Enclosure 3

Luncheon Address - James K. Asselstine, Commissioner
U.S. Nuclear Regulatory Commission

Good afternoon ladies and gentlemen. It's a real pleasure for me to be here to participate today in this ASQC Energy Division Topical Conference on Nuclear Waste Management Quality Assurance. It's a particular pleasure because first I think that the waste issue, in general, is one of the most important and challenging issues that we all face in the area of nuclear regulation; and, second, because this is my second appearance before an ASQC Energy Division Conference, and through both sessions I have gained a great deal of understanding about what quality assurance is all about and what quality assurance people and the contributions they make to overall effective and safe nuclear operation.

During the next few minutes what I would like to do is give you a regulator's perspective on implementation of the repository program of the Nuclear Waste Policy Act of 1982, and I intend to focus my remarks on three subjects. The first of these is the discussion of some of the more significant challenges that the Department of Energy and we at the Nuclear Regulatory Commission face as we move into the repository licensing process, including an assessment of what we can all do to improve our performance and to ensure a smooth and effective licensing proceeding. The second subject is the role of quality assurance in achieving a successful repository development program. And the third subject has to do with the events of the past year concerning DOE's management of the repository program, the potential threat that these events pose to the likelihood of the success of the repository development effort, and what I see are some options on what can be done to remove that threat.

Before I start, let me just say I intend some of the comments I make to be in the nature of constructive criticism, not only of the Department of Energy's efforts, but also to a large extent, of our efforts at the NRC as well; and, I make these comments in recognition of many of the efforts that are made by many of the people in the repository development program toward assuring a successful program and a safe program and that includes both our people at NRC, DOE people, and DOE's many contractors.

Turning first to my first topic, I want to begin with a few comments on some of the broad characteristics of the repository licensing process. Understanding the nature of this licensing process is essential to an appreciation both the challenges that we all face in the repository program licensing and of the critical role of quality assurance if we are to be successful. The first of these broad characteristics is the repository licensing process will be very similar to the present licensing process for the nuclear power plants in this country. Thus, we envision the two-stage licensing process with the first stage preceding an authorization to construct the repository and the second stage preceding repository operation. We also expect that this licensing process will employ on-the-record adjudications very similar to the formal licensing hearings used in the reactor licensing process. Under this approach, DOE will bear the burden of demonstrating that it's application meets the applicable legal

requirements including the Commission's regulations, that it's proposed site is adequate, that it has adequately considered alternate sites, and that the repository can function safely and effectively for the long periods of time contemplated by the Commission's technical regulations. Given the long periods of time that a repository must function effectively, the many technical uncertainties and unknowns in this area and the first of a kind nature of the repository development effort, this is a significant burden. DOE's key judgments and the technical basis for those judgments will be exposed to careful scrutiny, and the opinions of it's scientific experts will be tested by cross examination. As the NRC has emphasized repeatedly in the past few years, the outcome of the formal licensing proceeding will depend heavily upon the quality of DOE's license application, including especially the data and experimental results supporting the application. Assuming a complete high quality and well-supported license application from DOE, we anticipate that the licensing proceeding leading to the issuance of a construction authorization could be completed in three years, and that's been the Commission's consistent position for several years now. On the other hand, a flawed and poorly supported application could lead to a much more extended licensing proceeding and could eventually lead to a rejection of the application. I should also note one difference between the repository licensing process and our current licensing process for nuclear power plants. Unlike the reactor process, our procedural regulations for repository licensing do not contemplate the use of a limited work authorization. Thus, construction of the repository will not begin until the successful conclusion of the construction authorization hearing.

The second basic characteristic of the repository licensing process is the timing of the formal licensing proceeding. The Commission has divided the licensing into two separate but related parts. The formal proceeding will not begin until DOE submits it's application for a construction authorization, and under DOE's proposed Mission Plan Amendment, this now would not occur until 1995. Prior to this formal phase of the licensing process, the Commission has intentionally left the process very informal. During this informal phase, we will monitor, review, and comment on the work being done by DOE in preparing its application. It's worth noting that during this informal phase, DOE will be doing most of the work, including site selection and characterization, choice of waste form and packaging, and technical research, which will ultimately determine the success or failure of its license application. This early informal portion of the process is really a two-edged sword in my view. On the one hand, it provides for the broadest possible opportunity for the free exchange of comments, concerns, and suggestions by the NRC staff, DOE, and interested parties, such as the potential host states, effected Indian tribes, and members of the public. If vigorously pursued, this informal approach can work effectively to identify most, if not all, of the key technical issues which must be decided in the formal licensing phase. This can lead to a more complete, high-quality application which anticipates and addresses the issues of greatest concern. On the other hand, the more informal approach limits our ability to require DOE to address the issues of real concern early on. If DOE fails to heed the early warnings, the consequences may not be readily apparent until it's too late.

With that introduction, I want to turn to a discussion of the potential pitfalls which face us in the repository licensing process, and I see four of these which could have a significant impact on the timing and outcome of the licensing proceedings for the repository. Not surprisingly, the first and foremost of these on my list is the possibility that DOE will not submit an essentially complete, high-quality application for a good site, which is supported by the information needed to address the key technical issues in the licensing hearing. I've already described potential consequences should this occur, and I won't belabor the point. Suffice it to say, that I view this as the single most important element in determining the success or failure of the repository program.

The second pitfall that I see is the failure to resolve differences among the various federal agencies with responsibilities for the repository program. The most obvious example here is the complementary, and to some extent, the overlapping responsibilities of NRC and EPA. Another example is the preparation of an environmental impact statement by the Department and Energy and the NRC for the proposed repository, including the very difficult issue of NRC adoption of DOE's EIS.

The third pitfall I see is the possibility that there will be sharp divisions within the scientific community on the key technical issues in the repository licensing proceedings. Such divisions will make it very difficult to reach a timely licensing decision and will very likely lead to a protracted hearing.

And the final pitfall I see is the emergence of strong and concerted opposition to DOE's application by the potential host state, effected Indian tribes, and the public. Even if the site proposed by DOE survives the Congressional review procedures established by the Act, concerted state, tribal, and public opposition to the project in the licensing process could well lead to a protracted and difficult hearing.

What can be done to avoid these pitfalls or at least to minimize their potential impact on the repository licensing process? In my view several things can and should be done to address these potential problem areas. With respect to the NRC and EPA regulatory responsibilities, I believe that problem is now essentially behind us. EPA issued its final environmental standards for high-level waste disposal in 1985, and last year the NRC proposed amendments to our technical regulations to insure that they will conform to the EPA standards. The conforming changes include a set of performance and assurance criteria, which are designed to insure that the EPA standards are met. When we complete work on these conforming changes, hopefully in the next couple of months, this should resolve the potential for conflicting regulatory requirements by EPA and NRC. We will then have in place the basic technical regulatory standards by which DOE's license application is to be judged. With respect with the DOE and the NRC EIS responsibilities, Section 114F of the Nuclear Waste Policy Act provides that the NRC for licensing purposes shall adopt DOE's EIS for the repository application to the extent practicable. The Commission, for some time now, has been considering a set of options identified by the NRC staff, which would define how and when the NRC would make its decision on adopting all of part of the DOE's EIS, and which would describe the impact of that decision on the opportunity to litigate

environmental issues in the repository licensing proceeding. The legislative history of this provision of the Act is somewhat limited, like much of the rest of the Act, and the Commission's decision on this issue could have a significant impact on the opportunity to raise environmental issues in the licensing hearing. We will be proposing regulations shortly which will define how the NRC proposes to handle the issue of adopting DOE's EIS in carrying out our own responsibilities.

Apart from these two instances, I think we should continue to look out for other potential trouble spots where the jurisdictions of two or more agencies may overlap. As for reducing the potential for concerted state, tribal, or public position during the license hearing, DOE in my view simply has to learn to work more closely with the effected states and Indian tribes. I was troubled by the fact that DOE was unwilling or unable to do more to address the concerns of the potential host states and effected Indian tribes on the repository site selection guidelines, and I saw problems in the reactions in the effected states and tribes to DOE's draft environmental assessments for the first round repository sites. The state and tribe concerns do not appear to be satisfied by the final environmental assessments either. What is disturbing is DOE's apparent inability to address at least some of the state's concerns about the adequacy of DOE's site selection process criteria and the adequacy of the information on which those decisions were made.

I view these concerns on the part of the states and the effected Indian tribes as really being somewhat different than the more general view that we don't want the repository in our state. I think DOE must find the formula for at least considering and hopefully addressing these more technical and programmatic concerns by the affected states and Indian tribes.

One approach that has proven helpful to the NRC is the use of more informal meetings to keep the states and tribes informed of what is going on and to solicit their views. In fact our staff did this before the NRC submitted its comments to DOE on the draft environmental assessments for the first round site, and we routinely open our technical discussions with DOE to outside participation. However, for such informal preliminary exchanges of ideas to be truly beneficial, the states and tribes must be allowed to be active participants and not just observers. Although DOE is expanding its use of this type of informal exchange, I think there's still considerable room for improvement.

As for assuring a high-quality application and avoiding sharp divisions within the scientific community, I think there are several steps that DOE should take. First, DOE must learn to take a critical and pessimistic approach to site investigation. A key element in this approach is to recognize that there are potential problem areas with each site and to identify those problems early in the site investigation process.

In the past, DOE has tended to view the sites under investigation quite optimistically and to ignore or discount potential problem areas. We can't afford to repeat that mistake in the future. Once the potential problem areas have been identified, DOE must embark on an early program to

do the testing and to gather the data needed to understand the nature of the problem and to assess the acceptability or unacceptability of the site.

The NRC staff comments to DOE on both the draft and final environmental assessments for the first round repository site. Note that DOE continues to take an overly optimistic view with respect to the problem areas at some of these sites. The NRC staff found several instances in which DOE had either not considered some available but potentially negative information about these sites, or in which DOE had not given recognition to the uncertainties involved in our current state of knowledge about the sites, or to alternative interpretations of the existing data. In some instances, our staff reached more pessimistic conclusions about the potential problem areas at these sites than did DOE based upon the same information considered by DOE. Although the NRC staff noted some efforts to improve by DOE in the final environmental assessments, this is still an area of significant concern. Indeed, as our staff comments on the final EAs note recognizing the range of uncertainties and alternative interruptions of the data is essential if DOE is to develop test plans that will lead to adequate site characterization and that will result in information needed for licensing.

If it is to avoid failure down the road, DOE must increase its efforts to identify, understand, and address the most significant technical issues for each site, and begin building a consensus within the technical community on each of these items. A key element in building that consensus is the ability by DOE to explain its methodology and to present the information needed to defend its analysis and conclusions. And here again, the draft and final environmental assessments for the first round sites show the need for further improvement in DOE's efforts. The many state and Indian tribe criticisms which have been leveled at DOE's site selection methodology and site ranking process, and DOE's continuing inability to provide a credible and persuasive response to those criticisms are indicative of the seriousness of this weakness in DOE's repository program to date.

I should also emphasize that the need for a forward looking program to identify and resolve the key technical issues in repository development in licensing is not the exclusive province of the Department of Energy. We at the NRC must pursue the same goal in our pre-licensing review. Our staff has undertaken a number of initiatives to enable the NRC to identify and address key issues earlyon in order to make the litigation of issues in the formal licensing hearing go more smoothly and be more meaningful. These initiatives include: the development of a licensing support system to manage the extensive information base that will be developed in the licensing process, the possible use of rule making to resolve generic issues early in the process, the use of partial initial decisions in the licensing hearings, and the development of an issue management and tracking system for key licensing issues.

If these initiatives are to work, we will need the support and acceptance of DOE and the potential host states and affected Indian tribes. The NRC staff has begun working with these groups to obtain their advice and suggestions on the usefulness and acceptability of these or other

possible efforts to make the licensing process operate more efficiently and more effectively.

I now want to turn to my second topic, quality assurance. DOE must apply a rigorous and effective quality assurance program to its site investigation and research activities. This is crucial to DOE's ability to demonstrate the validity of its findings and analyses in the repository licensing hearing. As several other speakers at this conference have already noted, quality assurance has become a major source of uncertainty in the licensing process for some nuclear power plants, and where quality assurance breakdowns have occurred, questions concerning the adequacy of plant design and construction have proven very costly and difficult to resolve. In a few cases such as Zimmer, Marble Hill, and Midland, quality assurance problems and their financial consequences led to the eventual cancelation of the projects. TVA is another example of our quality assurance problems in the reactor area. We cannot afford to repeat those mistakes in the repository development program.

Certainly the steps involved in developing a repository such as site characterization are in some respects quite different than the steps for a reactor. Moreover the greatest technical challenges in the repository program may well be in assuring quality information in the site investigation and repository design phases rather than in the construction phase. To some degree, the structure of DOE's repository development program including the use of many different contractors and individual project offices for the different geologic media which have on occasion become advocates for their individual sites, may pose some special challenges in achieving an effective and uniform quality assurance program.

Furthermore, the repository development program requires the blending of engineering and earth sciences disciplines to a much greater degree than is the case in the reactor area. However, there are also some similarities. Just as in the reactor area, repository development will be subject to a high degree of public concern and scrutiny. Quality assurance will inevitably be a component in the Commissions's licensing decision and could well be an issue in a formal licensing hearing. Moreover, the consequences of a significant quality assurance breakdown in the repository program would be disastrous. For example, unlike in the reactor area, there doesn't appear to me to be a viable method for curing a quality assurance breakdown in the site information gathering process for the repository. At the same time the sound management practices that can lead to successful quality assurance in the design and construction of a reactor are also applicable to repository development.

As several speakers noted yesterday, the broader findings and recommendations in the Ford Amendment Study provide some instruction for quality assurance in the repository development program as well. Quality is a line management responsibility; it cannot be delegated to a separate group of quality control inspectors, nor can it be delegated to the NRC. A quality assurance organization is an essential monitoring and evaluating tool, but it is not a subject for day-to-day involvement by management in all phases of the project. I think it's not too soon to put these lessons that we have recently learned in the reactor area to work in the repository program. The challenge now is to go beyond these broad principles and

develop the detailed elements of an effective quality assurance program which meets the unique demands of the repository development process. In doing that, I would echo the advice of other speakers that DOE and we at the NRC for that matter should take a conservative approach in developing details of the program in such areas as defining what should be on the Q-list and how to certify or qualify adequacy of existing data.

I would simply end my comments on quality assurance by noting that although DOE has committed to having fully qualified QA programs in place before the issuance of site characterization plans for the first round sites, the stop work orders last year effecting work at the Nevada and Washington sites indicate that much work remains to be done to insure an effective quality assurance program.

I now want to turn for a few minutes to the current state of affairs in the repository program as a result of the decisions by the Department of Energy this past year on the first and second round repository sites. Put simply, it seems to me that the repository program is in disarray and that the prospects for success are in serious jeopardy. I remain convinced that the Nuclear Waste Policy Act provides a workable framework for developing a safe and environmentally acceptable system of repositories, but I fear that these decisions as well as the manner in which DOE has elected to implement certain features of the law are undermining that framework and sowing the seeds for possible failure down the road.

The decision to postpone indefinitely the site specific work on a second repository threatens to upset the delicate regional balance that was struck in the 1982 Act. As a result, the debate in Congress has become increasingly polarized. Representatives of the western states have been successful in limiting site specific work on the sites being considered for the first repository. At the same time, representatives of the eastern states appear to be opposed to any resumption of exploration of the eastern sites for the second repository. This east-west debate is fueled at least in part by concerns that political considerations may be prevailing over technical judgments in making siting decisions in the repository program.

There appear to be continuing legitimate concerns about DOE's site comparison and selection methodology and the adequacy of information used to make its site selection and site ranking decisions. Underlying these concerns is a continuing dissatisfaction with DOE's site selection guidelines.

There are also strong and legitimate concerns about DOE's working relationship with potential host states and affected Indian tribes. Finally, there is a valid concern that a desire to meet schedules rather than technical merit is the principle driving force behind DOE's program decisions. Although DOE has just proposed a five-year delay in the schedule for repository operation, something that could be viewed as a positive sign, I fear that the proposed delay represents more a belated recognition by DOE of the seriousness of its troubles than a commitment to attack the specific causes of the present controversy.

All of this has resulted in a substantial number of lawsuits--more than I can even keep track of--and an erosion of confidence in DOE's

ability to make sound and objective technical decisions, and to insure that the repository program is guided by conservative and prudent decisions based upon the technical merits. If left uncorrected, these difficulties can substantially delay the repository program and lead to bitter and extensive litigation both in the courts now and eventually in NRC's licensing proceeding. Any sense of cooperation and mutual trust between the federal government and the states, tribes, and the public could well be lost. Given the complexity of the repository development process and the role of the states and tribes as full participants in that process, this is a potentially disabling blow.

What can be done about this situation? There may be many possible solutions, but I'll offer you my own views on at least one alternative. In my view, we need to attack the sources rather than the symptoms of the problem, and I would begin with DOE's site selection process.

I think we need to reopen the site selection guidelines, DOE's site ranking methodology. I would revise these documents to make them more specific, to define the levels of information needed to make reasoned evaluation and comparisons of the sites, and to insure that these documents become effective tools for identifying the best possible sites in the country and for screening out sites that are likely to prove unacceptable or that are going to be very difficult to evaluate or qualify. I would formalize the process requiring that these documents be adopted by rule making. I would require NRC concurrence, and I would provide for a period of Congressional review similar to that now provided for the Mission Plan. I would also require that application of the site ranking methodology be documented fully and that NRC provide formal comments on the site ranking decision.

Second, I would eliminate the second round repository program and eliminate the capacity limits for the repository. This would mean refocusing the program on a single repository with sufficient capacity to meet all of the nation's high-level waste disposal needs.

Third, I would suspend all work on the first round sites and conduct a national review of sites to identify a small number of sites that are likely to be among the best available. The revised site selection and site ranking regulations that I mentioned would be used as a basis for these decisions. Under this approach fewer sites would probably be characterized than under the two-repository approach, thereby easing the cost of characterization, but we should have greater assurance that the sites actually chosen for characterization are likely to prove to be high quality sites. At the same time, I think the financial incentive package would perhaps ease somewhat the unattractiveness of being considered or chosen as the host site for the repository.

Fourth, we should reexamine the schedule for repository development to insure that it is consistent with a careful and conservative technical approach to repository development, and with the site selection approach which I've outlined. It should be made clear, however, that technical merit and the means to satisfy fully all applicable requirements must take precedence over adhering to whatever schedule is adopted.

And, finally, I think that we should at least give some consideration to establishing a new federal agency to operate the high-level waste storage and disposal program, thus removing these responsibilities from the Department of Energy. Such an agency would have the advantage of focusing all of its efforts on solving the waste disposal problem and would likely be more susceptible to Congressional oversite than a cabinet level agency with broad responsibilities beyond the waste issue. In fact, this would transfer the waste functions from DOE to a new agency.

The actions I've outlined are probably not the only solution to the current problems in the repository program, and they may not even be the best solutions, but I believe that they represent at least one option for dealing with the difficulties which now seriously threaten the success of the repository development effort. Clearly, most if not all of the actions that I've suggested can only come about by Congressional action to reopen the Nuclear Waste Policy Act of 1982. And all of this will take time, but in the long run I fear that if we do not address the route causes of the current problems in the repository development program, we could end up losing a great deal more than the five-year delay in repository operation that DOE has just proposed.

Thank you.

B0287 LETTER REPORTS

The following Letter Reports have been completed to date (04/30/87) by Oak Ridge National Laboratory staff for the NRC Project FIN No. B0287, and transmitted to the NRC Project Manager.

Date	Number	Title
03/06/87	LR-287-71	A. D. Kelmers and R. E. Meyer, "Concerns Relative to the Plan for Quality Assurance of Radionuclide Sorption and Precipitation Investigations (Los Alamos National Laboratory Scientific Investigation Plan SIP No. 86/4.1.5-SP), June 1986."
03/03/87	LR-287-70	J. G. Blencoe, "Review and Evaluation of: Mineralogic Summary of Yucca Mountain, Nevada, LA-10543-MS, D. L. Bish and D. T. Vaniman, October 1985."
02/02/87	LR-287-69	J. G. Blencoe, "Review and Evaluation of Chemistry of Diagenetically Altered Tuffs at a Potential Nuclear Waste Repository, Yucca Mountain, Nye County, Nevada, LA-10802-MS, D. E. Broxton, R. G. Warren, R. C. Hagan, and G. Ludemann, October 1986."
01/31/87	LR-287-68	K. L. Von Damm, "Review of: 'The mobility of uranium and associated trace elements in the Bates Mountain Tuff', Economic Geology 79, 558-564 (1984), by J. A. Kizis and D. D. Runnells."
01/07/87	LR-287-67	J. G. Blencoe, "Review and Evaluation of: Gamma and Alpha Radiation Levels in a Basalt High-Level Waste Repository: Potential Impact on Container Corrosion and Packing Properties, RHO-BW-SA-462 P (1985), by D. T. Reed, S. D. Bonar, and M. F. Weiner."
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03/31/86	LR-287-37	K. L. Von Damm, "Review of: 'Leaching Savannah River Plant Nuclear Waste Glass in a Saturated Tuff Environment,' in Scientific Basis for Nuclear Waste Management VIII, Mat. Res. Soc. Symp, Vol 44, 247-256 (1985), by N. E. Bibler, G. G. Wicks, and V. M. Oversby."
04/30/86	LR-287-36	J. G. Blencoe, "Review and Evaluation of: FY-1984 Annual Report: Spent fuel and UO_2 source term evaluation results, PNL-5650, DOE/CH-19 (1986), by W. J. Gray and G. L. McVay."
02/28/86	LR-287-35	K. L. Von Damm, "Review of: 'Hydrothermal Interaction of Topopah Spring Tuff with J-13 Water as Function of Temperature,' in Scientific Basis for Nuclear Waste Management VIII, Mat. Res. Soc. Symp. Vol. 44, 539-546 (1985), by K. G. Knauss, J. M. Delaney, W. J. Beiriger, and D. W. Peifer."
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03/03/86	LR-287-33	J. G. Blencoe, "Review and Evaluation of: Examination of Solids from 200 C Hydrothermal Tests with Spent Fuel, SD-BWI-TI-283 (1985), by L. E. Thomas, B. Mastel, and E. D.Jensen."
03/31/86	LR-287-32	G. D. O'Kelley, "Review of: Solubility Experiments for the Nevada Nuclear Waste Storage Investigations Project, by J. F. Kerrisk, LA-10560-MS (1985), Los Alamos National Laboratory."
02/25/86	LR-287-31	G. D. O'Kelley, "Review of 'Surface Oxidation-Reduction Kinetics Associated with Experimental Basalt-Water Reaction at 25 C,' by A. F. White, A. Yee, and S. Flexer, Chem. Geol. 49, 73-86 (1985)."
02/18/86	LR-287-30	A. D. Kelmers, "Review of the report: An Assessment of the Important Raqdionuclides in Nuclear Waste, by J. F. Kerrisk, LA-10414-MS, Los Alamos National Laboratory, Los Alamos, New Mexico."
02/12/86	LR-287-29	J. C. Mailen and J. T. Bell, "Plutonium Chemistry and Migration Behavior in High-Level Waste Repository Environments"

02/14/86	LR-287-28	A. D. Kelmers, "Review of the paper: 'Distribution of Plutonium and Americium Beneath a 33-year-old Liquid Waste Disposal Site,' J. Environ. Qual. 14, 501-509, (1985), by J. W. Nyhan, B. D. Drennon, W. V. Abeele, M. L. Wheeler, W. D. Purtymun, G. Truijillo, W. J. Herrea, and J. W. Booth, Los Alamos National Laboratory, Los Alamos, New Mexico."
01/30/86	LR-287-27	G. D. O'Kelley, "Review of: 'Aqueous Oxidation-Reduction Kinetics Associated with Coupled Electron-Cation Transfer from Iron-Containing Silicates at 25 C,' Geochim. Cosmochim. Acta 49, 1263-1275 (1985), by A. F. White and A. Yee."
02/02/86	LR-287-26	K. L. Von Damm, "Review of: 'Hydrothermal Interaction of Columbia Plateau Basalt from the Umtanum flow (Washington, U.S.A.) with its coexisting groundwater,' Chem. Geol. 49, 53-71 (1985), by E. L. Moore, G. C. Ulmer, and D. E. Grandstaff."
01/31/86	LR-287-25	K. L. Von Damm, "Review of: Reaction of Bullfrog Tuff with J-13 Well Water at 90 C and 150 C, UCRL-53442, by V. M. Oversby and K. G. Knauss."
02/03/86	LR-287-24	J. G. Blencoe, "Review of: Analyses of Solids from Initial 200 C, 30 MPa Hydrothermal Tests with "Fully-Radioactive" Waste Glass and Spent Fuel, SD-BWI-TI-278, by L. E. Thomas, B. Mastel, and E. D. Jensen."
01/31/86	LR-287-23	A. D. Kelmers, "Review of: 'Appendix B, Spent Fuel Dissolution,' in November Monthly Progress Report, 1985, The Aerospace Corporation."
01/20/86	LR-287-22	A. D. Kelmers, "Review of the report: Derivation of a Waste Package Source Term for NNWSI from Results of Laboratory Experiments, UCRL-92096 (1985), by V. M. Oversby and C. N. Wilson."
01/21/86	LR-287-21	A. D. Kelmers, "Review of: 'The Chemical State of the Fission Products in Oxide Fuels,' J. Nucl. Matls. 131, 221-246 (1985), by H. Kleykamp."
12/30/85	LR-287-20	K. L. Von Damm, "Review of: 'The Geochemistry of Ca, Sr, Ba, and Ra sulfates in some deep brines from Palo Duro Basin, Texas,' D. Langmuir and D. Melchior, Geochim. Cosmochim. Acta 49, 2423-2432 (1985)."
11/25/85	LR-287-19	G. D. O'Kelley, "Review of: 'Measurements of thermal

		neutrons in the subsurface,' by M. W. Kuhn, S. N. Davis, H. W. Bentley, and R. Zito, Geophysical Research Letters 11, 607-610 (1984)."
12/12/85	LR-287-18	J. G. Blencoe, "Review of: Field and Theoretical Investigations of Fractured Crystalline Rock Near Oracle, Arizona, by J. W. Jones, E. S. Simpson, S. P. Neuman, and W. S. Key, NUREG/CR-3736 (1985)."
11/24/85	LR-287-17	K. L. Von Damm, "Review of: Reaction of Topopah Spring Tuff with J-13 Well Water at 90 C and 150 C, by V. M. Oversby, UCRL-53552 (1984)."
11/01/85	LR-287-16	G. D. O'Kelley, "Review of: 'The Kinetics of the Oxidation of Ferrous Iron in Synthetic and Natural Waters,' by W. Davison and G. Seed, Geochimica et Cosmochimica Acta 47, 67-79 (1983)."
10/30/85	LR-287-15	K. L. Von Damm, "Review of: Mobility of Radionuclides in High Chloride Environments, NUREG/CR-4237 RW (1985), by H. J. Simpson, A. L. Herczeg, R. F. Anderson, R. M. Trier, G. G. Mathieu, and B. L. Deck."
10/07/85	LR-287-14	A. D. Kelmers, "Review of: Preliminary Bounds on the Expected Postclosure Performance of the Yucca Mountain Site, So. Nevada, SAND84-1492, by S. Sinnock, Y. T. Lin, and J. P. Brannen."
10/04/85	LR-287-13	J. G. Blencoe, "Review of: Evaluation of Minerals in Fractures of the Unsaturated Zone from Drill core USW-G4, Yucca Mountain, Nye County, Nevada, LA-10415-MS (1985), by B. Carlos."
09/09/85	LR-287-12	G. K. Jacobs, "Review of: Chlorine Isotopes as Environmental Tracers in Columbia River Basalt Groundwaters, RHO-BW-SA-372 P (1984), by D. Graham, S. Gifford, and H. Bentley."
09/09/85	LR-287-11	J. G. Blencoe, "Review of: Petrologic and Geochemical Characterization of the Topopah Spring Member of the Paintbrush Tuff Used in Waste Package Experiments, UCRL-53558, by K. G. Knauss."
09/09/85	LR-287-10	J. G. Blencoe, "Review of: Verification and Characterization of Continuum Behavior of Fractured Rock at AECL Underground Research Laboratory, BMI/OCRD-17, LBL-14975."
08/15/85	LR-287-9	G. K. Jacobs, "Comments concerning S. L. Phillips' reply to LR-290-10, March 28, 1985."

08/15/85	LR-287-8	J. G. Blencoe, "Review of: 'Downhole Geophysical Logging,' Ann. Rev. Earth Planet. Sci. 13, 315-344 (1985), by A. Timur and M. N. Toksoz."
07/09/85	LR-287-7	A. D. Kelmers, "Concerns Relative to the Applicability of the Yucca Mountain Radionuclide Sorption Information for Site Performance Assessment Purposes."
07/09/85	LR-287-6	A. D. Kelmers and G. K. Jacobs, "Review of: Critical Parameters for a High-Level Waste Repository, Volume I: Basalt, by E. P. Binnall, H. A. Wollenberg, S. M. Benson, L. Tsao, O. Weres, A. L. Ramirez, and G. A. Armentrout, NUREG/CR-4161 (1985)."
06/11/85	LR-287-5	G. K. Jacobs, "Review of: 'Brine Migration in Salt,' by W. Kelly."
06/11/85	LR-287-4	J. G. Blencoe, "Review of: The Dissolution of Rainer Mesa Volcanic Tuffs and Its Application to the Analysis of the Groundwater Environment, MS Thesis of M. S. Henne, University of Nevada, Reno, NV (1982)."
06/11/85	LR-287-3	G. K. Jacobs, "Review of: The Potential of Natural Analogues in Assessing Systems for Deep Disposal of High-Level Radioactive Waste, by N. A. Chapman, I. G. McKinley, and J. A. T. Smellie."
04/16/85	LR-287-2	G. K. Jacobs, "Review of: Geochemical Sensitivity Analysis I. Identification of Conditions and Criteria for Design of Transport Experiments When Radioelement Speciation Must be Considered in High-Level Waste Repository Risk Assessment, by Siegel, Erickson, and Vopicka, Sandia National Laboratory."
02/14/85	LR-287-1	G. K. Jacobs, "Calculated Solubilities for Selected Radionuclides as a Function of Eh: To Support NRC Review of DOE's Environmental Assessment for the Hanford Site."
11/28/84	LR-3.6	G. K. Jacobs, "Review and Evaluation of: Performance Assessment Plans and Methods for the Salt Repository Project, BMI/ONWI-545 (1984)."
10/17/84	LR-2.3	J. G. Blencoe, "Scoping Review of the Draft EA for the Yucca Mountain Site."
10/15/84	LR-3.5	G. K. Jacobs, "Scoping Review of the Draft EA for the Salt Sites."
10/11/84	LR-1.4	A. D. Kelmers, "Scoping Review of the Draft EA for

the Hanford Site."

10/10/84	LR-4.1-19	S. Y. Lee, "Review of: An Application of the Population Balance to the Assessment of the Importance of Radionuclide Colloids in High-Level Waste Management, by Nuttall, Siegel, and Bonano."
08/07/84	LR-3.3	G. K. Jacobs, "Review Comments on: 'Draft Umbrella Site Technical Position on Geochemical Issues for a High-Level Waste Disposal Facility in Salt'."
05/22/84	LR-2.1	A. D. Kelmers, "Review and Analysis of NNWSI Sorption Information."
05/18/84	LR-3.1	G. K. Jacobs, "Geochemical Conditions for Candidate Salt Sites: Limitations of Available Data (ONWI)."
04/24/84	LR-1.3	C. F. Baes, III and A. D. Kelmers, "Review and Analysis of BWIP Sorption Information."
04/24/84	LR-1.2	A. D. Kelmers, J. G. Blencoe, and C. K. Bayne, "Review Comments on: Barrier Materials Test Plan, SD-BWI-TP-022."
03/28/84	LR-4.2-6	J. G. Blencoe, "Matrix Diffusion of Radionuclides: Limitations of Available Data (NNWSI/NTS)" with a draft of the supporting topical review, "Matrix Diffusion of Radionuclides in Rock/Groundwater Systems."
02/29/84	LR-4.1-17	G. K. Jacobs, "Review of: The Salton Sea Geothermal Field, California, as a Near Field Natural Analog of a Radioactive Waste Repository in Salt, BMI/ONWI-513, by W. A. Elders and L. H. Cohen."
02/28/84	LR-4.2-5	J. G. Blencoe and G. E. Grisak, "NNWSI Site Technical Position and Review of Matrix Diffusion of Radionuclides in Rock/Groundwater Systems."
02/23/84	LR-4.2-4	A. D. Kelmers and C. F. Baes, III, "Site Technical Position and Review of Radionuclide Sorption Data for the Basalt Waste Isolation Project Site."
01/31/84	LR-4.2-3	G. K. Jacobs, "Information Required for a Conceptual Model of a Repository Located at the Nevada Test Site, with an Emphasis on Geochemistry."
01/24/84	LR-4.2-2	G. K. Jacobs, "Draft: Purpose, Objectives, and Discussion Items for a Workshop on Geochemistry with the Office of Nuclear Waste Isolation."
01/20/84	LR-4.1-15	G. K. Jacobs, "Review of: A Computer Code for

		Producing Eh-pH Plots of Equilibrium Chemical Systems, RHO-BW-SA-299 P, by D. R. Drewes."
01/19/84	LR-4.1-14	A. D. Kelmers, "Suggested Activity to Review the Chemical Status of Radioactive Elements in Spent Fuel."
01/13/84	LR-4.1-13	S. Y. Lee, "Review of: A Review of the State-of-the-Art and Preliminary Assessment of the Feasibility of Modeling the Transport of Radionuclides as Colloidal Particles in Geologic Media, by E. J. Bonano."
12/07/83	LR ...	C. S. Haase, "Review of geochemical portions of: A Summary of Repository Siting Models, NUREG/CR-2782, and Benchmark Problems for Repository Siting Models, NUREG/CR-3097."
11/11/83	LR ...	S. Y. Lee, "Review of: Clays and Clay Minerals for Application to Repository Sealing, ONWI-486."
11/09/83	LR ...	Letter review of documents on the conceptual models for repositories in basalt and granite.
11/04/83	LR-4.2-1	G. K. Jacobs, "The Scope of Geochemical Issues for Nuclear Waste Repositories in Salt."
11/01/83	LR ...	Review of the second draft of: 'Assessment of Radionuclide Apparent Solubilities by Conservative Estimation of Steady-State Concentration - NRC Draft Technical Position.'
10/31/83	LR ...	Letter report on "Review of draft document entitled: 'Site Technical Position on Waste Form and Package Issues for the Nevada Nuclear Waste Storage Investigations'."
09/29/83	LR-4.3-5	G. K. Jacobs, "Review of Geochemical Parameters Section of: 'Critical Parameters for Basalt'."
09/29/83	LR-4.1-10	G. K. Jacobs, "Review of: 'Letter report on the Uncertainties in the Thermodynamics of Basalt-Oxygen and Basalt-Water Reactions,' by D. G. Schweitzer and M. S. Davis (BNL)."
09/16/83	LR ...	Letter Report discussing 1) chemical reactions in unsaturated vs. saturated media and 2) transport of volatile radionuclides in unsaturated media.
08/11/83	LR-4.3-4	A. D. Kelmers and J. G. Blencoe,"Review of: NRC Draft Technical Position 'Solubility and Speciation of Radionuclide Compounds for High-Level Repository Safety Assessments'."

08/08/83	LR ...	N. H. Cutshall, "Review of: Geochemical Controls on Radionuclide Releases from a Nuclear Waste Repository in Basalt: Estimated Solubilities for Selected Elements, RHO-BW-ST-29 P, by T. O. Early and others."
07/15/83	LR ...	A. G. Croff, "Review of Draft NRC Staff Position Paper entitled: 'Identification of Specific Licensing Information Needs.'"
07/06/83	LR-4.1-9	N. H. Cutshall, "Review of: Statistical Evaluation of Hydrochemical Data from the Saddle Mountains, Wanapum, and Grande Ronde Basalts, Basalt Waste Isolation Project, Hanford Site.'"
07/06/83	LR ...	Letter Report on review of report entitled: Draft Technical Position - Subtask 1.2; Post-Emplacement Monitoring, NUREG/CR-3219, by S. V. Panno.
06/20/83	LR-4.1-8	J. G. Blencoe and A. D. Kelmers, "Review of LA-9328-MS, Summary Report on the Geochemistry of Yucca Mountain and Environs."
06/06/83	LR ...	"Review of two papers: 'Solubility Equilibria in Basalt Aquifers: The Columbia Plateau, Eastern Washington, U.S.A.,' Chem. Geol. 36, 15-34 (1982), by Deutsch, Jenne, and Krupka; and Computed Phases Limiting the Concentration of Dissolved Constituents in Basalt Aquifers of the Columbia Plateau in Eastern Washington, PNL-4089 (1982), by Deutsch, Jenne, and Krupka."
05/23/83	LR ...	"Review of Section 7 of ANS Standard 2.24 entitled: '(Proposed) Standard Establishing Geotechnical Parameters for Evaluating Geologic Repositories for High-Level Wastes'."
05/20/83	LR-4.3-3	J. G. Blencoe, "A Brief Review and Critique of Commentary/Data on Radionuclide Solubility and Sorption Contained in the Three-Volume NUREG/CR Draft Final Report (Task 4): Evaluation of Engineered Barrier Design and Performance in an Underground Basalt Repository."
02/15/83	LR-4.3-2	"Review Comments on SCA Chapters and Appendices related to geochemical considerations."
11/30/82	LR-1.4-1	A. G. Croff, H. C. Claiborne, and J. S. Johnson, "Comments on RHO-BWIP Site Characterization Report."
10/08/82	LR-4.3-1	D. R. Cole and H. C. Claiborne, "Review of 'Draft

Technical Position on Radionuclide Speciation and Solubility Determinations'."

B0287 TOPICAL REPORTS AND MISCELLANEOUS PRODUCTS

The following Topical Reports completed to date (04/30/87) by Oak Ridge National Laboratory staff, and miscellaneous project products prepared by Oak Ridge National Laboratory staff, or subcontractors, for the NRC Project FIN No. B0287 have been transmitted to the NRC Project Manager.

Date	Number	Title
02/06/87		Manuscript submitted to Nuclear Safety, A. D. Kelmers, R. E. Meyer, J. G. Blencoe, and G. K. Jacobs, "Radionuclide Sorption Methodologies for Performance Assessments of High-Level Nuclear Waste Repositories."
02/12/86		"Radwaste Natural Analog Catalog," by D. G. Brookins, University of New Mexico.
01/10/86		A. D. Kelmers, "Glossary for sorption terms related to draft NRC Technical Position on sorption."
12/18/85		Express mail -- "Review Comments on draft NRC Techincal Position: 'Determination of Radionuclide Sorption for Assessment of High-Level Waste Isolation'."
04/16/85	ORNL/TM-9585 NUREG/CP-0062	"Proceedings of a Conference on the Application of Geochemical Models to High-Level Nuclear Waste Repository Assessment."
10/24/84	NUREG/CR-3763	"Final Draft: Review and Assessment of Radionuclide Solubility Information for the Basalt Waste Isolation Project Site, by J. G. Blencoe.
10/02-84		Held workshop on "The Application of Geochemical Models to High-Level Nuclear Waste Repository Assessment" at Oak Ridge, TN.
05/18/84	ORNL/TM-9221	Draft topical review: Review and Assessment of Information on Geochemical Conditions for Candidate Salt Sites of the Office of Nuclear Waste Isolation (ONWI), by G. K. Jacobs.
04/06/84	NUREG/CR-3763	Final draft of the topical review: Review and Assessment of Radioactive Sorption Information for the Basalt Waste Isolation Project Site, by A. D.

		Kelmers.
03/22/84		Draft Proposal on: "Workshop on the Application of Geochemical Models to High-Level Nuclear Waste Repository Assessment", by G. K. Jacobs.
01/04/84		Draft annotated outline for a Site Technical Position entitled: "Review and Evaluation of Information on the Geochemical Conditions for Candidate Salt Sites of the Office of Nuclear Waste Isolation (ONWI)", by G. K. Jacobs
10/18/83	ORNL/TM-9873	Draft copy of: "Description and Use of the Waste Management Document Data Base", by A. G. Croff.
09/29/83		Second draft copy of Appendix A and a first draft copy of section 2.5 on: "The significance of rock/water ratio for the revised DSTP on solubility."
09/29/83		Draft of: "Draft Staff Technical Position on the Geochemical Aspects of HLW Repositories", by A. G. Croff.
08/09/83		Three draft topical reviews:
	NUREG/CR-	A Scientific Review and Critique of NNWSI Studies on Radionuclide Solubility and Speciation in Tuff-Groundwater Systems, by J. G. Blencoe.
	ORNL/TM-9224	Radionuclide Sorption Information for a High-Level Nuclear Waste Repository in Yucca Mountain, Nevada, by A. D.Kelmers.
	NUREG/CR-	Review of Geochemical Information for the Nevada Nuclear Waste Storage Site, by C. F. Baes, III.
05/23/83	NUREG/CR-3763	Second draft of a BWIP topical review entitled: Radionuclide Sorption Information for the Basalt Waste Isolation Project (BWIP) Candidate High-Level Waste Repository: A Scientific Review and Technological Assessment.
05/23/83	NUREG/CR-4024	First draft of a BWIP topical review entitled: Review of recent studies on solubility and speciation of radionuclides relevant to the Basalt Waste Isolation Project.
05/23/83	NUREG/CR-4186	First draft of: Review of Geochemical Condition Information at the Basalt Waste Isolation Project Site.
03/28/83		Nine revised SIAs (incorporating comments from

	internal review), and the revised SCA redox appendix (incorporating comments from internal review and extended to include BWIP-site-specific features).
02/14/83	"Four-day review of SCR at NRC headquarters in Silver Spring", by H. C. Claiborne.
01/19/83	Consolidated version of the redox appendix, including some editorial and organizational changes as compared to earlier submission and a copy of the sorption appendix updated to include a section on redox control.
01/11/83	Revised redox appendix (whole) and Section on redox control for solubility Appendix.
01/07/83	Revised Appendix T on Sorption; revised Chapter 2 of redox appendix; and mark-up of draft SCA Chapter 6.
12/22/82	Draft list of questions for the NTS Geochemistry Workshop to be held January 12-14, 1983, in Las Vegas.
11/30/82	Nine geochemical SIAs revised to accomodate comments received as of 11/29/82 and extended to include Sections 7 and 8; SCA appendices on sorption, solubility and apeciation, and redox conditions.
11/02/82	Drafts of nine SIAs for which the geochemistry team has the lead, and draft appendices on sorption and Eh.

B0287 MEETING REPORTS

The following Meeting Reports have been prepared to date (04/30/87) by Oak Ridge National Laboratory staff for the NRC Project FIN No. B0287, and transmitted to the NRC Project Manager.

Date	Number	Title
02/18/87	MR-287-10	A. D. Kelmers, "Meeting Report on: The Second Topical Conference on Nuclear Waste Management Quality Assurance, sponsored by the Energy Division of the American Society for Quality Control, at Las Vegas, Nevada, February 9-11, 1987."
01/07/87	MR-287-9	G. K. Jacobs, "Meeting Report for NRC/DOE/BWIP Hydrology Data Review."
02/xx/86	MR-287-8	J. G. Blencoe, "ASTM Meeting on Waste Package Testing."
02/07/86	MR-287-7	G. K. Jacobs and K. L. Von Damm, "SRP/NRC Waste Package Workshop for Salt Sites."
11/18/85	MR-287-6	J. G. Blencoe and G. K. Jacobs, "Annual Meeting of the Geological Society of America"
10/04/85	MR-287-5	A. D. Kelmers, G. K. Jacobs, J. G. Blencoe, and R. E. Meyer, "NRC/DOE Data Review for Sorption Information of the Yucca Mountain Site"
08/14/85	MR-287-4	G. K. Jacobs, "Examination of Palo Duro Basin rock core - Texas Bureau of Economic Geology"
07/30/85	MR-287-3	G. K. Jacobs, A. D. Kelmers, and S. K. Whatley, "NRC/DOE Waste Package Workshop for the Yucca Mountain Candidate Site"
07/30/85	MR-287-2	G. K. Jacobs, "ACS Short Course on Environmental Chemistry of Groundwater"
07/26/85	MR-287-1	J. G. Blencoe, "Review of BWIP Solubility Topical Report"
07/26/85	MR-287-1 (# incorrect)	S. K. Whatley, "Meeting with D. J. Brooks, J. R. Bradbury, S. K. Whatley in Silver Spring, Maryland."

02/08/85	MR-287-1 (# incorrect)	J. G. Blencoe and G. K. Jacobs, "Trip Report of Geological Society of America Meeting at Reno, Nevada."
11/28/84	MR-5.4	S. K. Whatley, "Meeting Report for the B0287 and B0290 Project Review."
09/25/84	MR-5.3	G. K. Jacobs, "Penrose Conference on the Geochemistry of the Environment near a High-Level Nuclear Waste Repository."
09/07/84	MR-5.2	G. K. Jacobs and S. K. Whatley, "Discussions of Geochemistry Areas Which Might be of Mutual Interest with Malcom Siegel."
08/23/84	MR-3.4	G. K. Jacobs, "Geochemistry Program Overview for ONWI."
07/31/84	MR 2.2	A. D. Kelmers and J. G. Blencoe, "DOE/NRC Geochemistry Workshop on the NNWSI Candidate High-Level Waste Repository Site at Yucca Mountain, Nevada."
06/19/84	MR 3.2	G. K. Jacobs, "Visit to present seminar: 'Review and Assessment of Geochemical Conditions for Candidate Salt Sites of ONWI', and for discussions with NRC staff."
02/09/84	MR 4.1-16	J. G. Blencoe and A. D. Kelmers, "NRC/DOE Geochemistry Workshop in Richland, Washington."
12/08/83	MR 4.1-12	H. C. Claiborne and A. D. Kelmers, "7th Scientific Basis for Nuclear Waste Management."
11/17/83	MR 4.1-18	J. G. Blencoe, "GSA Engineering Geology Division Symposium on the Geologic Disposal of Radioactive Wastes and a GSA Forum on Nuclear Waste Disposal Issues."
10/31/83	MR 4.1-8	H. C. Claiborne and G. K. Jacobs, "NNWSI Waste Package Workshop."
04/15/83	MR ...	A. G. Croff, "Discussion of Work to be Performed under B0290 and Draft Work Plan Describing Same."
04/25/83	MR ...	J. H. Kessler, "International Symposium on Geochemical Behavior of Disposed Radioactive Waste."
03/11/83	MR 4.1-7	A. D. Kelmers, "BWIP Overview Seminar presented by Bill Cottam of RHO-BWIP."
01/27/83	MR 4.1-6	H. C. Claiborne and A. D. Kelmers, "NRC-NNWSI

		Meeting on Geochemistry Issues."
01/18/83	MR 4.1-5	H. C. Claiborne and R. R. Turner, "1982 NWTS Program Information Meeting."
11/12/82	MR 4.1-4	D. R. Cole, "Geochemical Society Symposium on Geochemistry of Radionuclide Migration/Retardation."
10/13/82	MR 4.1-3	A. D. Kelmers and D. R. Cole, "Discussions with Jess Cleveland about his Plutonium Solubility/Speciation Experiments in Site Groundwaters."
10/07/82	MR 4.1-2	A. D. Kelmers, "NRC Research Program Planning Workshop on Geochemistry of HLW Disposal."
09/21/82	MR 5.0-1	A. G. Croff, "Discussion of Proposed Activities."
08/19/82	MR 4.1-1	A. D. Kelmers and D. R. Cole, "Participation in NRC Geochemistry Workshop Team at RHO."