liability Act, or Superfund.

II. <u>Regulatory Time of Compliance for Radioactive Waste Disposal</u> (Open)

[Note: Dr. Andrew C. Campbell was the Designated Federal Official for this portion of the meeting.]

The ACNW held a working group session on the "Regulatory Time of Compliance for Radioactive Waste Disposal," during this meeting. Dr. William J. Hinze was Chairman of this session. The purpose of the working group session was to review and evaluate technical and policy issues in specifying a time period for regulatory compliance in licensing high-

level radioactive (HLW) and low-level radioactive waste (LLW) disposal systems. The time frame issue for HLW was discussed in ACNW's letter of February 9, 1996, "Issues and NRC Activities Associated with the National Research Council Report, 'Technical Bases for the Yucca Mountain Standard (TBYMS).'" Other compliance periods have been suggested, particularly because a new HLW standard will be Yucca Mountain specific. Existing standards (i.e., 40 CFR Part 191) specify a 10,000 year compliance period. A key objective of the working group session was to develop information for the Commission on an appropriate time frame of compliance for licensing the proposed HLW repository at Yucca Mountain.

The TBYMS report stated that although there may be policy reasons for setting such a time of compliance, the panel concluded that there is no scientific basis for limiting the time period for the individual-risk standard to 10,000 years or any other value at Yucca Mountain. Specifically, the TBYMS panel concluded that an "assessment is feasible for many aspects of repository performance for much longer times [than 10,000 years] and that the ultimate restriction on time scale is determined by long-term stability of the fundamental geologic regime, [which] is on the order of one million years at Yucca Mountain." The TBYMS panel also noted that some potentially important exposures may not occur until after several hundred thousand years, given the longevity of the inventory of radionuclides and the potentially long transport times.

Although emphasis was on an HLW time frame, another important objective of this working group session was to provide the Commission with ACNW's views and comments on specifying a compliance period for 10 CFR Part 61, the LLW regulation. Part 61 relies, in part, on dose-based performance objectives, but does not specify a time of compliance. In its letter of June 28, 1995, "Regulatory Issues in Low-Level Radioactive Waste Disposal

Performance Assessment," the ACNW said that it believes the application of a peak dose is an important issue and will report to the Commission after timely review. The key question for both HLW and LLW is, what technical and policy bases need to be considered for specifying a time of compliance in dose-, risk-based standards and regulations. This issue has both policy and technical components and cannot be resolved solely on the basis of scientific studies and analyses.

A number of participants, with differing expertise and experience in radioactive waste disposal, discussed various aspects of regulatory compliance time frames for both high-level and low-level radioactive waste disposal facility licensing. Three main topic areas include: (1) background and regulatory context; (2) insights from performance assessments for both LLW and HLW; and (3) scientific issues and concerns. The first topic area included EPA, DOE, NRC, and international perspectives. The second topic area focused on the use of performance assessment to gain insights about overall risks for both HLW and LLW. The third topic area was concerned with scientific issues and concerns, including: Yucca Mountain site characterization studies; natural analogue studies; dose assessment issues and concerns; basis for the TBYMS Committee's recommendations on time frame; and a summary of various rationales for consideration in setting a time of compliance. Finally, a round table discussion was held to bring together the different elements of the working group session.

Mr. Ray Clark, Environmental Protection Agency (EPA), discussed the rationale and bases for 10,000 year time frame in the EPA HLW Standard, 40 CFR Part 191. He noted that 40 CFR Part 191 is a relatively old standard that was developed in the 1970's and early 1980's. It is based on models developed at that time and models are generally better now. It was developed as a generic standard in order to compare alternative sites and as part of the

framework for the acceptability of a specific site. The implementing agencies (DOE and NRC) would fill in the site specific factors involved. When 40 CFR Part 191 was proposed in 1983 there was significant discussion of the time frame issue. Time periods of one hundred or one thousand years were rejected because they were too short -- there was a low probability of disruptive events, groundwater travel times were hoped to be long, and radionuclides would not have decayed significantly. It is also difficult to make quantitative analyses at very long time frames because the basic stability of the geology and the basis for a quantitative assessment break down. Thus, 10,000 years was accepted, in part, because it was assumed that many of the radionuclides would have reached the accessible environment at that point -- no more than 5 kilometers away from the waste. It was felt that no major changes in geology or climate, such as the onset of the next ice age, would occur in that time frame. A review of this issue by the EPA Science Advisory Board (SAB) accepted 10,000 years but recommended that a "qualitative look" take place beyond that time -- to about 50,000 years -- in order to ensure that there was not a sudden increase in impacts beyond 10,000 years. Although challenged in 1987, the court upheld EPA's prerogative to set 10,000 years as a time of compliance. Thus, time frames less than 10,000 years were rejected because generic analyses could not distinguish between different sites. More than 10,000 years was rejected because the uncertainty was getting too great. Whereas at 10,000 years, one could see differences between sites, but still avoid the large uncertainties associated with geologic and climatic changes.

Mr. Clark responded to a series of questions from ACNW members and consultants. In response to a question about the court case, he said that the court recognized EPA's prerogative to set a time frame in the standard. Mr. Roseboom, ACNW consultant, noted that the Yucca Mountain unsaturated zone repository was not considered until 1984. The other sites were saturated zone repositories that would not experience great effect due to

climate change. Mr. Clark said that EPA did not see any larger potential releases at Yucca Mountain relative to the other sites -- in fact there were even fewer. In response to a question from Dr. Garrick, Mr. Clark noted that human intrusion was considered in the standard, but that it did not play a part in setting the time frame. Dr. Garrick also asked if quantitative assessments had been done and Mr. Clark replied that EPA analyzed several generic repositories: salt, basalt, granite, and later tuff for potential releases of radionuclides and health effects. Dr. Hinze inquired what the SAB meant by a "qualitative look" beyond 10,000 years. Mr. Clark responded that they wanted to be sure there were no large impacts beyond 10,000 years, but that this would be done in a more qualitative manner. He also discussed some of the activities EPA is carrying out with regard to the development of a Yucca Mountain specific standard, including interactions with NRC and consideration of available information. He said that it would be set on an acceptable health basis, a risk level, as recommended by the National Academy of Sciences (NAS). Dr. Steindler asked about efforts to ensure that the regulatory time of compliance for one facility is comparable to others (e.g., comparing WIPP to Yucca Mountain). Mr. Clark noted that there is an effort within EPA to do that. Mr. Hornberger, ACNW consultant, noted that he recalls that 10,000 years was of a regulatory nature, but that peak risk was likely to occur far into the future and that calculations would be done to peak risk to provide "reasonable assurance" that the standard would provide protection. He did not recall 50,000 years as part of the discussion and wanted to know if EPA had backed off from looking at peak risk? Mr. Clark responded that 50,000 years was a suggestion. Dr. Ewing, ACNW consultant, asked about the basis for assuming that no climate change would occur in 10,000 years. Mr. Clark responded that they were trying to avoid factoring in the effects due to the next ice age. Dr. Saunders-Price, ACNW consultant, asked if 40 CFR Part 191 still applies as a generic standard with Yucca Mountain as a specific application of it. Mr. Clark noted that the WIPP land withdrawal act and the Energy Policy Act of 1992 removed Yucca Mountain from 40 CFR Part 191, which

continues to apply to spent fuel, high-level waste, and transuranic waste everywhere, except Yucca Mountain. He also discussed use of the NAS panel recommendations and the development of background documents for the standard. He also noted that the new standard would not deal with non-radioactive materials.

Dr. Barbara Watkins, QuantiSci Inc., discussed the national and international perspective on the time of compliance for other nations. She discussed different time frames for a variety of activities in the nuclear field. For example, reactor decommissioning is around 150 years. For low-level waste it depends upon whether it goes to a municipal waste site, where post-closure institutional management is 30 years or if it goes to a specialized shallow land burial site where the post-closure institutional control period is around 300 years. For deep disposal this phase varies from 100 to 300 years. Performance assessment time frames for shallow land burial are up to the order of 10,000 years because the surface environment will have changed considerably due to climate change. For deep disposal the performance assessment time frames are from 10,000 years to indefinite periods. The time frame for institutional control is set by the ability to predict human behavior for only a hundred years or so. Climatic and ecological changes will occur over longer time spans, perhaps up to 10,000 years, but maybe on periods of 100's of years rather than 1,000's for ecological change. The geosphere may be stable for millions of years, but one may not be able to fully characterize the geology over those time frames.

Dr. Watkins discussed some of the national perspectives to resolve this dilemma. Canada and Germany do detailed dose and risk assessments up to 10,000 years. These countries also look at the period after 10,000 years and require some supporting calculations to ensure that the risk targets will not be significantly exceeded in the later time frames. Japan has not

developed HLW regulations yet, but for LLW the control period is 300 years with consideration of likely and unlikely scenarios after that. France also assumes 300 years institutional control, but after that does calculations using present conditions for 50,000 years, after that climate change is taken into account but the dose and risk targets are not significantly affected. France uses the distinction between short-lived from long-lived waste rather than low level and high level. Sweden and Switzerland use the same basic approach, initially they established no time cutoff until peak values have been reached. Later documents became more detailed, with quantitative calculations before 10,000 years and after that a broad range of safety indicators would be evaluated to ensure that the release would not be greater than natural fluxes from the geosphere. After a few million years the repository is considered indistinguishable from nature. Further refinements include calculation of doses to a group living immediately adjacent to the repository for the first 1,000 years with other dose calculations done from 1000 to 10,000 years. In the United Kingdom (UK) the National Radiological Protection Board has a two-tiered approach. From 100 to 10,000 years there are quantitative calculations for a hypothetical critical group. Comparison is made to a risk constraint. From 10,000 to a million years the analysis becomes more qualitative. She also discussed the "Principles Document" from the UK Authorizing Department, which states that there is no definite time cutoff -- the developer needs to justify one if it is used. The developer must also show that there would not be a significant increase in radioactivity in the environment at any time.

The goal appears to be to look at a variety of safety indicators. The International Atomic Energy Agency (IAEA) looks at three time frames 1,000 to 10,000 years where present day conditions are assumed. From 10,000 to one million years where climate change is assumed to occur and a reference biosphere is developed and illustrative calculations are done. Only qualitative indicators are looked at beyond a million years. IAEA does not favor a time

cutoff because it may underestimate the hazard, it is against the concept that radiological protection is independent of time and it is not appropriate when doses are rising. In all of the different approaches the common element for long time frames is to evaluate a variety of safety indicators and release mechanisms rather than relying on a single factor for safety. Dr. Watkins then answered questions related to the following: the usefulness of the different approaches in an adjudicatory setting; whether 10,000 years has a technical basis; whether uncertainty can be quantified; whether the general time frame of 10,000 years is driven by the concept of glacial cycling; and whether these concepts might be tested in an actual licensing action in Europe.

Dr. Stephen J. Brocoum, Department of Energy (DOE), discussed the DOE's perspective on time frame of compliance. He presented the background and an overview of the time frame issue and the comments to EPA on the new standard. The two key comments are that the quantitative force of the standard does not exceed 10,000 years and that the biosphere and tangible assumptions should be set in the standard. The EPA standard and NRC implementing regulations must be understandable, implementable, and consistent with other radiation protection regulations. The technical assumptions and policy judgments must be clearly stated and should not require proof beyond the capabilities of science and engineering. Quantitative compliance should not be required for periods longer than 10,000 years, because the uncertainties in the bounds would make it difficult to defend in a licensing arena. The DOE's concern is that a site may be able to contain waste for many tens of thousands of years, but because of a scenario that exceeds the standard at several hundred thousand years the debate about licensing the site would focus on the latter even though it is containing the waste for very long time frames. He also discussed other approaches that focus quantitative assessment on 10,000 years and qualitative assessment after that, including Sweden, 40 CFR Part 191 for WIPP, and licensing board decisions about radon emissions.

Dr. Ewing asked Dr. Brocoum if it is contradiction to speak of geologic disposal but then restrict it to 10,000 years? The concept extends way beyond 10,000 years. Dr. Brocoum noted that there is no reason to stop at a million years for inter-generational equity. He was asked if the compliance concept is based on peak risk, then for the Yucca Mountain site one might be able to evaluate to one million years for the specific standard given that this time frame encompass most of the results calculated for the site. He responded that DOE will do the calculations to peak risk to be available to the decision maker, but that this may require significantly more work than was required for 10,000 year compliance. He noted that the original standard was based upon release and going to a dose/risk standard, the situation becomes more complicated. There was some discussion how 10,000 years was derived and also about the 100,000 year figure for comparison of different sites. It may also be difficult to document and defend the NAS suggestion that the site is stable for a million years. There was some discussion of the relationship between the biosphere and the critical group, specification of the time frame, and the issue of inter-generational equity.

Mr. Timothy J. McCartin, NRC Staff, discussed the Agency's perspective on time frame of compliance. He noted that calculations to long time frames avoid the problem with the regulator having to guess whether a dose curve might rise significantly beyond the standard after the time of compliance ends. In addition, the timing of the peak appears not to have a large effect on the value of the peak dose [for HLW] whether it occurs a 1,000 or 100,000 years. He noted that there are also arguments against longer time frames of compliance. It may work against incorporating engineered containment features into the design which could delay but not reduce the dose. He also noted that shorter time frame calculations are perceived as more reliable and also favor the incorporation of engineered features into the design to better contain the waste. He defined long time frames for HLW as greater than 10,000 years and LLW as greater than 1,000 years. Short time frames for HLW and LLW

would be less than these values, respectively. A shorter time frame may require more sophisticated analyses to show that the peak cannot occur earlier than the cutoff. Both the site and engineering contribute to the concept of isolation of the waste. Most significant releases occur shortly after the engineering fails in the performance assessments done to date. The peak doses are due to a small subset of mobile radionuclides with the peak occurring beyond 1,000 years for both HLW and LLW.

Mr. McCartin discussed the time at which a peak dose occurs and the effect that different modeling assumptions have on this time. He showed a dose graph derived from a model using HLW type of inventories, but not necessarily representative of Yucca Mountain or the repository. The dose from Np-237 rises until it reaches a plateau that continues for hundreds of thousands of years. He noted that by using different assumptions he can easily move the time of the plateau. He stated that from a regulatory perspective, the preferred concern is to know what the magnitude of the plateau is, not where in time it occurs on a particular chart. He discussed the proposed NRC approach for HLW. He noted that NRC will want to specify the reference biosphere and critical group in the regulations and would prefer flexibility in the EPA standard with respect to time frame. The NRC is looking at a two-tiered approach which recognizes difficulties in predicting performance over long time frames, but also recognizes problems with an arbitrary cut off time. He said that they believe that the analyses are not intended to accurately predict the future, but do provide a way of looking at the robustness of the repository to a range of reasonable potential outcomes. The approach he suggested was compliance with respect to a standard up to 10,000 years and possibly setting a risk limit as a goal after 10,000 years.

For LLW he said that inventory is small relative to HLW, but there are some mobile long-lived radionuclides. He noted some of the similarities and differences between LLW and HLW performance assessments. He also noted the site requirements are important for LLW. He said that, generally, commercial LLW has a lot of hot, short-lived radionuclides that need to be contained for a few hundred years until decay decreases the inventory enormously, but that the remaining small inventory of long-lived radionuclides needs to be addressed. Unlike HLW, the dose for LLW reaches a peak and then tapers off due to depletion of the inventory. In response to a question from Dr. Hinze, Mr. McCartin noted that the dose for LLW is calculated at the site boundary and for HLW, 5 km from the repository. The time frame recommended for LLW is to set an upper limit of 10,000 years for the calculation, which the staff believes is sufficient for capturing the peak dose. This, he said, will preclude an over reliance on using engineered barriers to, for example, get 1,000 years performance. The 10,000-year time frame allows comparison of site performance to discriminate good and bad sites. It also reduces the level of sophistication in the compliance demonstration since a shorter time [than 10,000 years] might require detailed modeling to show that the peak cannot occur before a thousand year's performance period. He noted that it would be very difficult to show that a peak at 1100 years would not occur at 900 years. He also said that the magnitude of the peak would not change significantly over that interval and that regulators are interested in limiting the peak -- not in getting a precise groundwater prediction of when it occurs. The disadvantage of setting 10,000 years is the potential for increased speculation on the evolution of the site. Also, since 10 CFR Part 61.41 has no time limit, it may be challenged on those grounds. However, this would only occur in extreme cases where there are extremely low flow rates and large inventories of uranium, thorium, and transuranics. He noted that defense waste may have more of the latter than commercial waste.

Mr. McCartin also discussed time frame for decommissioning, which has a different situation from LLW since the inventories are primarily uranium and thorium (inventories of uranium are 2 to 3 curies). Decommissioning sites are generally looking at dose to an intruder, with the effects of surface contamination of soils as the main issue. Unlike LLW or HLW, where engineered barriers are important because they delay releases over long time periods, decommissioning site evaluations are mainly looking at the geosphere with relatively short times for release and transport. The doses are "typically" very low. For decommissioning, 1,000 years is used for compliance.

In response to a question from Dr. Steindler, Mr. McCartin noted that the risk limit beyond 10,000 years is a goal. The regulators might consider it important if the dose at 11,000 years is significantly above the standard. Dr. Steindler asked how such a situation would be handled in regulatory space. McCartin noted that the staff had been thinking about the problem and is concerned about what a 400,000 year dose means and how to deal with it as a regulator. In part, this will be decided in the rulemaking process. He said that one of the problems they are dealing with is that a strict cutoff at 10,000 years is one of public perception if the peak is increasing at the cutoff. Dr. Ewing said that in terms of solubility limits that constrain actinide releases, oxidizing environments like Yucca Mountain are less desirable than reducing environments. Mr. McCartin noted that they are only looking at one site and that at Yucca Mountain the low water flow limits the releases. A specific backfill might be used to condition the near-field, however, the time of peak dose is due to the low flow and dose is what the regulator is interested in. Dr. Pomeroy asked what radionuclide might appear in the 100,000 year to 1,000,000 year time frame and what the assumptions are? McCartin noted that two assumptions drive the time of occurrence. If fracture flow and transport in the unsaturated zone occurs, as assumed in NRC's IPA (Iterative Performance Assessment) analysis then the peaks appear earlier -- within 2,000 to 10,000 years. If one

assumes matrix flow and transport, then the peaks occur much later. From the DOE TSPA results where they are taking more credit for the thermal phase and matrix flow, the calculated peaks come out at around 100,000 to 400,000 years. Although both sets of calculations show large disagreement about timing, the peak doses are similar. There are many assumptions with respect to timing of the peaks that would have to be defended if time was the focus instead of dose.

Dr. Andrew C. Campbell, ACNW Staff, discussed the regulatory background and performance assessment perspectives for LLW. He noted that the LLW regulation, 10 CFR Part 61, is analogous to the agency's defense-in-depth philosophy in that compliance is based upon a number of requirements. One of the key factors is compliance with the 61.41 performance objectives for dose, which is accomplished through a performance assessment. He discussed different time frames that have been used in NRC rulemaking for Part 61 and State/Compact performance assessments for license applications. He also noted that for low-level waste the timing of the peak is important in terms of its amplitude. Dr. Campbell discussed some results from the LLW test case modeling that he had participated in as a member of the NRC's Division of Waste Management. One of the key results of the modeling was that the water flux through the disposal facility was the most important parameter affecting radionuclide release. However, different combinations of other parameters affect the calculated dose at any one water flux value. He compared results from rinse release (no waste form) and diffusion release (cement waste form) modeling, which show the importance of waste form performance. He also discussed variable time frames used in different calculations to capture peaks from different suites of radionuclides. The standard calculation time used was 20,000 years for the more mobile radionuclides, 100,000 years to evaluate plutonium and one million years for the uranium daughters (Ra). He discussed the relationship between peak dose and the time of occurrence for LLW with a

limited inventory, which is unlike the situation for HLW with very large inventories. He also discussed the peak doses at very long time frames -- 100,000s of years -- for radium ingrowth from uranium and the role total inventory has in determining the long term dose from uranium or other long-lived radionuclides.

Dr. Matthew W. Kozak, QuantiSci Inc., discussed the background and performance assessment perspectives for LLW. He discussed the issue from a fundamental or philosophical perspective. The key issues are what is the purpose of doing a performance assessment, what do the results mean, and how uncertain are the outcomes? He noted a fundamental difference between the LLW and HLW communities with respect to these questions. He noted that performance assessment provides a technical basis for decisions and a formal way to organize information. It is because of the paucity of data, the analyses are a technical way to represent opinion rather than actual fact. From the LLW point of view, the analyses are not a prediction. Scientific evidence is a foundation, but the calculational procedure is not a scientific one. The results are a conservatively biased representation of a stylized system, particularly with regards to the biosphere and critical group. The disposal is done in the geosphere because it is believed to be stable. The geosphere is also stylized because of assumptions about where the critical group resides -- at the edge of the disposal system, where transport distances are short. Only in the source term can a great degree of rigor be brought in. However, rigor is not the same as correctness or accuracy. The goal is to rigorously represent more processes in the engineered features [as opposed to the site] because it is believed that they are understood better. Dr. Kozak discussed the stylization and definition of the biosphere and the critical group and noted that this is primarily a policy issue.

Dr. Kozak discussed the degree to which one can do generic assessments for the critical group, the biosphere and the geosphere with Dr. Garrick. Dr. Kozak said that there is a large uncertainty in future human behavior and these assumptions have a large affect on the outcome of the calculation. Dr. Garrick maintained that one cannot do generic assessments of risk for a specific site and that one must incorporate site-specific information into the model. He also noted that there is far more stability, particularly for the geosphere and its interface with the biosphere, than is often assumed in these models. Dr. Kozak maintained that the amount of data available for waste disposal Performance Assessments (PAs) is far less than for reactor PRAs and that in the LLW community the application of probability theory is considered useful in a limited context -- to elucidate combinations of parameters that are important. One of the biggest concerns within the LLW community is how to handle uncertainties when the calculation is considered a prediction. These uncertainties are very large and untenable. However, in the context of an agreed upon stylized calculation the uncertainty can be managed with respect to making a decision about the overall safety of a site, if all agree to use the same stylized approach. In this type of situation the uncertainty does not grow with time. Dr. Kozak discussed some of the problems trying to use PA as a predictive tool. He noted that post auditing predictive calculations show poor comparison with real results even over relatively short periods of time, e.g., ten years. He also cited results from INTERVAL (the International Model Validation Program) which showed that none of the models could be validated at any scale or time frame. Thus, one cannot accurately predict concentrations of a contaminant at future time. However, in an approach where one is trying to establish the bounds of the problem and determine if there may be an undue health risk, then the problem is manageable at all times. He viewed the use of a Bayesian probability in PA to be essentially individual judgment in the language of probability. Dr. Kozak also discussed a number of different approaches being used or promoted for dealing with the time frame for LLW, including peak dose, 10,000 years as in

HLW, cutoff when the waste dose is less than the natural site background and other variations on these themes. He also discussed the possible use of a qualitative standard of comparison at long time frames rather than an absolute comparison at any time and some of the perceived problems with these different approaches.

In a subsequent question and answer session Member Hinze raised the issue of glaciation and whether its effects are incorporated into LLW PAs. Dr. Kozak noted that the LLW community in general has chosen not to deal with trying to calculate these sorts of effects or to incorporate them into the calculation for several reasons. The analysis done for the intruder in developing the waste classification system for Part 61 can be used to show that there are not unacceptably high doses even at 100 years and so the effects of a glacier digging up the waste will not be unacceptable. In addition he argued that the consequences of the next ice age on individuals will far outweigh any effects due to LLW. Dr. Steindler discussed the use of stylized approaches and concerns with the phrase, which is sometimes interpreted to mean arbitrary. Dr. Kozak noted that he did not intend to give that impression. There was some discussion on the subject of the meaning of the results -- to what extent they do or do not represent a prediction of system behavior. Dr. Kozak argued that because it is a stylized calculation the uncertainty does not grow with time, rather the results provide information. The argument that it must be cutoff at some time because of a lack of confidence in the predictions is a specious argument. The information that is provided may be qualitative, but it does inform the decision makers. Dr. Garrick discussed the definition of probability and the role of uncertainty analysis in defining or quantifying the state of knowledge in a particular area. Even if the uncertainty is very large that may define the existing state of knowledge. Dr. Kozak noted that getting different groups to agree on what the state of knowledge is or even to agree on how to approach the problem is difficult. Dr. Garrick noted that Ed James maintained that given the same amount of information, most

people will tend to end up with the same probabilities. He continued that there may be disagreement over the definition of terms. [In this context] stylization is important and one needs to make sure that it takes full advantage of the knowledge that we have and if this is about a specific site then we need to be sure that full advantage is taken of that information.

Dr. John Kessler, Electric Power Research Institute (EPRI), discussed factors that control timing of peak dose/risk in HLW PA. Included in his presentation were the following: EPRI's involvement in the development of 40 CFR Part 197, the new HLW standard; their Total System Performance Assessment code -- IMARC; comparison of 10,000 years versus a peak dose standard using TSPA; the shape of the dose versus the time curve and what affects it; the uncertainty versus time and what increases and what doesn't; and his conclusions including EPRI's proposed approach for the regulatory time frame for Yucca Mountain. He noted that EPRI's involvement in the area stems from the fact that they conduct research for U.S. nuclear utilities. They believe that the standard must protect the health of present and future generations, but that the facility must also be licensable, and the standard should not ask more than science can deliver. He described EPRI's primary assessment tool as their TSPA code -- IMARC. The code uses an event tree approach which is different from other Monte Carlo approaches. The features of the code include an ability to calculate to one million years, time varying infiltration to model pluvials, 1-D in the unsaturated zone and 3-D in the saturated zone, fracture matrix coupling, dispersion, and daughter ingrowth. The results he presented were described as preliminary in nature. The code takes into account a number of different components. External components include climate and rainfall. Geosphere components include infiltration and properties above and below the repository. Engineering components include inventory, waste matrix and containers. Biosphere components include agricultural practices and population characteris-

tics. In the logic tree approach values are assigned to parameters and processes. Expert judgment is used to assign probabilities.

Dr. Kessler described the results from a series of calculations to illustrate differences between 10,000 years and peak dose from the standpoint of dose rate versus time at different portions of the curve, important processes parameters, and design features at 10,000 years and what affects the magnitude and time of peak dose. For the maximally exposed individual (defined as drinking 2 liters of water per day), he noted that there was essentially no dose at 5 km before 10,000 years, that the transition to peak occurs after tens of thousands of years and the peak dose occurs around 100,000 years. The transition from no dose before 10,000 years to peak occurs as an increasing number of branches from the logic tree breakthrough. At peak all of the logic branches have broken through. Decreasing dose from a branch occurs due to decay or decreasing inventory. The main contributor to the peak dose is Np-237 and at very late times Pa-231, which grows in from U-235, becomes important. At 20 km from the site the peak is delayed and has a lower dose than at 5 km. He said that the model may underestimate the delay time. He discussed the different results for different container failure times and modes. He also described the effects of removing the geosphere from the models and the benefits of the geosphere in terms of dose, particularly at early (less than 10,000 years) time frames. Dilution in the saturated zone is the most important geosphere effect at long time frames. He compared the important mechanisms and parameters at 10,000 years and peak. At the earlier time frame there are a lot of different things that must be tracked down and model quite well if there is a quantitative standard that ends at 10,000 years. For a peak dose standard there is a shorter list of issues that affect both peak magnitude and the timing of the peak. He discussed a number of these issues that affect peak magnitude, including: well location, population, infiltration, solubility and sorption, engineered barriers, geosphere, saturated zone dilution, critical group and exposure scenarios.

Factors that affect peak timing include: well location, container performance, flow velocity and fast paths, and sorption. Also, engineered features such as backfills and flow diversion barriers might have a large effect on both magnitude and timing.

Dr. Kessler discussed the effects of different aspects of the model with respect to the uncertainty. Particular emphasis was on the change in uncertainty magnitude with time. From the results of the EPRI model the uncertainty is high at all times -- about 2 orders of magnitude between the 5th and 95th percentiles. The expected value is skewed toward the upper percentiles because most of the uncertainties have a log-uniform or log-normal distribution. The curves do not deal with the biosphere and so the results represent the uncertainty in the engineered and geosphere components only, and this is large. The true uncertainty may be larger because due to computer restraints many variables and model assumptions were not treated with uncertainty. If these were carried along then the error bands would have gotten larger. Thus, they believe the trend but not the absolute value of the peak because of the large uncertainties. Dr. Kessler also discussed the biosphere and comparison of the "conservative individual" (who intersects the plume and drinks all of his water from a contaminated well) with other individuals who may not derive all of their sustenance from contaminated water. Other issues that affect the critical group include the location of the well (whether it intersects part of or any of the contaminant plume) and dilution by uncontaminated groundwater. Many different behaviors could be assumed for individual or societal behavior.

In the absence of the uncertainties due to human behavior (other than intrusion) one area of focus could be on the engineering and geosphere to assure isolation of waste for the first 1,000 years, when decay decreases the inventory by two orders of magnitude. After that, the decrease is a lot less over the next 10,000 to 100,000 years. In addition he discussed what

scientists and engineers felt that they could defend on the witness stand for the lifetime of engineered features, which EPRI believed was on the order of 1,000 years. This was based on the "weakest link principle" which was the corrosion rate and failure of waste containers. After 1,000 years the uncertainty was perceived to grow significantly, at least in terms of defending the numerical analyses. So EPRI proposed a two-tier time frame up to 1,000 years for a quantitative demonstration of container integrity. Although a dose criterion may be used, container integrity is the main criterion during this time frame. Beyond 1,000 years, calculations using performance indicators for regulatory insight such as dose or risk of health effects, would be the criterion. A combination of probabilistic and sensitivity studies would be most effective in doing the analysis in beyond 1,000 years.

EPRI did not consider the waste form in setting their proposed time frame because they were primarily concerned with keeping the waste in the container and issues that lead to breach of the container. Dr. Garrick asked how they did their PA. Dr. Kessler replied through the use of expert judgment to evaluate data from DOE. Dr. Garrick also asked whether there is more uncertainty in the time of peak occurrence than in amplitude of peak risk. Dr. Kessler replied that the time had more uncertainty and explained some of the factors that lead to that conclusion. Dr. Pomeroy asked about the use of expert judgment in the EPRI modeling. Dr. Kessler described the process used to assign uncertainties, which was based on both data and expert judgment, and the types of expertise involved. In response to a question concerning reconciling differences with 40 CFR Part 191, Dr. Kessler responded that they did not consider this and argued that 10,000 years need to be rethought because it was originally considered for comparing different sites. He also added that there are no good technical arguments and noted other comments that this is a policy issue. In response to a series of questions concerning the basis for 1,000 years, Dr. Kessler discussed the issues involved in the selection of this time frame, including two main factors: reduction in

inventory in the first 1,000 years and the ability of scientists and engineers to testify to and defend the numbers and confidence intervals (full uncertainty) used in a quantitative demonstration. He noted that for alternative performance measures, such as comparison to uranium ore bodies there is less confidence in the numbers, but this type of information may be important for the regulatory decision. Dr. Ewing asked Dr. Kessler if time frame is not really dependent on the state of scientific knowledge and the confidence in that state of knowledge, rather than on specific data (e.g., spent fuel corrosion experiments), which may only be based upon 30 day tests. Dr. Kessler noted that they used both best estimate and conservative approaches that one can bound the behavior of the corrosion in a specific material. Dr. Ewing asked if a natural system could be used to bound the phase assembly that results from corrosion then could one extend the time to that of the natural system? Dr. Kessler agreed. Dr. Hinze asked about the scenarios used in the modeling, such as climate. Dr. Kessler described some of the climate assumptions for infiltration, seismic effects on larger drift designs and vulcanism. Dr. Steindler asked about the "weakest link" principle and the rapid reduction in inventory as a basis for 1,000 years. He noted that rapid inventory reduction may not be relevant to dose. Dr. Kessler replied that he was trying to avoid the uncertainties involved in quantifying what human behavior will be, which is necessary in calculating dose. Dr. Steindler pointed out that all of the graphs presented by Dr. Kessler used dose, he wanted to know what assumptions were involved to do those calculations. Dr. Kessler noted that he assumed a "conservative individual," but later considered different "average individuals" based on current U.S. behavior patterns to show the degree of uncertainty. Dr. Steindler asked if a different group of experts might come up with 10,000 years rather than 1,000 years. Dr. Kessler noted that this is a subjective and policy issue in terms of when you set the regulatory cut off and, although there is likely to be some agreement about the confidence to predict out in time will be higher in some areas than in others, that a different group could come up with a different time frame

Dr. Tim Sullivan, DOE, discussed insights gained from site characterization studies at Yucca Mountain. The principle assumption is that past records are indicators of future events and form the basis for extrapolations into the future. A rule of thumb is to have a past record longer than the performance lifetime and several return periods for extreme events. This is a typical approach for civil structures with 40-50 year lifetimes. In this context the presentation focussed on tectonic effects, volcanic effects and climate variability. With respect to tectonic effects there are earthquake records for the last 150 years and, more importantly at Yucca Mountain, there are indirect records of individual fault displacements from trenches and dated quaternary deposits. Some of these studies have evaluated individual fault displacements that extend back as much as 700,000 years. There is also data on the Miocene Tuff Sheets that provides a cumulative record for the late Cenozoic evolution at Yucca Mountain. For example the Paintbrush tuffs date from 12.6 million years. Based on these and other data it is possible to constrain cumulative displacements on some faults, to gain insight into deformation at Crater Flat, and to evaluate Yucca Mountain faults at depth. He noted that DOE would argue that there is sufficient information for pre-closure and for 10,000 years. He noted that DOE will sponsor a probabilistic seismic hazard analysis in 1997 to use a formal process to capture the uncertainties and provide a seismic design basis for closure. He also noted that they don't necessarily disagree with the NAS for the million-year time period. They could provide some bounding estimates, but probably would not be able to extend the record of individual fault displacements beyond where it is now. He also discussed the regional tectonic effects and said that the general regime of extension has dominated the deformational patterns in the basin and range for 15 to 20 million years. Recognition of these durations may increase confidence that predictions of time frames for as much as a million years may be stable.

Dr. Sullivan also discussed changes that could affect the regional stability, including: reorganization of the Pacific Pate boundary, (e.g., initiation of spreading in the Gulf of California about 5 million years ago). Although these effects have been restricted to the plate boundary, which is 200 km from Yucca Mountain, these probably indirectly drive deformation in the basin and range. Other changes include increased strike-slip fault movement or increases in extension rates. Volcanism is another important issue over long time frames. Through site characterization DOE has developed a nearly complete record of basaltic volcanism for the last 10 million years of the Pliocene and Quaternary at Yucca Mountain. Geophysical data is being used to detect potential hidden bodies of basaltic magma. They feel they have been able to constrain the size and frequency of events, which appears to be decreasing. They have a nearly complete record of large silicic volcanic events in the region 15-11 million years ago, some as recently as 8 million years ago, which would have catastrophic effect on the repository. In general, there appear to be regional pulses in silicic volcanism and there are no indicators of an imminent return to silicic volcanism at Yucca Mountain.

With respect to climatic variability, Dr. Sullivan discussed the regional climate signals that have been obtained from Playa Lake deposits that extend back as much as 850,000 years. There is also a 600,000 year record from Devil's Hole. At Yucca Mountain the local climate record has been obtained from vegetation in dated packrat middens and from fracture lining minerals from boreholes and the ESF (Exploratory Studies facility). The YM program is developing conditions associated with the maximum glacial advance for use in the total system performance assessment model. These analyses have established that benchmark average conditions for glacial precipitation was 300 percent more than current values and temperatures were cooler by 5 to 8 degrees centigrade. Several paleoclimatic episodes have been captured in the studies and this information will be used to calibrate future climate

modeling. Green house effects are not currently considered in the model but will be evaluated in future TSPA '96-'97 analyses. Current conditions are not representative of average conditions for the quaternary and a return to wetter cooler climate is expected. He also noted in closing that the percolation flux into the repository is the most important parameter in TSPA 95 and other modeling of the site. This cannot be measured at the site under current conditions and so it's estimated from precipitation data, shallow infiltration data, and from different conceptual models of the unsaturated zone. He described various studies focussed on this problem and noted that there does not appear to be a strong link of percolation flux and the climate record, which he suggested indicates that climate change may not have a significant perturbation or influence on performance at Yucca Mountain. Dr. Hinze asked about field tracer tests ongoing at the C-well complex. In response, Dr. Sullivan noted that they had observed the breakthrough and were now monitoring the tail. They also discussed possible additional tests. Dr. Hinze also asked about the consequence analysis from the volcanic hazards assessment. Dr. Sullivan noted that preliminary both DOE and NRC (iterative) performance assessments show very limited if any wiggles in the complementary cumulative distribution functions as a result of volcanic events. There was also some discussion of site stability for a million years. He noted that the data are adequate to bound predictions for a 10,000 year period. Although the scientists may have sufficient data to bound estimates for earthquakes, volcanos and climate for half a million to a million years, the length of the record is not sufficient to defend in an adjudicatory hearing.

Dr. Rodney C. Ewing, University of New Mexico (UNM), discussed insights gained from natural analogue studies. He said that he has looked at the literature and examined the ideas of others in terms of insights that can be obtained from natural analogue studies for compliance time frames. His conclusion was that there is no basis direct or inferred for extracting compliance time frames from natural analogue studies or natural systems. To the

degree that it may be wise to establish a time frame, shorter periods 1,000 to 10,000 years should be the concern. He said that his presentation would attempt to make two points in terms of natural analogue studies and their relationship to performance assessment. The first point is that from the probabilistic modeling perspective the waste package is a good place to devote considerable amounts of time. The second point is that various "damage indices" lead to time frame because the measure is total curies released or dose rate per time. He said that he was surprised that dose release curves (as shown on one of his overheads) are so smooth because in terms of geological systems, such as trace element distributions and histories for, say, uranium ore deposits, one would expect a number of spikes on the curve. So in comparing the dose curves to the natural system they appear to capture more of the model than of reality. Another point is that in terms of the historic and geologic records there are a lot of deficiencies -- the record is incomplete, errors in age determinations are quite large, and critical parameters are not known. In addition, the configurations of the natural system are not analogous in detail to the configuration of the repository. Dr. Ewing discussed possible means for obtaining a compliance time frame from natural systems. Natural systems provide the conceptual basis for the old repository system (geologic disposal). In some cases parameter values can be obtained from natural systems. If precise answers cannot be obtained then sometimes it's possible to arrive at bounding values. The relationship of natural analogues to performance assessment is essentially one of helping to construct models, acquire data (data either real or data from expert panels), and to some degree do model testing and validation. The disposal system concept consists of a series of barriers -- waste form, canister, overpack, backfill, and the repository. He focused on material science and near-field geochemistry. He cited a number of natural analogue studies that he had participated in, but noted that it is very difficult to transfer that information to an actual site. Site characterization could provide the basis of a natural analogue study specific to the repository. A contribution of the natural analogue studies has been the development

of sampling approaches for colloid studies. Other areas of interest are knowing what is the long term alteration products, determining corrosion rates, and validating corrosion models. He discussed dissolution of basaltic glass as an analogue for the dissolution of borosilicate glass. These studies have important implications about whether glass follows first order dissolution kinetics (whether all components simply dissolve) or follows higher order kinetics (if alteration products form that inhibit the release of certain components). The implications of these two models are that at 100 years it makes no difference which model is correct, but at 10,000 years there is a substantial difference in terms of fractional release, and at one million years first order kinetics results in a complete dissolution of release from the waste form. The other question is one of identifying the corrosion products from natural uraninite to see if these are the same as for spent fuel. The results from six and a half year laboratory experiments and natural samples show that one can bracket the phase assemblage that results in natural samples under conditions similar to Yucca Mountain. In the case of corrosion rates it is more difficult to draw conclusions, because the alteration rind thickness varies as a function of the contact time with water, which is unknown. At best one can establish a minimum corrosion rate, whereas one needs to know the maximum rate. The short term rate can be obtained from the dissolution of basalt in seawater (on the ocean floor). To obtain the long term information, one can look at the dissolution rate of the glass in the ocean sediments, where the silica concentration reaches saturation in the pore waters [as would occur over long times in a repository]. He then discussed the application of this information to time of compliance. He said that one can deduce requirements that have a compliance time frame of 1,000 or 10,000 years, stating that from a geologic point of view there is no greater uncertainty in saying 1,000 versus 10,000 years. One could deduce requirements for near-field properties and behavior for the waste form, canister, overpack and backfill. Beyond this time frame one is really extrapolating physics and chemistry not

ideas on climate change or volcanic activity and one must become geologic and use induction rather than deduction.

Dr. David Kocher, Oak Ridge National Laboratory (ORNL), discussed dose assessment issues and concerns. He discussed his involvement with both HLW and LLW, including work done for the NRC in its development of 10 CFR Part 60 and work for the EPA's Science Advisory Board. He agreed with Matt Kozak that PA is a tool to demonstrate with reasonable assurance that you have compliance -- not to predict actual outcomes. When PA is viewed in this way, many questions about actual outcomes become unimportant. For example, uncertainties are only important to the decision whether you are in compliance, not to the actual outcome. He stated that there is no objective technical basis for establishing a time of compliance. He said that it should be in some way commensurate with the hazard potential of the materials. It should be sufficiently long that the host environment itself is important to disposal. He noted he is uncomfortable with attempts to "engineer" this problem away. He noted that land disposal is done because it is felt there are benefits from it and the compliance time should be long enough that this barrier actually plays a role. But the time of compliance should not be so long that significant but unpredictable changes in the host rock and dirt are likely. These decisions are largely subjective matters of public policy. He discussed the intrinsic ingestion hazard of HLW and spent fuel, and noted that this was a rationale for 10,000 years because the intrinsic hazard got down to about that of a natural ore body at that time. Whether the hazards from an ore body are acceptable is an issue that is not talked about.

Dr. Kocher discussed the DOE Performance Assessment Task Team and its activities. He noted that they recommended 10,000 years as a time of compliance for DOE LLW sites. The rationale was that this provided a sufficiently long time at the site, and that not just

engineered barriers are important in meeting compliance. Dr. Kocher stated that this provides an incentive to seek good sites because you can't engineer your way out of the problem to 10,000 years. Over 10,000 years at most sites the near surface environment should be reasonably predictable, with no catastrophic and unpredictable changes occurring over that time frame. It was also felt that for LLW you should not have serious impacts after 10,000 years because of two reasons. One is that the compliance point is 100 meters from the waste, any site that complies at 100 meters for 10,000 years is a very good site. The second point is that there isn't much radioactivity in LLW and the concentration limits are set for the hypothetical intruder. These are so low that nothing catastrophic can ever happen, no matter what is assumed. They also recommended that if the peak had not been reached in 10,000 years that the calculation be carried out to show the peak to give the additional perspective on performance, but not for compliance. He believes that given the complications and high level of uncertainties one must present all of the information that can be gathered and carrying out the calculations to peak provides more information than not doing it. If it takes two million years for a peak dose to appear for a LLW site one has an excellent site no matter what the magnitude of the dose.

Dr. Kocher raised the question whether there should be a common time frame for both LLW and HLW. He argued that one can look at the time frames in two different ways. One for LLW there is much lower activity but the disposal system is less isolating. Inversely for HLW you have much higher activity but the disposal system is much more isolating. Part of the problem is that LLW has low-level hazards that persist just as long as for HLW, because of the presence of uranium. The other argument is that one could justify a longer compliance period for HLW because the calculations show that the release to the biosphere occurs farther in the future than for LLW. He noted that too early a time frame, before any releases occurred, proved to be problematic for EPA in the early days of 40 CFR Part 191.

In terms of assessing dose three areas are important. One, changes to the biosphere will occur due to climatic changes and topography changes (i.e., erosion). These are important beyond 10,000 years due to glacial cycles. Another important area is future conditions of human exposure. He noted that what people will be doing in the future is essentially unpredictable, even over a few hundred years. This is true for any reasonable time of compliance one might choose. The third area is the problem of uranium disposal, because the hazard increases out to about two million years due to the buildup of radium and other daughter products, not from the uranium itself. He also said that the issue of future changes in the biosphere and human behavior are not relevant to the compliance issue because they are not part of the disposal system performance -- the biosphere is not a barrier. So it is reasonable to either use present conditions near specific sites or to assume a generic reference biosphere (e.g., a reference northern temperate environment or a reference southwest desert environment). A similar idea should be used in developing future conditions of human exposure. Dr. Kocher pointed out that the reason one calculates dose or risk is that it is a convenient way of measuring impacts. The dose calculation allows one to compare different sites and facility designs and to judge the acceptability of disposal. But it doesn't have anything to do with whether the disposal facility is doing its job in regard to isolating and containing waste. While the calculation should be stylized there needs to be some degree of realism based upon what people do. The IAEA, he noted, is thinking about the problem and has suggested that the reference critical group at any site can be defined on the basis of present site conditions and assuming some sort of a subsistence community that grows its own food and obtains its water from the highest contaminated reasonably accessible location (i.e., they would drill to where water is found of sufficient quantity and quality to use for their purpose). People would not drill 1500 meters to a contaminated aquifer to get water if they could get it from 100 meters. Assuming that one gets water where the concentration is highest is an extremely conservative assumption for a person going out and randomly

drilling a well. However, different critical groups could be defined on the basis of different climatological conditions (e.g., people behave differently in Nevada than at Barnwell). This approach is a logical extension of approaches used in the radiological protection field since day one, namely the idea of reference man. Both film badges and body fluid samples are a way of measuring values to put into a standard model that converts radioactivity to an estimated dose. He also maintained that radiation protection is not about estimating dose; it is about controlling exposure. Any reasonable time of compliance should be longer than the time period over which we have some confidence in what people are going to be doing at real sites. He said that this approach avoids highly contentious issues that are basically irrelevant to whether waste disposal at any site will be safe.

The third issue he discussed was uranium disposal and the ingrowth of daughter products with time. For natural uranium it will take about 100,000 years to reach secular equilibrium and for depleted uranium the time to reach equilibrium is over a million years. Excluding radon the dose to an intruder goes up by two orders of magnitude due to daughter ingrowth if you include radon dose goes up by a factor of 3,000 - 4,000. This is an important problem for an intruder analysis because if one has waste material that contains natural uranium and decay products at background concentrations (about 1 picocurie per gram) it could not be disposed in a near-surface facility because in the DOE system it would exceed the dose limits to the inadvertent intruder. In other words, one could not put background dirt into a facility if the decay products are present. The time of compliance is important because significant doses from ingrowth do not occur until long times in the future. For releases to water, the increase in the hazard potential is somewhat more than an order of magnitude because the dose per unit intake of radium is higher than for uranium. Because of the issues that he discussed the regulatory time of compliance would have a large effect on acceptable near-

surface disposal of uranium. This is an area that needs policy investigation -- what to do with uranium and thorium waste, in general.

Dr. Kocher next discussed probabilistic risk assessment. He said that because the performance objectives are dose based for LLW, probabilistic risk assessment would not play a large role in demonstrating compliance with such a standard. PRA may be useful in helping identifying useful features of siting and design. But a dose standard does not allow you to take into account the probability of a dose being received. One would have to have a multi-tiered dose system or a probability weighted dose as the performance objective. So events and processes are treated in two ways. Those that are reasonably likely to occur are assumed to have a probability of one and the consequences are evaluated. The other event and processes are called unlikely and are not evaluated in terms of compliance, but are dealt with in siting and design. His main concern with PRA for waste disposal is the lack of data available on the effects and interactions of different things that affect performance. He noted NRC's original decision not to regulate reactors on the basis of risk and therefore it should not be applied to waste disposal. He disagreed with the National Academy Committee on Yucca Mountain Standards' proposal to regulate on the basis of risk.

He also noted the selection of a time of compliance by NRC or EPA will have some significant differences between LLW and HLW disposal. For LLW only a few long-lived radionuclides are affected by the selection of a particular time frame. Most LLW will still be acceptable for disposal at most sites regardless of the time frame. In contrast for HLW, the time frame may have an impact on the acceptability of disposing of any waste at a repository because you cannot segregate particular radionuclides out of the waste. The repository must be able to accept all of the waste going to it or it won't be built. For example, one cannot remove the neptunium from the spent fuel if that is the problem for

compliance of the site. For this reason he felt that the time of compliance is more important for HLW than for LLW. A possible exception is the impact on the near-surface disposal of uranium, which he described as a problem for LLW in the DOE sector. He also stated that he was in 100 percent agreement with Dr. Ewing on the issue of having sensible siting and design criteria that contribute to defense in depth barriers that are absolutely necessary because you don't really trust your calculations. Whatever standards for HLW disposal are developed should not arbitrarily disqualify good sites. Having a standard and models of all kinds does not take away the need to render subjective judgment and decisions.

In the questions that followed, Dr. Garrick noted that he did agree with Dr. Kocher that risk assessment should be approached from the point of view for gaining understanding and insight, rather than for simply calculating a number. However he disagreed that risk assessment should not be used where there is little data. He maintained that is precisely where it should be used. When a lot is known there is no need for risk assessment. It is most useful in dealing with uncertainties and expressing what is known about something. He also asked if Dr. Kocher thought that regulatory time frames are an asset or a liability with respect to the regulatory process? Dr. Kocher noted that he was originally opposed to time limits on compliance. But he was uncomfortable with the idea that a calculated dose that exceeds the performance objective by a factor of 2-3 at 100,000 years provides sufficient justification for spending a lot more money to do something different today. He said that he was comfortable with 10,000 years for LLW because the limitations imposed on concentrations of radionuclide that can go into a disposal facility. He stated that he was unhappy with the EPA proposal for 1,000 years for LLW because it was too short and suggested that it fosters the idea that one can engineer around the problem. He believed that there is a need for incentives to seek good sites and the time frame for compliance should be sufficiently long to evaluate the site. Dr. Hinze asked if the 10,000 years included uranium. Dr. Kocher

responded that it did, that a lot of benefit was derived because the radium and radon are not multiplying factors to dose in 10,000 years. For HLW, Dr. Kocher thought 10,000 years was sufficient if coupled with siting and design criteria to ensure that impacts beyond 10,000 years were not catastrophic. He added that 100,000 years was probably also acceptable for HLW but that he had problems with a million year time frame because of the same issue as for LLW, what would or should be done differently for a dose exceeding the standard at say 900,000 years? Dr. Hornberger asked about the compliance time frame for HLW as a disqualifying factor. Does not the setting of the reference biosphere and critical group constrain the calculation regardless of the time frame? Dr. Kocher responded no, that the engineered system and geologic barriers limit releases to the biosphere, that is the goal not to limit dose. Dose is just a measuring stick that can be understood. But the time of compliance has a lot to do with the calculated result if it takes 100,000 years for releases to occur and the compliance time is 10,000 years then you are home free. On the other hand if the compliance time is one million years you are not. Dr. Garrick asked if he thought Part 191 was a good standard? Dr. Kocher replied yes, except for the probabilistic analyses required to comply with it. Dr. Garrick replied that was the only part he liked.

Dr. Myron Uman, National Research Council staff, discussed the basis for the recommendations on time frame, in the Technical Basis for Yucca Mountain Standards report. Dr. Uman noted that he was not a member of the panel and was a stand in for members of the panel who could not be there. He noted that the panel was specifically asked by Senator Johnston, who disagreed vigorously with 40 CFR Part 191 to examine if there is a scientific basis for a standard that would protect public health (based upon individual dose), to identify that basis, and to be specific to the Yucca Mountain site. Dr. Uman noted that the committee was not asked to compare the existing released based standard with a dose or risk based standard. He noted that it is perfectly reasonable to set a release standard for 10,000 years, but this was

not part of the charge to the committee. The committee determined that the release limits standard did not have a public health basis in itself. He noted that there was also no clear understanding of the public health basis for the release rate limits in the standard. He discussed some of the basis for the calculation but noted that the relationship to public health was limited because the approach did not evaluate transient behavior of contaminants which would have a major impact on public health. He also noted that there is an individual dose limit in Part 191, but that if there is no release in 10,000 years then the problem goes away. He discussed the background to the reports conclusions. One is that one cannot measure the doses from the repository, because they occur in the far future. The second point is that assessing compliance a priori implies theoretical calculations, but the challenge is to include as much scientific knowledge as possible in the calculations. But two types of judgments will need to be made. One, judgments from experts as to certain parameter values to be used, and policy judgments, which are basic assumptions that have no scientific guidance. The latter include the definition of the reference biosphere and critical group. The other problem was to deal with the "expected dose" (the expected value of the dose in a mathematical sense). This requires assumptions about behavior, which the panel recommended be based upon the current socioeconomic system of subsistence farming in the region, rather than hypotheses about behavior in the next ice age. He also repeated the statement made by other presenters in the session that the dose/risk calculations are not predictions. The panel suggested that there be agreed-upon methods of testing compliance, including exposure scenarios. The panel recommended that EPA determine the calculation method as part of developing a new standard. This would allow public input and acceptance, which they deemed essential. The committee also concluded that expected values from probabilistic calculations be used as a measure of compliance because they include uncertainties involved. On the question of the individual dose standard they concluded that the critical group concept be used and since dose and risk are linearly related, that the result should be expressed in

terms of risk. This includes not only risk from the dose itself, but also the risk of incurring adverse health effects. With respect to time limit the committee concluded that this was policy issue -- there is no scientific basis for selecting a time limit. However, the committee noted that the main effects on risk occur well after 10,000 years and any time limit restricted to that period would have difficulty after the public became aware of the impacts at later times. The committee believed that the compliance time should be the period out to the greatest risk to the public as long as that time is less than a million years. The qualifier was based on the basic stability of the basin and range -- it would still be recognizable by a geologist a million years from now. Some of the problems in fact, get easier at long time frames, (e.g., specific issues about groundwater travel time). He also said that volcanic and seismic processes are more predictable over longer time frames. He noted that part of the problem faced by the committees report is that it requires a new way of thinking about the problem (i.e. it is not a release limit and that many people find it difficult to deal with it in that sense. Dr. Hornberger asked if the use of risk criteria and calculations would create more problems than it would solve because of the need to put them into legalistic terms? Dr. Uman noted that the standard setting process would provide a public forum for issues to be raised and resolved. Dr. Garrick raised the issue of whether specifying the calculational methods in advance was contrary to reaching the most innovative solution to the problem. He noted that the NRC had some success in allowing flexibility to meet requirements, which allowed some extremely creative and innovative things to surface. Dr. Uman responded that the committee felt that EPA needed to set the exposure scenarios and critical group definition, but would not necessarily get into prescribing particular mathematical models to use. Mr. McCartin noted that some of the issues the committee referred to belong in the standard setting body (EPA) and others with the regulation setting body (NRC) and that the distinction was not clearly made in the committee's report. Dr. Uman responded that a

number of parties, including the public, should be involved so that policy judgments and compliance methods are agreed upon before going into the adjudicatory process.

Dr. Eugene Roseboom, U.S. Geological Survey (USGS) (retired), ACNW consultant, provided a summary of various rationales for consideration in setting a time of compliance. He noted that the time frame of compliance could be broken up into several different rationales. Three are scientific or technical in nature. Another is to go to peak risk whenever that occurs. The initial goal in setting time frame in the regulation was that it had to be long enough to compare different sites. He also read the definition of a policy issue and noted that setting a time of compliance was fundamentally a policy issue. He also noted that the original definition of time of compliance set by EPA was a policy matter since it treated long-lived radioactive waste different from toxic waste. An early concern was that standards for the protection against radioactive waste not become precedents for toxic or hazardous waste. Going to peak risk for Yucca Mountain would, he said, require evaluating the effects of a cooler and wetter climate on repository performance. A minimum of 30,000 to 40,000 years might be required to look at new glacial conditions. Data from Devil's hole go back 600,000 years and compare well with sea floor sediment data. More recent data from Devil's hole correlates with ice core data (Vostok). The minimum time to get to a full glacial condition is 20,000 years. He discussed some of the societal effects of an ice age on other parts of the country. He also noted that the alternative to licensing an HLW repository at Yucca Mountain is not to go somewhere else, as was the case in the original standard and regulations, but simply not to do it and to store the waste at reactor sites or in a central facility. He noted that this may have the effect of the problem becoming localized and the waste essentially remaining in storage for a long time. Budget reductions in the future may not allow anything else to be done. A number of papers have argued for surface storage until a different solution to the problem is found. However, most of these new solutions would

involve transmutation in reactors or accelerators and chemical reprocessing, both of which are unpopular. The availability of funding 100 years from now may also be a problem as the arguments about trust funds currently before Congress demonstrates. He also asked if the risks from the repository to subsistence farmers is too high, what are the risks from storage over the same time frame? He also discussed the issue of human intrusion into the repository and some of the bills before Congress dealing with this and other issues including time frame. So Congress may, as a matter of policy, solve the time frame issue by requiring performance evaluations for 10,000 years and meeting the standards for 1,000 years.

In a round table discussion that followed, Dr. Hinze asked Tim McCartin, NRC staff, to further discuss the staff's proposed position on HLW time of compliance. Mr. McCartin noted that the staff was looking at 10,000 year compliance with calculations carried out further to peak risk. At the present preliminary studies of NRC indicate a peak dose at 4,000 years whereas DOE's calculations suggest 400,000 years, but if there is agreement to focus on the peak dose value and it is acceptable then there is little need to argue about the factors that may control when that peak may occur. There are many assumptions in the calculations that can push a peak past 10,000 years. Everything heard to date suggests that the time of peak dose is an artifact of the calculation. He said that the staff wants to focus on dose rather than time. He also noted that the NRC intends to specify the exposure scenarios in a rulemaking, including the reference biosphere and critical group. He was asked by Dr. Pomeroy about the simplicity of any compliance regulations and standards. Mr. McCartin noted that this will be determined in part by the rulemaking process. In principle one could end up with a simpler calculation by specifying the reference biosphere, the critical group, and exposure scenarios, although scientific rigor would still be important to defend what is done. Dr. Garrick discussed his views on the time frame. He noted that years before a lawyer had suggested that the introduction of uncertainty issues and risk-based process into

the licensing regulations would cause problems. He added that the regulatory process is not necessarily logical and couldn't embrace all of the technical issues. So in putting together regulations one should strive for simplicity. He wrote a paper advocating calculations to peak risk as a basis of compliance. He noted that PRA had made major contributions towards better understanding of rector safety. So he concluded that some type of combination of simplistic, deterministic risk based calculations be done in full view of what the risk is. He said that this is in the spirit of risk-informed decision making. Dr. Steindler discussed the need to evaluate the peak, not so much for technical reasons, but to assure others that serious consequences are not being ignored or missed due to a time cutoff. Dr. Roseboom also said that it is important to the peak risk calculations to ensure that there isn't some bad consequence beyond the time of compliance. Substantially complete containment could be kept in a new regulation, but groundwater travel time, which was devised for a saturated site, should not be part of a Yucca Mountain- specific standard. Dr. Saunders-Price summed up her impressions of the presentations and issues. She noted that it would be difficult to get EPA to agree to exposure scenarios up front. Dr. Hornberger noted the need for simplicity in the regulations, but he also raised the need for flexibility to allow creative solutions to be developed. Dr. Ewing noted that most of the presenters had agreed that the issue does not have a technical solution. To him simple and straightforward means applying regulations to those parts of the repository where science has the greatest chance of having an impact. Dr. Kocher noted his agreement with Dr. Garrick about the utility of PRA for studying systems, but that the disagreement comes in when the issue is the use of PRA to demonstrate compliance. He also cautioned that we are expert now in defining critical groups with respect to dose but not so in terms defining risk to the critical group. Dr. Kozak discussed the issue or whether humans will evolve into something else in these time frames. Dr. Hinze discussed the need for defensible approaches. He also discussed the need for simpler approaches, but that these were not necessarily going to come out of the site-specific

discussion presented to the ACNW. Dr. Campbell discussed some of his insights gained from doing performance assessment for LLW. One was that risk assessments provided much information about how these systems operate -- how the will perform over time -- and what are the key things that affect possible releases, such as the water flux. The other was the importance of having simple regulations for demonstrating compliance, which is essential for having successful regulation. Carl Johnson, State of Nevada, agreed with the idea that regulations should be simple and flexible. But the public also wants to see regulations with some type of measurement attached to them, so the issue is how one can turn all the various input from the discussion into something that is measurable in terms of the regulation.

III. <u>NRC Staff Issue Resolution Procedures for the DOE High-Level Waste Program</u> (Open)

[Note: Ms. Lynn G. Deering was the Designated Federal Official for this part of the meeting.]

Ms. Margaret Federline, Mr. Michael Bell, and Mr. John Thoma briefed the Committee on this topic. Ms. Federline began the briefing by noting that the staff has two primary activities in the near term for the HLW program: (1) to develop reasonable and implementable standards working with EPA, and (2) to focus on the most important issues for repository performance and providing timely feedback to DOE. Ms. Federline then discussed the Committee's letter of February 16, 1996, on Key Technical Issues (KTIs), noting that the staff agreed with the Committee's recommendation to approach issue resolution cautiously, and the concern about disaggregation of KTIs. Finally, Ms. Federline summarized the FY 1996 NRC high-level waste program assumptions, FY 1996-1997 program objectives, and an overview of NRC FY 1996 key program activities.

Mr. Thoma reviewed the background of the KTI program. He noted that in November 1995 the NRC and DOE staffs held a dialog on KTIs during a technical exchange, where they reached agreement on eight KTIs, and differed on the igneous activity and structural deformation KTI. This meeting has been followed by NRC/DOE management meetings and telephone calls.

Mr. Thoma outlined the issue resolution procedures, describing the background, objective, general guidelines, overall procedure, interactions, documentation, generic criteria for issue resolution, and example issues. He noted that his purpose was not to discuss the detailed procedure, but rather, to share the management philosophy for the Committee's input. He also noted that the objective of the procedure is to describe the process, including interactions and necessary documentation, for resolution of short-and long-term technical issues with DOE, although no agreements are binding. The purpose of issue resolution is to identify what DOE needs to do for the licensing process so it will have an idea how to estimate costs associated with the Viability Assessment.

Mr. Thoma discussed the general guidelines, noting that the staff may need to revisit the NRC/DOE Procedural Agreement and how it might need to be modified to facilitate issue resolution. He also noted that the 1992 issue resolution remains in effect, that is, when an issue is resolved, the NRC has no more comments or questions, but has the right to reopen issues if new information becomes available. He noted that the staff will use all available (qualified and non qualified) data for issue resolution, and that parts of issues may be resolved rather than whole issues. Dr. Steindler questioned how much progress can be made when nothing is binding, considering that issues could never get resolved. Ms. Federline responded that a rulemaking to resolve the technical basis of issues is an idea to handle the

problem. John Austin, NMSS, noted that no regulatory guidance is binding, thus the problem is not really unique to issue resolution.

The overall procedure is to select and evaluate aspects of each key issue most significant to repository performance, narrow areas of factual and interpretative differences with DOE and other parties, develop a path to resolution based on vertical slice approach, and document resolution.

All NRC/DOE interactions will be focused on specific objectives, defined in writing prior to the meeting. DOE will document issue resolution through Project Integration Safety Assessment (PISA) reports. The NRC will document progress in resolving issues by: Letter Reports, Issue Resolution Status Reports, Pre-Licensing Evaluation Reports (PERs) and Safety Evaluation Reports. NRC will also develop a yearly status report on KTIs. Dr. Hinze questioned how issues can be resolved without having DOE's data synthesis and analysis reports, and whether these reports are still planned. The staff responded that the synthesis reports will be integrated into the single PISA report. Finally, Mr. Thoma reviewed a partial list of potentially resolvable issues.

Mr. Michael Bell, NMSS, provided an example of the issue resolution process using Extreme Erosion, and an example of application of the issue resolution strategy using infiltration and percolation at Yucca Mountain. He noted that resolution requires three components to be addressed: data quality and sufficiency, adequacy of conceptual models and projection of conditions into the future, and discussed each item. Mr. Bell summarized the presentation by concluding that the focus is on issues important to performance, efficient and effective integrations with DOE and affected parties, clear documentation of issue resolution, and timely feedback to DOE.

Following several questions from the Committee on NRC's draft Branch Technical Position on Use of Expert Judgement, Mr. Bell concluded his presentation.

Following the staff's formal presentation, Dr. Pomeroy questioned the Committee as to whether a letter was needed on issue resolution. Dr. Hinze noted that the KTI letter already covered much of what would need to be reported, the most important being the need for the staff to develop criteria for deciding when an issue is resolved. Dr. Steindler noted that his primary concern is that issue resolution may not lead anywhere despite all the effort if everything gets reopened at the licensing stage. Dr. Garrick implied that the staff should avoid getting lost in the details of the process. Dr. Pomeroy commented that the Committee needs to monitor the concern DOE has raised about the process that could cause proliferation of subissues under each KTI rather than lead to resolution of KTIs.

IV. Meeting with the Director, Division of Waste Management (Open)

[Note: Mr. Richard K. Major was the Designated Federal Official for this portion of the meeting].

Ms. Margaret Federline presented a current events session on items of interest to the ACNW. She discussed the recent budget request made by the DOE. The amount proposed for the Yucca Mountain revised program approach will increase by $250 million in FY 1997 over FY 1996. The DOE program has the viability assessment for Yucca Mountain scheduled for completion in 1998; a final environmental impact statement is scheduled for the year 2000. A site recommendation to the President is scheduled for completion in 2001, and a license application is scheduled for submission in 2002.

The tunnel boring machine is now about three miles into Yucca Mountain. There have been some problems with air quality. Work has begun on the fifth test alcove which will be used for thermal testing. There is no evidence that the Ghost Dance Fault has intersected with the exploratory studies facility (ESF) north ramp. This was expected. The Ghost Dance fault is now believed to be running parallel to the current progress on ESF. The Sundance fault was encountered by the ESF. The fault is about one meter wide with slick sides exposed. The slick insides were nearly horizontal indicating a strike slip fault. The DOE has plans to test attributes of the Ghost Dance fault in several alcoves. The staff was not aware of any detailed studies planned at depth for the Sundance Fault.

Ms. Federline discussed the interactions the NRC staff has had with representatives of the Environmental Protection Agency with regards to the standards for the Yucca Mountain repository. Both groups are working to define key points of the standard as it is developed. The Center for Nuclear Waste Regulatory Analyses has done an analysis, which was provided to EPA, to ensure that whatever standard is developed is reasonable and implementable.

An update on the branch technical position (BTP) on the use of expert elicitation was given. The BTP is currently out for public comment. The public comment period will end in May 1996. The staff intends to bring the standard to the ACNW for review in August of 1996.

The staff is doing both an audit and detailed review of DOE's Total System Performance Assessment-95 (TSPA-95). The audit review will study 5 key areas of TSPA-95, and be completed in May 1996. This is a vertical slice approach. The detailed review will be completed by December 1996. The staff integration team will focus on this review to ensure the right issues are addressed.

V. NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), based on Comments and Analysis of Alternatives (Open)

[Note: Mr. Howard J. Larson was the Designated Federal Official for this portion of the meeting].

After briefly summarizing the budget planning process and the policy analysis background that was provided in SECY-95-201, Mr. James Kennedy, NMSS, reviewed the public comments on the subject document. He noted that the staff had conducted a mass mailing to over 400 individuals and groups and that a wide spectrum of interests was represented in the 29 responses received.

Based upon a broad analysis of those comments, he quantified the preferences in the following manner:

- Maintain existing program (Option 1) - 10
- Reduce program (Option 2+) - 8
- Establish minimal program (Option 2) - 10
- Withdraw program (Option 3) - 1

Several concerns were expressed in the public comments. Among those noted were the potential loss of the impact that the NRC has had in facilitating development of new LLW disposal facilities (perhaps the most recent examples: the response to the Pu question raised at Ward Valley and the NRC review and comments on the proposed EPA LLW standards); the need for NRC's topical report reviews; the need for a continued generic LLW research program - as states cannot support such a burden; and the concern that without the NRC,

other Federal regulatory agencies might attempt to fill the vacuum left by NRC withdrawal from the LLW arena.

In concluding his formal remarks, Mr. Kennedy noted the intent to obtain stakeholder comments on the strategic assessment proposals early this summer. Comments provided on the NRC LLW program reassessment would be considered by the Commission in its determination as to the final direction of the agency's LLW program.

Committee members noted that the reduction in the agency's LLW program actually started several years ago and that the Committee's December 29, 1995 letter on this topic requested that the NRC LLW program be evaluated by the Commission in terms of overall agency priorities.

Dr. Steindler stated that it was not clear to him that a proposal fostering cooperatively shared LLW technical support expertise dispersed amongst the states and other agencies would be efficient. He postulated that such a system would, in all likelihood, be unworkable, noting that even the review and approval of topical reports could prove unwieldy.

The Committee thanked Mr. Kennedy and indicated their intent to continue to follow this issue to conclusion.

VI. EXECUTIVE SESSION (Open/Closed)

[Note: Mr. Richard K. Major was the Designated Federal Official for this portion of the meeting.]

A. Future Committee Activities (Open)

The Committee discussed anticipated and proposed Committee activities, future meeting dates, and agenda.

- The Committee changed the dates for the 83rd ACNW meeting to May 15 and 16, 1996.

- The Committee plans to hold a Working Group session on Igneous Activity as part of the 84th ACNW meeting in June.

B. New ACNW Members

The Committee discussed potential candidates for nomination to be an ACNW member. A slate of candidates is expected to be completed during the May ACNW meeting for submission to the Commission.

C. Future Meeting Agenda

Appendix IV summarizes the proposed items endorsed by the Committee for the 83rd ACNW Meeting, Rockville, Maryland, May 15-16, 1996, and future Working Group meetings.

The meeting was adjourned at 2:39 p.m., Friday, March 29, 1996.

- APPENDICES -

APPENDIX II

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

Rev. 2 March 20, 1996

SCHEDULE AND OUTLINE FOR DISCUSSION
82ND ACNW MEETING
MARCH 27-29, 1996
TWO WHITE FLINT NORTH
ROCKVILLE, MARYLAND

Wednesday, March 27, 1996, Two White Flint North, Room T-2 B3, 11545 Rockville Pike, Rockville, Maryland

1)	8:30 - 8:45 A.M.	Opening Remarks by the ACNW Chairman (Open) 1.1) Opening Statement (PWP/RKM) 1.2) Items of Current Interest (PWP/RKM)
2)	8:45 - 6:30 P.M.	Regulatory Time of Compliance for Radioactive Waste Disposal (Open) (WJH/ACC) Included in this session will be discussions of various issues including:
	8:45 - 9:~~25~~ 9:21 A.M.	2.1) Rationale and Bases for 10,000 year Time frame in EPA HLW Standard
	9:25 - 10:05 A.M.	2.2) International Perspective and UK Program
	10:05 A.M.	* * * BREAK * * *
	10:20 - ~~11:00~~ 10:57 A.M.	2.3) DOE Perspective on Time Frame of Compliance
	~~11:00~~ 10:58 - ~~11:40~~ 11:41 A.M.	2.4) NRC Perspective on Time Frame of Compliance
	~~11:40~~ 11:44 - ~~12:30~~ 12:32 P.M.	2.5) Regulatory Background and Performance Assessment Perspective for LLW
	12:30 - 1:30 P.M.	* * * LUNCH * * *
	1:30 - 2:10 P.M.	2.6) Factors that control timing of peak dose/risk in HLW PA
	2:10 - ~~2:50~~ 2:40 P.M.	2.7) Insights gained from Site Characterization Studies that bear on time frame
	~~2:50~~ 2:41 - ~~3:30~~ 3:15 P.M.	2.8) Insights gained from Natural Analogue studies with respect to time frame
	~~3:30~~ 3:15 P.M.	* * * BREAK * * *

3:30 ~~3:45~~ - 4:10 ~~4:25~~ P.M.	2.9)	Dose assessment issues and concerns with respect to time frame
4:10 ~~4:25~~ - 4:38 ~~5:05~~ P.M.	2.10)	Basis for TBYMS Panel recommendations on Time Frame
4:40 ~~5:05~~ - 5:05 5:45 P.M.	2.11)	Summary of Various Rationales for Consideration in Setting a Time of Compliance
5:05 ~~5:45~~ - 6:30 P.M.	2.12)	Round Table Discussion of time frame Issues and Concerns
6:30 P.M.		* * * RECESS * * *

Thursday, March 28, 1996, Two White Flint North, Room T-2 B3, 11545 Rockville Pike, Rockville, Maryland

3) 8:30 - 8:35 A.M. Opening Remarks by ACNW Chairman (Open)

4) 8:35 - 10:10 ~~10:30~~ A.M. NRC Staff Issue Resolution Procedures for the DOE High-level Waste Program (Open) (PWP/LGD)
The NRC staff will describe various tools they will use to come to closure or identify outstanding items or issues in need of confirmation in DOE viability assessment

10:20 ~~10:30~~ - 10:48 ~~10:45~~ A.M. * * * BREAK * * *

5) ~~10:45~~ 10:48 - 11:27 ~~12:00 NOON~~ Meeting with the Director, Division of Waste Management, NMSS (Open) (PWP/RKM)
The director will discuss recent items of interest with the Committee, topics may include Site Characterization:
- Progress at Yucca Mountain
- Update on Total System Performance Assessment
- Draft Technical Position on Expert Elicitation

11:30 - 12:35 See Item 8

~~12:00~~ 12:35 - 2:00 ~~1:00~~ P.M. * * * LUNCH * * *

6) ~~1:00~~ - ~~2:00~~ P.M. Preparation of ACNW Reports (Open)
Discuss possible reports on the following topics:

Cancelled
- 6.1) Time Frames for Regulatory Concern
- 6.2) Use of Expert Elicitation
- 6.3) Elements of a LLW Disposal Program
- 6.4) Latest Version of ACNW Priority List
- 6.5) Spent Fuel Storage Containers

2:00 - 4:30 Recess

2:00 - 4:15 Mtg. with NRC Commissioners

~~3:00 - 3:15~~ P.M. * * * BREAK * * *

7) ~~3:15 - 4:15 P.M.~~ Moved to 1:00pm 3/29/96 Postponed

ACNW Priorities/Task Action Plans (Open) (PWP/RKM)
The Committee will discuss priority issues it will consider in the future and action plans for accomplishing these reviews initiated by the ACNW

11:30 12:35
8) ~~4:15~~ - 6:00 P.M.

Committee Activities/Future Agenda (Open/Closed) (PWP/RKM)
8.1) Set Agenda for 83rd ACNW, May 8-10, 1996
8.2) Review Items for the Out Months
8.3) Future Working Group Topics
8.4) Outside Meetings Members may attend
8.5) Reconcile EDO Responses to Committee letter reports
8.6) Selection of New Members (Closed)

Not Transcribed

(Note: A Portion of this session may be closed to discuss matters that relate solely to the internal personnel rules and practices of this Advisory Committee, and matters the release of which would constitute a clearly unwarranted invasion of personal privacy.)

5:55
~~6:00~~ P.M. * * * RECESS * * *

Friday, March 29, 1996, Two White Flint North, Room T-2B3, 11545 Rockville Pike, Rockville, Maryland

9) 8:30 - 8:35 A.M. Opening Remarks by ACNW Chairman

10) 8:35 - 9:30 ~~10:00~~ A.M. NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), based on Comments and Analysis of Alternatives (Open) (MJS/HJL)

9:30 - 10:30 ⟷ Discussion of Proposed ACNW Reports

~~10:00~~ 10:30 - ~~10:15~~ 11:00 A.M. * * * BREAK * * *

11) ~~10:15 - 11:00 A.M.~~ ACNW Follow-up on the Joint ACRS/ACNW Subcommittee Meeting (Open) (BJG/MJS/HJL)
11.1) A brief review of the outcome of the March 26, 1996 Joint Subcommittee meeting topics will include: spent fuel storage, decommissioning facilities, and

CANCELLED

the biological effects of low-levels of ionizing radiation

12) ~~11:00~~ - ~~12:00~~ NOON — Report on Outside Meetings (Open)

CANCELLED

Presentation by Members and Staff on various technical meetings recently attended, such as:

12.1) PSA 5, Korea (BJG)
12.2) January '96 NWTRB Meeting (WJH)
12.3) Others: Volcanic Hazards (PWP/WJH) AGU (WJH/LGD), Materials Research Society and DOE/LLW Conf. (ACC)
12.4) Waste Management '96, Tucson, AZ (HJL)
12.5) LLW Forum, San Diego, CA (HJL)

12:50 - 1:00 ~~12:00 - NOON~~ — BREAK ~~LUNCH~~ * * *

13) 1:00 - 2:39 ~~4:00~~ P.M. — Preparation of ACNW Reports (Open)

Complete preparation and approval of proposed ACNW reports listed above.

2:39 ~~4:00~~ P.M. — * * * ADJOURN * * *

- **Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.**

- **Number of copies of the presentation materials to be provided to the ACNW - 35**

AGENDA
~~WORKING GROUP~~ ON REGULATORY TIME OF COMPLIANCE
FOR RADIOACTIVE WASTE DISPOSAL
March 27, 1996
8:45 am - 6:30 pm
Room T2-B3, 11545 Rockville Pike
ROCKVILLE, MD

I. Background and Regulatory Context

8:45 A. Rationale and Bases for 10,000 year Time Frame in EPA HLW Standard (Ray Clark, EPA)

9:25 B. International Perspective and UK Program (Barbara Watkins, QuantiSci)

10:~~05~~ 10 - 10:20 BREAK

10:20 C. DOE Perspective on Time Frame of Compliance (Steve Brocoum)

11:00 D. NRC Perspective on Time Frame of Compliance (Tim McCartin)

II. Insights from Performance Assessment - HLW and LLW

11:~~40~~ A. Regulatory Background and Performance Assessment Perspectives for LLW
(Andy Campbell, ACNW Staff; Matt Kozak, QuantiSci)

12:30 - 1:30 LUNCH

1:30pm C. Factors that Control Timing of Peak Dose/Risk in HLW PA (John Kessler, EPRI)

III. Scientific Issues and Concerns

2:10 A. Insights Gained from Site Characterization Studies (Tim Sullivan, DOE)

2:~~50~~ 1 B. Insights Gained from Natural Analogue Studies (Rod Ewing, UNM) 3:15

3:~~30~~ 15 - 3:30 - 3:45 BREAK

3:~~45~~ 30 C. Dose Assessment Issues and Concerns (Dave Kocher, ORNL)

4:~~25~~ 11 D. Basis for TBYMS Panel Recommendations on Time Frame, (Myron Uman, TBYMS Committee Staff)

~~5:05~~ E. Summary of Various Rationales for Consideration in Setting a Time of Compliance (Gene Roseboom, USGS-retired) 5:15

5:~~45~~ **IV. Round Table Discussion of Issues and Concerns (All)**

~~6:30~~ pm RECESS

APPENDIX III: MEETING ATTENDEES

82ND ACNW MEETING
MARCH 27-29, 1996

ACNW MEMBERS	1st Day	2nd Day	3rd Day
Dr. Paul W. Pomeroy	X	X	X
Dr. William J. Hinze	X	X	X
Dr. B. John Garrick	X	X	
Dr. Martin J. Steindler	X	X	X

ACNW CONSULTANTS	1st Day	2nd Day	3rd Day
Ms. Barbara Saunders-Price	X	X	
Dr. George Hornberger	X		
Dr. Rodney Ewing	X		
Dr. Eugene Roseboom	X	X	

ACNW STAFF	1st Day	2nd Day	3rd Day
Dr. Andrew Campbell	X	X	X
Ms. Lynn F. Deering	X	X	X
Mr. Howard J. Larson	X	X	X
Mr. Richard K. Major	X	X	X
Dr. John T. Larkins	X	X	X
Dr. Richard P. Savio	X	X	X
Ms. Michele S. Kelton	X	X	X

ATTENDEES FROM THE NUCLEAR REGULATORY COMMISSION

March 27, 1996

Philip Justus, NMSS
Sandra Wastler, NMSS
Jerry Kline, ASLBP
James Firth, NMSS
Dan Graser, IRM
Phil Reed, RES
Tim McCartin, NMSS
Ralph Cady, RES
R. B. Neel, NMSS
Jeffrey Pohle, NMSS

March 28, 1996

Philip Justus, NMSS
John Thoma, NMSS
John Austin, NMSS
Bobby E, NMSS
Chang, NMSS
M. Bell, NMSS
Robert Johnson, NMSS
King Stablein, EDO
Don Chery, NMSS
David Brooks, NMSS
N. Eisenberg, NMSS

March 29, 1996

B. Nelson, NMSS
Phil Reed, RES
Michael Weber,NMSS

ATTENDEES FROM OTHER AGENCIES AND GENERAL PUBLIC

March 27, 1996

Bill Russo, EPA
Gene Roseboom, USGS
Matt Kozak, QuantiSci
B. Watkins, QuantiSci
W. Matyskichs, Gamma Eng.
Ray Wallace, USGS
Adam Levin, TLG Services, Inc.
Jake Parrott, TJHSST
J. Russell, CNWRA
Myron Uman, NAS
F. Rodgers, DOE
C. Hanlon, DOE
T. Sullivan, DOE
M. Lugo, M&O/TRW
A. Brownstein, DDF
Amy Huang, Golder
Stan Echols, Winston & Strawn
Leon Reiter, NWTRB
Jan Docka, INTERA
Paul Krishna, TRW
Steve Hanauer, DOE
R. Murphy, DOE
Bill Vocke, ERM
Robin Haden, NCDRP-LLRW
C. Johnson, State of Nevada
P. LaPlante, CNWRA
D. Smith, TJHSST
J. Duguid, INTERA

March 28, 1996

Ray Wallace, USGS
Stan Echols, Winston & Strawn
A. Levin, TLG Services, Inc.
Jim York, Weston
J. Russell, CNWRA
Paul Krishna, M&O/TRW
Jim Duguid, M&O/INTER
C. Grabery, DOE
A. Brownstein, DOE

ATTENDEES FROM OTHER AGENCIES AND GENERAL PUBLIC (CONT'D)

March 28, 1996 (Cont'd)

M. Lugo, M&O/TRW
C. Johnson, State of Nevada
John Schmitt, NEI
A. Huang, Golder
Gene Roseboom, USGS

March 29, 1996

Ray Wallace, USGS
Carl Johnson, State of Nevada
A. Levin, TLG Services, Inc.
A. Huang, Golder
Laura Scheele, LLW Forum/Afton

APPENDIX IV: FUTURE AGENDA

The Committee agreed to consider the following during the 83rd ACNW Meeting, May 15-16, 1996:

A. Total System Performance Assessment 1995 - The Committee will review comments from the NRC staff on the Department of Energy's Total System Performance Assessment 1995. Participation by the staffs of both DOE and NRC is anticipated.

B. Natural Analogues - The Committee will discuss Zirconolite as a natural mineral analog for nuclear waste disposal. A representative from the Geophysical Laboratory, Carnegie Institution of Washington will make the presentation.

C. Meeting with the Director, NRC's Division of Waste Management, Office of Nuclear Materials Safety and Safeguards - The Director will discuss items of current interest related to the Division of Waste Management programs which may include: progress at the Yucca Mountain site, status of Key Technical Issue resolution, and a discussion of shallow-land disposal long-term performance.

D. Status of Nuclear Waste Related Research - The Committee will meet with representatives of NRC's Offices of Nuclear Regulatory Research and Nuclear Material Safety and Safeguards to discuss the current status of nuclear waste related research.

E. Preparation of ACNW Reports - The Committee will discuss proposed reports, including: time frames for regulatory concern, the use of expert elicitation, elements of an adequate Low-Level Waste program, Committee priorities and task action plans, and biological effects from low-levels of ionizing radiation.

F. Committee Activities/Future Agenda - The Committee will consider topics proposed for future consideration by the full Committee and Working Groups. The Committee will discuss ACNW-related activities of individual members. The Committee will also consider potential new ACNW members. A portion of this session may be closed to public attendance to discuss information the release of which would constitute a clearly unwarranted invasion of personal privacy pursuant to 5 U.S.C. 552b(c)(6).

G. Miscellaneous - The Committee will discuss miscellaneous matters related to the conduct of Committee activities and organizational activities and complete discussion of matters and specific issues that were not completed during previous meetings, as time and availability of information permit.

APPENDIX V
LIST OF DOCUMENTS PROVIDED TO THE COMMITTEE

[Note: Some documents listed below may have been provided or prepared for Committee use only. These documents must be reviewed prior to release to the public.]

MEETING HANDOUTS

AGENDA ITEM NO.	DOCUMENTS
2	Regulatory Time of Compliance for Radioactive Waste Disposal (Open) WJH/ACC)

1. 10,000-Year Regulatory Period: A Review of the 40 CFR Part 191 Disposal Standards presented by Ray Clark, EPA, dated March 1996 [Viewgraphs]

2. Regulatory Time of Compliance for Radioactive Waste Disposal presented by Barbara Watkins, QuantiSci, UK, undated [Viewgraphs]

3. DOE Perspective on Time Frame of Compliance presented by Dr. Stephan J. Brocoum, DOE, dated March 27, 1996 [Viewgraphs]

4. Considerations for Selecting Compliance Periods in Performance Assessments for Waste Disposal and Decommissioning presented by Tim McCartin, NMSS, dated March 27, 1996 [Viewgraphs]

5. Regulatory Background and Performance Assessment Insights for LLW Compliance Time Frame presented by Andrew C. Campbell, ACNW, dated March 27, 1996 [Viewgraphs]

6. Background and Performance Assessment Perspective on Time Frame for Low-Level Waste presented by Matthew W. Kozak, QuantiSci, Inc., Denver, undated [Viewgraphs]

7. Regulatory Time of Compliance for the "Yucca Mountain" Standard presented by John Kessler, EPRI dated March 27, 1996 [Viewgraphs]

8. YMP Insights from Site Characterization presented by Tim Sullivan, DOE, dated March 29, 1996 [Viewgraphs]

9. Compliance Time Frame: Insights from Natural Analogues? presented by R. C. Ewing, UNM, dated March 27, 1996 [Viewgraphs]

10. Dose Assessment Issues and Concerns presented by David C. Kocher, ORNL, dated March 27, 1996 [Viewgraphs]

MEETING HANDOUTS (CONT'D)

AGENDA ITEM NO.	DOCUMENTS
2 (cont'd)	Regulatory Time of Compliance for Radioactive Waste Disposal
	11. Summary of Rationales for Setting Time of Compliance presented by Eugene H. Roseboom, Jr., dated March 27, 1996 [Viewgraphs]
4	NRC Staff Issue Resolution Procedures for the DOE High-Level Waste Program
	12. NRC Proposed Approach to Issue Resolution presented by Margaret Federline, NMSS, John Thoma, NMSS, and Michael, NMSS, dated March 28, 1996 [Viewgraphs]
	13. Letter from Michael Bell, NMSS, to Mr. Ronald A. Milner, DOE: Issue Resolution Status Report on the Potentially Adverse Condition - Evidence of Extreme Erosion During the Quaternary Period at Yucca Mountain, dated February 29, 1996 with Enclosure
	14. Issue Resolution Strategy, Draft Approach to Addressing Issues, dated January 18, 1996 [Agenda Item 4, Handout #1]
8.1	Set Agenda for 83rd ACNW, May 8-10, 1996
	15. Open Market Trading, 1) Memo from M. Steindler to R. Major: Comments on Dade Moeller's Proposed "Open-Market Trading Rule" dated March 21, 1996 2) Memo from R. Major to ACNW/ACRS Members: Letter from Dr. Dade Moeller Concerning "Open-Market Trading Rule" dated February 15, 1996 [Agenda Item 8, Handout # 1]
10	NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), based on Comments and Analysis of Alternatives
	16. Summary of Public Comments on SECY-95-201, Alternatives to NRC's LLW Program presented by James E. Kennedy, NMSS, dated March 29, 1996

MEETING NOTEBOOK CONTENTS

TAB NUMBER	DOCUMENTS
1	Opening Remarks by ACNW Chairman

1. Introductory Statement by the ACNW Chairman, undated
2. Items of Current Interest, undated
3. Introductory Statement by the ACNW Chairman - Second Day, undated
4. Introductory Statement by the ACNW Chairman- Third Day, undated

2 Regulatory Time of Compliance for Radioactive Waste Disposal

5. Table of Contents
6. Status Report
7. Article from Star Tribune, Minneapolis, MN, entitled "10,000 Years is a Long, Long Time, NSP," by Tony Anderson Solgard, dated April 28, 1994
8. Geologic Time Scale: From 4600 Million Years Ago to Present
9. Memorandum from James M. Taylor, Executive Director for Operations, NRC, for The Commissioners, NRC: Transmittal to EPA of comments on Draft Federal Radiation Protection Guidance for Exposure of the General Public, SECY-94-119, dated May 2, 1994
10. Federal Register Notice, Vol. 59, No. 246, pg. 66419: Part III, Environmental Protection Agency, Federal Radiation Protection Guidance for Exposure of the General Public, dated December 23, 1994
11. Letter from Margaret V. Federline, NMSS, to Ray Wassel, National Academy of Sciences: NRC Comments to EPA on the Choice of a 10,000 Year Period for Containment Requirements and Statements on the Persistence and Effectiveness of Institutional Controls, dated February 14, 1994 with Enclosures
12. Note to Norm Eisenberg, NMSS, from James Firth, NMSS: Preliminary Results of Literature Survey on Comparisons of High-Level Waste to Unmined Uranium Ore, dated December 6, 1995 with Attachments
13. Note for Robert M. Berner, Director, NMSS, from Daniel J. Fehringer, NMSS: Transmittal of Paper on Long-Term Dose Estimates, dated October 28, 1991 with Enclosure
14. High-Level and Transuranic Radioactive Wastes, Background Information Document for Final Rule, EPA 520/1-85-023, dated August 1985
15. On the Development of Environmental Radiation Standards for Geologic Disposal of High-Level Radioactive Wastes, prepared by D. C. Kocher for NRC, NUREG/CR-3714, ORNL-60006
16. Paper, Criteria for Long-Term Safety of Radioactive Wastes: A Proposal, by Benjamin Ross

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
2 (cont'd)	Regulatory Time of Compliance for Radioactive Waste Disposal

17. Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, DOE/EIS-0046F, Volume 1, dated October 1980
18. Population Risks from Uranium Ore Bodies, EPA 520/3-80-009, dated October 1980
19. Safety Indicators in Different Time Frames for the Safety Assessment of Underground Radioactive Waste Repositories, First Report of the International Radioactive Waste Management Advisory Committee (INWAC) Subgroup on Principles and Criteria for Radioactive Waste Disposal, IAEA-TECDOC-767, dated October 1994
20. Documents of the NRPB, includes Board Statement on Radiological Protection Objectives for the Land-based Disposal of Solid Radioactive Wastes, Volume 3 No. 3 1992, National Radiological Protection Board
21. Regulatory Guidance for Radioactive Waste Disposal - an Advisory Document, SKI Technical Report 90:15, Swedish Nuclear Power Inspectorate, Swiss Nuclear Safety Inspectorate, Swedish Radiation Protection Institute

4 NRC Staff Issue Resolution Procedures for the DOE High-Level Waste Program

22. Table of Contents
23. Status Report
24. Memorandum from Andy Campbell, ACNW, to ACNW Members: Report on DOE/NRC Management Meeting, January 19, 1996, (Washington, D.C. and Las Vegas, NV - Video-Conference), dated January 22, 1996 with Attachments
25. Draft Procedural Agreement Between the Nuclear Regulatory Commission and the U.S. Department of Energy Identifying Guiding Principles for Interface During Geologic Site Investigation and Site Characterization, dated January 17, 1996

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
5	Meeting with the Director, Division of Waste Management (Open) (PWP/RKM)
	26. Status Report
6.3	Elements of a Low-Level Waste Program
	27. Table of Contents
	28. Status Report
	29. Memorandum from H. J. Larson, ACNW, to ACNW Members: Draft Document "Elements of a Low-Level Waste Program," Prepared by Dr. M. J. Steindler, dated January 3, 1996 with Attachments [Draft Predecisional]
7	ACNW Priorities/Task Action Plans
	30. Status Report
	31. Memorandum to Chairman Jackson from Paul W. Pomeroy, Chairman, ACNW: Revision of ACNW Priority Issues, dated December 28, 1995 with Attachment
	32. Draft ACNW Task Action Plan on Negligible Incremental Risk Level (NIRL), dated March 4, 1996
	33. Draft 1.1 ACNW Task Action Plan on Site Characterization Activities Related to Waste Isolation Strategy FY 1996, dated February 28, 1996
	34. ACNW Task Action Plan on Role of NRC/ACNW in Low-Level Waste, dated March 7, 1996
	35. Facsimile from Martin J. Steindler, ACNW, to Richard Major, ACNW, and Howard Larson, ACNW: Addendum to Task Action Plan on the Low-Level Paper, dated March 12, 1996
	36. Memorandum to ACNW Members from Andy Campbell, ACNW: The Use of Expert Judgment in the High-Level Radioactive Waste Program - A Priority Issue, dated March 18, 1996 with Attachments
	37. Supplemental Notebook

MEETING NOTEBOOK CONTENTS

TAB NUMBER	DOCUMENTS
8	Committee Activities/Future Agenda
	38. Table of Contents
	39. Set Agenda for 83rd ACNW Meeting, May 8-10, 1996
	40. Review Items for the Out Months
	41. Future Working Group Topics
	42. Memorandum to John T. Larkins, ACRS/ACNW, from James L. Blaha, EDO: Proposed Agenda Items for the ACRS and the ACNW, dated March 5, 1996
	43. CRWMS/M&O Meeting Status, dated March 4, 1996
	44. Calendar of Events, March 1996 - December 1996, dated February 9, 1996
8.3	Future Working Group Topics
	45. Memorandum to ACNW Members from L. Deering, ACNW: Summary of March 5, 1996 Scoping Meeting for Working Group on Igneous Activity, dated March 14, 1996 with Attachments
8.5	Reconcile EDO Responses to Committee Letter Reports
	46. Table of Contents
	47. Status Report
	48. Memorandum to Paul W. Pomeroy, ACNW, from James M. Taylor, EDO: Response to Advisory Committee on Nuclear Waste Letter dated February 9, 1996, on U.S. Nuclear Regulatory Commission Activities Associated with the National Research Council's Report, "Technical Bases for Yucca Mountain Standards," dated March 8, 1996
	49. Letter to The Honorable Shirley Ann Jackson, Chairman, NRC, from Paul W. Pomeroy, Chairman, ACNW: Issues and NRC Activities Associated with the National Research Council's Report, "Technical Bases for Yucca Mountain Standards," dated February 9, 1996
	50. Memorandum to ACNW Members from H. J. Larson, ACNW: Draft Minutes of the February 13, 1996 Joint EPA - NRC Task Force on the EPA Yucca Mountain Standard, dated March 1, 1996 with Attachment

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
10 (cont'd)	NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), Based on Comments and Analysis of Alternatives

51. Table of Contents
52. Status Report
53. Letter to The Honorable Shirley Ann Jackson, Chairman, NRC, from Paul W. Pomeroy, Chairman, ACNW: Comments on SECY-95-201 and the NRC Activities Regarding Low-Level Radioactive Waste, dated December 29, 1995
54. Memorandum for The Commissioners, NRC, from James M. Taylor, EDO: Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program, SECY-95-201, dated July 31, 1995
55. Memorandum to James M. Taylor, EDO, and John T. Larkins, Executive Director, ACNW from John C. Hoyle, Secretary, NRC: SECY-95-201 - Alternatives to Terminating the NRC's Low-Level Radioactive Waste Disposal Program, dated September 15, 1995
56. Letter to Dr. Paul W. Pomeroy, Chairman, ACNW, from James M. Taylor, EDO: SECY-95-201, "Alternatives to Terminating NRC's Low-Level Radioactive Waste Disposal Program," and Nuclear Regulatory Commission Activities Regarding Low-Level Radioactive Waste, dated February 8, 1996
57. Letter to James Kennedy, NRC, from John Runkle, President, Conservation Council of North Carolina: Elimination of Regulation for Low-Level Radioactive Waste, SECY-95-201, dated February 21, 1996
58. Letter to Mr. James Kennedy, NRC, from Charles E. Jensen, President, Diversified Technologies Services, Inc.: Retention of the Topical Report Program, dated February 19, 1996
59. Letter to Mr. James E. Kennedy, NRC, from Bhudatt R. Paliwal, President, American Association of Physicists in Medicine: AAPM Response to the Nuclear Regulatory Commission's Request for Comments on the Termination of the Low Level Waste Disposal Program, dated January 17, 1996
60. Letter to Mr. James E. Kennedy, NRC, from Mike Alissi, Nuclear Energy Institute: Nuclear Energy Institute Comments on NRC's Low-Level Radioactive Waste Regulatory Program, dated January 18, 1996 with Enclosure
61. Letter to Mr. Michael J. Bell, NRC, from William T. Gregory, III, Chairman, Nuclear Engineering Division, ASME International: Termination of NRC Low Level Waste Topical Report Review Program, dated September 25, 1995
62. Letter to Mr. James E. Kennedy, NRC, from Sierra Club National Nuclear Waste Task Force: SECY-95-201, Alternatives to Terminating the NRC LLW Disposal Program, dated January 15, 1996

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
10 (cont'd)	NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), Based on Comments and Analysis of Alternatives

63. Letter to Shirley Jackson, Chairman, NRC, from Gregg S. Larson, Convenor, LLW Forum: NRC Staff Participation in the Activities of the LLW Forum, particularly the Three Yearly Meetings
64. Letter to James E. Kennedy, NRC, from Joseph G. Klinger, Head of Licensing, State of Illinois, Department of Nuclear Safety: Alternatives to Terminating the NRC LLW Disposal Program (SECY-95-201) State Agreements Program Information Letter (SP-95-172), dated December 5, 1995
65. Letter to Mr. James E. Kennedy, NRC, from Steve R. Jones, P.G., Chief, Department of Environmental Protection, Bureau of Radiation Protection: Review and Comment on NRC Policy Issue SECY-95-201, Suggested Reply Format, dated November 29, 1995
66. Letter to Mr. James E. Kennedy, NRC, from Alice Hamilton Rogers, P.E., Manager, Texas Natural Resource Conservation Commission: Alternatives to Terminating the NRC LLW Disposal Program, dated November 29, 1995
67. Letter to James E. Kennedy, NRC, from Fint c. Watt, P.E., Chief, Department of Public Health, State of Michigan: Comments on SECY-95-201, "Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program," dated January 8, 1996
68. Letter to James E. Kennedy, NRC, from Teresa D. Hay, Chair, Midwest Interstate Low-Level Radioactive Waste Commission, dated January 8, 1996
69. Letter to Mr. James E. Kennedy, NRC, from Robert M. Quillin, Director, Radiation Control Division, State of Colorado: Comments on the Three Options for the NRC Low-Level Waste Program, dated January 2, 1996
70. Letter to James E. Kennedy, NRC, from William J. Sinclair, Director, Division of Radiation Control, State of Utah: Pending Decision by the NRC on the Status of the Low-Level Radioactive Waste Regulatory Program, dated December 28, 1995
71. Letter to Mr. James E. Kennedy, NRC, from Virgil R. Autry, Director, Division of Radioactive Waste Management, South Carolina Department of Health and Environmental Control: Comments on the Future of NRC's Regulatory Program for Low-Level Radioactive Waste, dated January 15, 1996
72. Letter to Mr. James E. Kennedy, NRC, from Barbara Youngberg, Supervisor, Radiation Section, New York State Department of Environmental Conservation, dated January 26, 1996

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
10 (cont'd)	NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), Based on Comments and Analysis of Alternatives

73. Letter to Mr. James E. Kennedy, NRC, from Carol S. Marcus, Ph.D., M.D., President, American College of Nuclear Physicians, California Chapter: Comments Concerning the Future of NRC's LLW Program, dated January 24, 1996
74. Letter to Mr. Jack Roe, Director, NRC, from Judith H. Johnsrud, Ph.D., Director: NRC Initiates National Performance Review Phase 2 Study, dated April 15, 1995
75. Letter to Mr. James E. Kennedy, NRC, from Donald H. Charlesworth, Facilities & Support, Waste Management and Decommissioning, AECL: Comments on the Future of NRC's Regulatory Program for Low-Level Radioactive Waste
76. Letter to Mr. James E. Kennedy, NRC, from R. E. Vaughan, Manager, Safety, Security, and Licensing, Siemens Power Corporation: NRC Letter Dated December 4, 1995, dated January 12, 1996
77. Letter to Mr. James E. Kennedy, NRC, from Cheryl L. Parrino, Chairman, Scott A. Neitzel, Commissioner, and Daniel J. Eastman, Commissioner, Public Service Commission of Wisconsin: Comments on "Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program," (SECY-95-201), dated January 19, 1996
78. Letter to Mr. Marvin Lewis, from Michael F. Weber, NRC: U.S. Nuclear Regulatory Commission Low-Level Waste, dated January 18, 1996
79. Letter to Mr. James E. Kennedy, NRC, from Paul Bessette, IES Utilities: Request for Comments on Regulatory Program for Low-Level Radioactive Waste, dated January 16, 1996
80. Letter to Mr. James E. Kennedy, NRC, from Michael J. Angus, Pacific Gas and Electric Company: Future of NRC's Regulatory Program for Low-Level Radioactive Waste, dated January 12, 1996
81. Letter to Mr. James e. Kennedy, NRC, from Susan L. Hiatt, Director, Ohio Citizens for Responsible Energy, Inc.: Review of SECY-95-201, "Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program, dated January 15, 1996
82. Letter to Mr. James E. Kennedy, NRC, from Susan B. Griffin, Coordinator, Chenango North Energy Awareness Group: Comments on SECY-95-201, "Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program," dated January 12, 1996

MEETING NOTEBOOK CONTENTS (CONT'D)

TAB NUMBER	DOCUMENTS
10 (cont'd)	NRC Staff Discussion of Alternatives for NRC's LLW Program (SECY-95-201), Based on Comments and Analysis of Alternatives

83. Letter to Mr. James E. Kennedy, NRC, from Michael T. Ryan, Ph.D., CHP, Vice President, Regulatory Affairs, Chem-Nuclear Systems, Inc.: Comments on SECY-95-201, "Alternatives to Terminating the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program," dated January 15, 1996
84. Letter to Mr. James E. Kennedy, NRC, from James S. Tulenko, Professor & Chairman, Nuclear Engineering Services, University of Florida: Comments on the Future of the NRC's Regulatory Program for Low-Level Radioactive Waste, dated January 10, 1996
85. Letter to Mr. James E. Kennedy, NRC, from Edith Chase: Request for Comments on the Future of the NRC's Regulatory Program for LLW, dated January 12, 1996
86. Letter to Mr. James E. Kennedy, NRC, from Virgil R. Autry, Director, Division of Radioactive Waste Management, Bureau of Solid & Hazardous Waste Management: Comments on the Future of NRC's Regulatory Program for Low-Level Radioactive Waste, dated January 15, 1996
87. Letter to Mr. James E. Kennedy, NRC, from Judith H. Johnsrud, Ph.D., Director,Environmental Coalition on Nuclear Power: SECY-95-201, Alternatives to Terminating the NRC LLW Disposal Program, dated January 8, 1996
88. Letter to Mr. James M. Taylor, EDO, NRC, from Stephen R. Mapley, Chief, Radioactive Waste Disposal Division, Department of the Army: Alternatives to Termination of the Nuclear Regulatory Commission Low-Level Radioactive Waste Disposal Program, dated November 27, 1995

12.4 Waste Management '96, Tucson, AZ

89. Memorandum to ACNW Members from Howard J. Larson, ACNW: Waste Management '96 (WM '96) February 25-29, 1996, Tucson, AZ, Convention Center, dated March 7, 1996

12.5 LLW Forum, San Diego, CA

90. Memorandum to ACNW Members from Howard J. Larson, ACNW: LLW Forum Meeting - San Diego, CA, February 13-16, 1996, dated February 22, 1996