From: Richard Dudley
To: Diane Jackson, Djw1, George Hubbard, mtm2, pmr...
Date: Fri, Jul 21, 2000 11:27 AM
Subject: DLPM responses to TWG comments

Attached are DLPM responses to TWG comments. These responses have not yet been reviewed by DLPM management, but are being looked at now. Tanya/Diane: Note that there are several highlighted areas where we need to refer to other responses by other groups. We need your assistance to find out where these issues are discussed. Also, many of our comments refer to our other responses. If they are renumbered, we will have to change the references in the text.

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Appendix 6 Public Concerns Raised During the Public Comment Period

In June 1999, a draft report was released for public comment. Many meetings were held with the stakeholders. The early stakeholder input improved the overall quality of the report. The draft report's Appendix 7 included a list of public meetings and how the staff addressed stakeholder comments in various technical areas.

On February 15, 2000, the Nuclear Regulatory Commission (NRC) released the "Draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Plants," for public comment. The NRC encouraged members of the public and stakeholders to review the draft report and to formally submit comments for review. Several public groups commented during this period that the NRC solicited comments from the public, when it had no intention of addressing the public's comments. In order to ensure that adequate consideration had been given to stakeholders comments, the staff reviewed stakeholder comments which had been received prior to February 15, 2000, as well as stakeholders comments received as a result of their review of the draft final report. Reviewed comments, which were received prior to February 15, were identified by reviewing transcripts of meetings with the public, letters from the public, and other available documentation related to the staff's efforts in completing the draft final report.

This appendix provides the NRC's responses to the comments and concerns received as described above. In most cases, responses are provided in this appendix. However, in other cases, the comments or concerns are identified in this appendix and a reference is provided to other parts of the report where the identified issues are addressed. The public comments were arranged in the following technical categories: Criticality, Insurance, Probability and Human Reliability, Seismic, Security/Safety Culture/EP, Thermalhydraulics, Rulemaking/NRC Process Concerns.

CRITICALITY

SRXB Public Comments #1, 3, and 4: A public commenter raised several concerns related to SFP criticality. First, they stated that the NRC should consider criticality events due to chemical stripping of primary piping. Second, they expressed concern that the potential exists for contaminated solution to go overboard into public waters or be flushed back into the SFPP. Finally, during primary system decontamination at decommissioning reactors, is it possible to misalign the valves and send corrosive chemicals into the SFP? Could these chemicals precipitate boron from the SFP water? Is there a potential for criticality? Is there a potential for fuel damage?

Response:
Should chemicals precipitate boron out of solution, there is no increase in criticality risk because the boron is not credited to maintain spent fuel pool subcriticality (k-eff < 1.0). Consideration of such things as chemical intrusion into the spent fuel pool or offsite discharge pathways will be considered when the staff reviews the plant specific decommissioning plans.

SRXB Public Comment #6: The NRC should identify the scenario where a steam explosion is possible because of a severe criticality event and the basis upon which the probability was determined to be "highly unlikely."

Response:
The discussion in the paper was intended to mean that a steam explosion from a super-prompt critical event is highly unlikely not because of the low probability of the scenario, but because of the fact that inherent negative feedback in the fuel would prevent a super-prompt critical event in all load drop scenarios, which are themselves of a low probability. The report will be clarified to better illustrate this point.

SRXB Public Comment #7: The NRC should identify all radioactivity in the SFP and that capable of being dispersed in an accident (beyond that on p A3-11 to A3-13).

Response:
The information supplied in pages A.3-11 to A.3-13 does not relate to the generation of the source term. These nuclides were selected because they contribute to the reactivity of the spent fuel. The nuclides listed there represent well over 90 percent of the reactivity contribution in spent fuel. Therefore, it is not necessary to expand the list because such an expansion will not significantly alter the predicted reactivity of the spent fuel in the storage racks. The source term is addressed in detail in Appendix 4.

SRXB Public Comment #8: The criticality accident analysis does not consider the risk of a criticality accident that arises from placement of low-burnup fuel assemblies in a pool where the licensee relies on burnup credit to prevent criticality.

Response:
The double contingency principle discussed in ANS 8.1, which has been endorsed by the staff, requires that only the worst highly unlikely single failure or event needs to considered in a criticality evaluation. The staff considers fuel misloading events to be highly unlikely and has demonstrated via analysis (affidavit of A. Ulses in hearing before the Atomic Safety and Licensing Board, ASLBP No. 99-762-02-LA, January 4, 2000.) that the worst possible misloading scenario will not lead to a criticality event. Therefore, further consideration is not needed.

INSURANCE

RGEB Public Comment #1:

The obligation for decommissioning plants to participate in the secondary financial protection should be reviewed in light of the low public risk posed for SFPs for decommissioned plants. Industry does not believe that the risk justifies requiring participation. (The majority of the 3 in 1 million risk of significant offsite consequences comes from an upper bound determination of the risk posed by seismic events, not on a best estimate of the seismic risk).

If it is determined that participation will be required during the short time that decommissioning plants pose a non-zero risk, then the level of participation should be in proportion to a best estimate of the risk posed relative to the risk posed by operating plants. If any participation is required, it should be only for the short period that clad surface temperatures greater than 570°C can occur in a loss of water configuration. The calculation of this temperature should be by an approved methodology. The capacity required for primary financial protection should be eliminated for consideration of any potential for accidents with significant offsite consequences.

This stakeholder also proposed that for other events with offsite consequences, onsite coverage be reduced to $25M for the period when spent fuel remains in the pool and offsite coverage be reduced to $5-10M. When fuel has been removed offsite or placed in an offsite ISFSI, we recommend onsite coverage be reduced to $25M while the site still contains significant sources of radioactive material. Onsite coverage could be reduced to zero when there are no sources exceeding 1000 gallons of fluid. Offsite coverage should be reduced to $5-10M for plants with fuel offsite or in an onsite ISFSI.

Response:

The staff has previously stated that, while it is correct that the risk of a zirconium fire is not significant, the property and liability insurance requirements of our regulations are meant to ensure that the public is protected in the event of a low probability, high consequence event. The underlying purpose of Section 50.54(w) is to provide sufficient property damage insurance coverage to ensure funding for onsite post-accident recovery stabilization and decontamination costs in the unlikely event of a nuclear accident. Section 140.11 also serves to provide sufficient liability insurance to ensure funding for claims resulting from a nuclear incident or precautionary evacuation.

In SECY-93-127, the Commission established that the amount of insurance coverage necessary for reactor licensees should be determined by the worst "reasonably conceivable" accident possible. Reasonably conceivable accidents may exceed design basis accidents but are less severe than remotely possible hypothetical accidents that are often termed "incredible." The TWG risk study concluded that the probability of a zirconium fire at a permanently shutdown plant is low but did not conclude that its probability is low enough to be considered "incredible." Thus, adequate insurance coverage is necessary for such an event.

The zirconium fire scenario would be possible for up to several years following shutdown. Since the consequences of such a fire are severe in terms of property damage and land contamination, the staff position is that full offsite liability coverage must be retained for five years, or until analysis has indicated that a zirconium fire is no longer possible. At that point, primary coverage would be reduced from $200 million to $100 million, and participation in the secondary retrospective pool would no longer be required. When all fuel has been moved offsite or to an onsite dry cask storage system, the primary insurance coverage would be reduced to $25 million.

PROBABILITY AND HUMAN RELIABILITY ASSESSMENT

SPSB Public comment #1 : Experience at nuclear power plants demonstrates that safety problems are not caused by workers making mistakes or by not following procedures. Problems are caused by bad management.

Response: The staff agrees that utility safety culture and utility oversight/expectations in the day-to-day operations of a facility are important contributors to either a well run plant or a poorly run one. The staff is proposing that utilities with decommissioning sites develop a process that will help insure that proper attention is paid to spent fuel pool status, procedures are developed that guide fuel handlers in the event of a spent fuel pool accident, communications are established between onsite and offsite organizations, and cask drop analyses are performed or a single failure proof crane is used for handling very heavy loads. These prescriptions and commitments are discussed in Sections 3.2, 3.3.1, 3.3.6, 4.2.1, 4.2.4, and Appendix 6 of the Draft Final Technical Study.

SPSB Public comment #2 : Experience at nuclear power plants shows that multiple shifts can make the same error and not recognize it for a long time. With watching the pool being their major responsibility, a fuel handler's life would be very tedious and boredom would set in. This should result in a poorer response by the fuel handler in the event of an accident.

Response: The staff agrees that multiple shifts can make the same error, although this is very unlikely. Our modeling and quantification of spent fuel pool risk includes consideration of multiple shift turnovers and the chance that shift after shift makes the same mistake. However, for almost all postulated SFP accidents, there is a very long time available to the fuel handlers to discover and recover from the existence of a problem in the spent fuel pool or its support systems. The staff believes that the commitments made by the industry and the NRC's staff decommissioning assumptions provide a basis for reducing the chances of multiple shift errors to the point where they do not contribute significantly to the overall risk of spent fuel pool operation (See Sections 3.2, 3.3.1, 3.3.6, 4.2.1, 4.2.4, and Appendix 6 of the Draft Final Technical Study). The rest of the accidents (i.e., seismic and heavy load drop), which progress rapidly, proceed independent of operator intervention once the accident has occurred because the SFP is drained so rapidly.

SPSB Public comment #3 Over time, tedious tasks will cause workers to make mistakes. The NRC needs to address this in a conservative manner.

Response: The staff agrees that tedious tasks can increase the chances of a fuel handler making a careless mistake. We do not agree that fuel handler errors need be handled in a conservative manner when performing a probabilistic risk assessment. It is the NRC's policy to make its risk assessments as realistic as possible, which the staff did in the report.

SPSB Public comment #4: How is common mode failure accounted for in the staff's risk analysis? How confident are you of your ability to model and quantify common mode failures?

Response: The staff's risk analysis accounts for dependencies among the initiating events, the equipment needed to mitigate the events, and also the operator actions needed for accident mitigation. Initiating events that have the potential of simultaneously degrading mitigating equipment or impeding operator actions are modeled in the construction of the event trees and in the estimation of equipment failure rates and human failure probabilities. For example, for an event where a fire is not extinguished within 20 minutes, it was assumed that the SFP cooling system and the electric-driven firewater pumps are failed (either due to fire damage or due to loss of the electrical supply to the plant). Therefore, no credit is taken for this equipment. In addition, the estimation of the human error probability (for starting backup diesel pumps or for offsite recovery) took into account a high level of operator stress, which increases the failure probability.

Equipment hardware failure dependencies, usually referred to as common cause failures, have also been modeled in the risk analysis. Since these failures have the potential for disabling multiple trains of equipment at the same time, they can be big contributors to the risk. In the staff's analysis, the only multiple train system modeled is the spent fuel pool cooling system. In the fault tree model for this system, common cause failures are modeled for the cooling pumps, the heat exchangers, and the discharge check valves. The modeling of dependent failures, including common-cause hardware failures, in the staff's risk analysis is consistent with NRC and industry guidelines.

SPSB Public comment # 5: NRC should set guidelines on how often fuel handlers make their rounds at decommissioning facilities. This would help assure operator attentiveness.

Response: The staff agrees that, if fuel handlers make the rounds of the SFP and its equipment on a frequent basis, the probability of the handlers detecting problems early is greatly enhanced. To this end staff decommissioning assumption (SDA) #1 states in part that walk-downs of the SFP systems will be performed at least once per shift by the fuel handlers. This is documented in Section 3.3.1 of the report. The staff expects that these assumptions will be translated into requirements or industry guidance during the rulemaking process.

SPSB Public comment # 6: NRC should assure that the probability of failure of systems required to mitigate the consequences of design bases and beyond design bases spent fuel pool events are minimized.

Response: The need to have highly reliable systems to prevent or mitigate an accident is partly a function of how rapidly the accident progresses and how serious its consequences are. If an accident would result in serious consequences unless a rapid response were achieved, then highly reliable systems and components are needed to prevent and/or mitigate the event. If the accident were very slow in progressing or has benign consequences, the equipment designed to prevent or mitigate it need not be as reliable. The large volume of water above the spent fuel provides an inherent delay time before fuel can be uncovered. This delay time (measured in days) allows for repair or replacement of equipment. If it were impossible to repair or replace the equipment, inventory could be added to the pool to match the boil-off rate. The industry has committed in industry decommissioning commitment (IDC) #4 (Section 3.2) to implement an off-site resource plan to include access to portable pumps and emergency power. IDC #7 and IDC #9 commit the industry to implement procedures or administrative controls to reduce the likelihood of rapid drain down events. The staff decommissioning assumption (SDA) #1 (Section 3.3.1) calls for procedures to be developed that will provide guidance on the availability of on-site and off-site inventory make-up sources and time available to initiate these sources. In addition, the industry has committed in IDC #10 to perform routine testing of the alternative fuel pool make-up system components and to have procedural controls on equipment out of service to increase confidence that components will be available. The two accidents that could lead to very rapid draining of the SFP are extremely large seismic events and heavy load drops. IDC #1 and SDA #2 (Section 3.3.6) address heavy load drop concerns. SDA #3 (Section 4.2.1) calls for each decommissioning plant to successfully complete the seismic checklist provided in Appendix 5 to this report. Implementation of these commitments and assumptions will help assure the frequency of a zirconium fire remains below the pool performance guideline of $1X10^{-5}$ per year.

SPSB Public comment #7: Why is station blackout at a decommissioning site acceptable to the staff?
SPLB Public Comment #2: Is SBO [station black out] of the SFP area acceptable?

Response: The staff does not find having station blackouts to be an acceptable practice. At the same time, as with an operating reactor, the staff recognizes that there is some small annual probability that a station blackout will occur at a decommissioning site. Unlike an operating reactor, decommissioning spent fuel pools (at one year or greater after the last fuel was irradiated in the reactor) can go without electrical power for almost a week and not suffer serious consequences. This is due to the inherent margin provided by the large volume of water sitting above the spent fuel in the pool. It takes a long time to heat this water up to boiling and then to continue to boil it off until fuel is uncovered. IDC #2 commits the industry to develop procedures and train personnel to ensure that on-site and off-site resources can be brought to bear during an event. IDC #3 calls for communication systems to be set up between the SFP site and off-site resources that can survive severe weather and seismic events, which can cause a station blackout. See Section 3.2.

SPSB Public comment #8: The risk assessment should take into account changes in local aircraft traffic when evaluating the probability and consequences from aircraft crashing into SFPs.

Response: The risk from aircraft crashes is small, and even large increases in traffic should not make aircraft crashes a dominant contributor to risk. A decommissioning plant will continue to be governed by 10 CFR Part 50 for the evaluation of hazards as discussed in Standard Review Plan 2.2.3, "Evaluation of Potential Accidents," including accidents involving nearby industrial, military, and transportation facilities. Changes in local aircraft traffic would continue to be assessed on a deterministic basis at a decommissioning plant and a reassessment of risk would be performed, as needed.

The frequency of an aircraft crash leading to an accident in a spent fuel pool was estimated in the report to be in the range of $9.6x10^{-12}$ to $4.3x10^{-8}$ per year where damage to the pool was significant enough that it resulted in a rapid loss of water from the pool (See Section 3.4.2 and Appendix 2b). The mean value was estimated to be $2.9x10^{-9}$ per year. These values are a small fraction of the overall risk of uncovering the spent fuel in the pool at a decommissioned plant, which was estimated to be less than 5.0×10^{-6} per year. An aircraft crash could also result in damage to a spent fuel pool support system. The estimated range of striking a support system was estimated to be in the range of 1.0×10^{-9} to 1.0×10^{-5} per year, with a mean value of 7.0×10^{-7} per year, without consideration of recovery actions. These values are also a small fraction of the estimated frequencies for the loss of cooling initiator (3.0×10^{-3} per year), the internal fire initiator (3.0×10^{-3} per year), or the loss of inventory initiator (1.0×10^{-3} per year).

Aircraft traffic and accident data were reviewed by the staff (Ref: "Data Development Technical Support Document for the Aircraft Crash Risk Analysis Methodology (ACRAM) Standard," C.Y. Kimura, et al., UCRL-ID-124837, Lawrence Livermore National Laboratory, August 1, 1996). The number of U.S. Air Carrier operations increased from about 5.5 million departures per year in the 1970s to about 8.7 million departures per year in the mid-1990s. The average miles traveled per departure increased from about 500 to 650. For the period from 1986 to 1993 general aviation operations remained relatively constant, with a decrease in activities reported in 1992 and 1993. Military aircraft data, which are a small fraction of the total risk (see Table A2d-1, "Generic Aircraft Data"), was not reviewed.

While it is very unlikely that changes to aircraft traffic near a decommissioning plant will significantly increase the estimated risk of uncovering the spent fuel in the pool, changes in aircraft traffic would continue to be assessed at a decommissioning plant.

SPSB Public comment #9: What is the generic frequency of events leading to zirconium fires at decommissioning plants before the implementation of industry commitments and staff assumptions?

Response: The staff visited four decommissioning sites as part of the preparation for developing the risk assessment of decommissioning spent fuel pools. The insights from those visits include that the facilities appeared to have been staffed by well trained, knowledgeable individuals with significant nuclear power plant experience. Procedures were in place for dealing with routine losses of inventory. Fuel handlers appeared to know whom to call off-site if difficulties arose with the SFP. The staff recognized that these attributes were not required by any NRC regulations nor suggested in any NRC guidance for decommissioning sites. The industry's IDCs and the staff's SDAs are an attempt to increase the assurance that fuel handlers will continue to be knowledgeable of offsite resources and have good procedures available to them. The staff believes that the initiating event frequencies at the visited decommissioning sites are very similar to those estimated in the staff's decommissioning SFP risk assessment. The response of the fuel handlers at the visited sites would probably be as good as estimated in the report. If somehow it were possible for a zirconium fire to begin at one of these pools, the staff believes that the frequency of this fire would be on the same order of magnitude as that estimated in the report.

SPSB Public comment #10: What will the NRC staff do to protect plant workers and the public from spent fuel pool risks at permanently closed plants and operating plants before the industry commitments and staff assumptions are implemented?

Response: Regarding protection of the public, for plants that are currently in a decommissioning status, the staff has no reason to believe that these sites have characteristics significantly worse than those discovered by the staff during its visits to four decommissioning sites. The as-found conditions at these sites were the basis for the modeling of the spent fuel pool cooling system and operator actions in the report. In addition, most decommissioning sites have even lower decay heat levels than assumed in the report, and the likelihood of a zirconium cladding fire should be even lower at these sites than estimated in the report since these sites have longer periods within which to recover spent fuel pool cooling or inventory. **The staff intends to review the heavy load operations at current decommissioning sites to assure that there are no vulnerabilities.** Future decommissioning plants will either implement the industry commitments and staff assumptions or will have to continue with full emergency preparedness, security, and insurance. Operating reactors are fully staffed, have multiple backup systems, and have full emergency preparedness, security, and insurance. The staff believes that the risks from operating reactor spent fuel pools are less than those of decommissioning plants and are within the NRC's Safety Goals.

The dominant health concern for decommissioning site workers caused by beyond design bases accidents is the potential for very high exposures should the spent fuel become uncovered (the field at the edge of the pool would be in the range of tens of thousands of rem per hour.) However, since the expected frequency of spent fuel uncovery is so low and workers already are aware that uncovering the fuel could subject them to high doses, the staff believes that no additional warnings to the fuel handlers are deemed necessary at this time regarding the potential dose rates at the edge of the spent fuel pool associated with fuel uncovery. Decommissioning plant workers continue to have radiation dose limits set by the NRC and their utility, just as workers do at operating nuclear power plants.

SPSB Public comment #11: There are several places in the draft report where the staff refers to "uncovering the core" rather than "uncovering the fuel."

Response: The phrase "uncovering the core" has been replaced by "uncovering the fuel."

SPSB Pubic comment #12: Recalculating the frequencies for event trees produced numerical results for some sequences that were off by one or two orders of magnitude.

Response: In the staff's risk analysis, the accident scenario frequencies in the event trees were calculated such that dependencies among the failure events (in the event tree branches) were taken into account. Therefore, if an event resulted in functional failure in more than one branch in the event tree, this dependency was taken into account, and the resultant scenario frequency is therefore larger (in some cases, by as much as two orders of magnitude) than if the events were assumed to be independent.

SPSB Public comment #13: The initiating frequencies, human error rates, and equipment failure rates should more accurately take into account the occurrence of actual events such as Chernobyl and Three Mile Island.

Response: The decommissioning SFP risk assessment takes into account actual events that are applicable to spent fuel pools and their support systems. The staff used initiating event frequencies from staff studies from actual events at spent fuel pools, from actual crane lift data, from site-specific seismic hazard curves, from studies on aircraft crashes and tornadoes, and from large databases developed to provide estimates for initiating events and equipment failure rates. Human error rates were developed by the staff in conjunction with experts at Idaho National Engineering and Environmental Laboratory. The staff believes that the values used in the report provide a reasonable picture of the risks associated with operation of decommissioning spent fuel pools under the assumptions and commitments documented in the study.

SPSB Public comment #14: The NRC should determine which failure rates used in the report are reliable and which are not, and the results should be included in the study.

Response: The staff uses the most reliable information on failure rates that it has at its disposal. Because of the long time it takes for water above the spent fuel to heat up and boil off, the failure rates of specific equipment that support a spent fuel pool are not important contributors to spent fuel pool risk for long term sequences (i.e., the results are not particularly sensitive to the assumed failure rate of equipment.) Very large seismic events or heavy load drops could rapidly drain the spent fuel pool. For seismic events, the robustness of the spent fuel pool is assured by implementation of a seismic checklist (See Appendix 5). For heavy load drops, industry decommissioning commitment (IDC) #1 calls for performance of cask drop analyses or use of a single-failure-proof crane when moving heavy loads over or near the spent fuel pool (See Section 3.2), which should help assure that the risk from heavy load drops is extremely low.

SPSB Public comment #15: Mitigating systems at decommissioning spent fuel pools are not automatic. The NRC should assure that fuel handlers are available in the event of an accident.

Response: The staff is developing regulations that will address staffing at future decommissioning sites. Staffing at present day decommissioning sites is controlled by Technical Specifications on a plant-specific basis. In addition, staff decommissioning assumption (SDA) #1 calls for walkdowns of the spent fuel pool area by fuel handlers every shift (See Section 3.2.)

SPSB Public comment #16: What measures are taken by the NRC to assure that fuel handlers remain attentive?

Response: The staff has sought to help assure fuel handler attentiveness in a number of ways. First, staff decommissioning assumption (SDA) #1 calls for walkdowns of the spent fuel pool area by fuel handlers every shift. Second, industry decommissioning commitment (IDC) #4 states that SFP instrumentation will be in place providing readouts and alarms in the control room or where the fuel handlers are stationed. Discussions with the industry indicate that it is a general practice for sites to log instrument readings in the decommissioning spent fuel pools at least once per shift. Such practices help maintain fuel handler alertness and keep them abreast of the status of the pool and its support systems. See Sections 3.2 and 3.3.1.

SPSB Public comment #17: What measures have been taken to help minimize fuel handler error in postulated SFP accident scenarios?

Response: Having procedures in place helps reduce that chance of human errors, especially under stressful conditions such as during a severe accident. The industry has committed to providing procedures or administrative controls to reduce the likelihood of rapid drain down events. Procedures and training of personnel are to be in place to ensure that on-site and off-site resources can be brought to bear during an accident. Procedures will be in place to establish communication between on-site and off-site organizations during severe weather and seismic events. An off-site resource plan will be developed that will include access to portable pumps and emergency power. In addition, fuel handlers will have available to them spent fuel pool instrumentation that monitors spent fuel pool temperature, water level, and area radiation levels. See Section 3.2.

SPSB Public comment #18: The NRC should review the need to place a containment around spent fuel pools.

Response: The staff has evaluated the risk from spent fuel pool operation and from zirconium fires at operating plants in Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools." NUREG-1353 determined that the risks of spent fuel pool operation and the cost of alterations did not justify performing any generic backfits at operating plants, including installation of improved containment structures. Risk estimates from the decommissioning spent fuel pool risk assessment are similar to risk numbers (same order of magnitude) found in NUREG-1353, and decommissioning sites have a shorter period of vulnerability to zirconium fires than do operating reactors. The staff believes that an additional containment structure is not warranted for decommissioning spent fuel pools.

SPSB Public comment #19: To the extent possible, experimental validation of risk-informed results should be addressed.

Response: The staff does not plan on performing any proto-typical tests of SFP configurations. However, the predictive models used for estimating the risk from spent fuel pools are based on a wealth of experimentation. Many experiments have been performed in the areas of human reliability analysis, seismic fragility of equipment, fires, and thermal hydraulics (where billions of dollars have been spent to better understand the phenomenology of reactor accidents.) The results of the decommissioning spent fuel pool risk assessment come from a systematic analytical modeling of the spent fuel pool and its support systems at a "typical" decommissioning site. The model of the spent fuel pool and its support systems was based on plant-specific visits made by the staff. The staff used failure rates of support system equipment based on existing large databases of equipment failure rates. Human error rates were developed by the staff with help from experts at Idaho National Engineering and Environmental Laboratory. Heavy load drops were based on modeling performed for NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants, Resolution of Generic Technical Activity A-36" with additional sources of data from U.S. Navy crane experiences, Waste Isolation Plant Trudock Crane System experience, and data supplied by NEI (See Appendix 2c). The effects of aircraft crashes were analyzed using Department of Energy models (See Appendix 2d) and generic aircraft crash data.

SPSB Public comment #20: moved to seismic section

SPSB Public comment # 21: The ruthenium inventory in spent fuel is substantial. Ruthenium has a biological effectiveness equivalent to that of Iodine-131 and has a relatively long half-life. If there were significant releases of ruthenium in a zirconium fire, the Regulatory Guide 1.174 large early release frequency (LERF) value might not be an appropriate surrogate for the prompt fatality quantitative health objective. The controlling consequence may become latent cancer deaths.

Response: The staff's conclusion in the draft final report was that, even though there are some differences in source term and timing, scenarios involving a spent fuel pool zirconium fire would result in population doses that are generally comparable to those expected from accident scenarios at operating reactors. Since a zirconium fire in the SFP would involve a direct release to the environment, the LERF guideline was applied. The staff reassessed these conclusions following the performance of additional consequence calculations that took into account the possibility of significant Ruthenium release fractions.

The staff's reassessment showed that, when the Ruthenium release fraction was increased to 100% from the originally assumed fraction of $2x10^{-5}$, the number of early fatalities increased by approximately two orders of magnitude. However, the resulting early fatality consequences are still relatively low when compared to those predicted for operating reactor accidents. For example, for the various source terms considered in the NUREG-1150 assessment of Surry, the conditional number of early fatalities varied from essentially zero to approximately 11. The reassessment for SFP zirconium fire consequences (assuming 100% Ruthenium release fraction, and a population distribution like Surry) indicated conditional prompt fatalities of 0.13 for the scenarios where evacuation was initiated before onset of a zirconium fire.

When considering latent cancer fatalities, the staff analysis also provided a sensitivity study for total latent cancer deaths up to 500 miles away, with and without the increased Ruthenium release fraction. For the situation where evacuation is initiated prior to zirconium fire, latent cancer fatalities increased by approximately 17%, indicating that latent effects were only slightly sensitive to the Ruthenium release fraction. It should also be acknowledged that these long term health impacts are sensitive to public policy decisions such as land interdiction criteria for returning populations.

SPSB Public comment #22: moved to seismic section

SPSB Public comment #23: Because the accident analysis is dominated by sequences involving human errors and seismic events that involve large uncertainties, the absence of an uncertainty analysis of frequencies of accidents is unacceptable. Absent knowledge of the uncertainties, the decision making process is flawed.

<u>Response</u>: The staff intends to use the decommissioning spent fuel pool risk assessment results and insights in decision making based on the guidance used in Regulatory Guide (RG) 1.174. In this approach, when acceptance (in this case performance) guidelines are established, it is understood that the appropriate measure with which to make the comparison is the mean value of a distribution characterizing the quantified uncertainty. Uncertainties that cannot be incorporated into this quantification and that are usually associated with modeling issues or the adoption of specific assumptions are to be addressed in the decision making process by demonstrating that the adoption of alternate, plausible modeling assumptions would not lead to a change in the conclusion that the guidelines have (or have not) been met.

Seismic analysis and the assessment of the human performance in response to losses of heat removal and fuel pool inventory were pointed out as having large uncertainties. With respect to the accident sequences developed using a detailed logic model for losses of heat removal and pool inventory, the frequencies generated for those sequences are point estimates, based on the use of point estimates for the input parameters. The input parameter values were taken from a variety of sources, and in many cases were presented as point estimates with no characterization of uncertainty. In some cases, such as the initiating event frequencies derived from NUREG/CR 5496 and the human error probabilities (HEPs) derived from THERP (Technique for Human Error Rate Prediction), an uncertainty characterization was given, and the point estimates chosen corresponded to the mean values of the distributions characterizing uncertainty. For all other parameters, it was assumed that the values would be the mean values of distributions characterizing the uncertainty on the parameter value. In the case of the Simplified Plant Risk (SPAR) HEPs, the authors of the SPAR human reliability analysis approach consider their estimates to be mean values since the numbers were established on the basis of considering several different sources, most of which specified mean values. Consequently, the results of this analysis are interpreted as being mean values.

A propagation of parameter uncertainty through the model was not performed, nor was it considered necessary. With the exception of the spent fuel pool cooling system itself, the systems relied on are single train systems. The dominant failure contributions for the spent fuel pool cooling system are assumed to be common cause failures. Thus there are no dominant cutsets in the solutions that involve multiple repetitions of the same parameter, and under these conditions, use of mean values as input parameters produces a very close approximation to mean values of sequence frequencies. Since typical uncertainty characterization for the input parameters is a lognormal distribution with error factors of 3 or 10, the 95th percentile of the output distribution will be no more than a factor of three higher than the mean value. This is not significant enough to change the conclusion of the analysis.

The numerical results are a function of the assumptions made and, in particular, the models used to evaluate the human error probabilities. The staff believes the models used are appropriate for the purpose of this analysis and, in particular, are capable of incorporating the relevant performance shaping factors to demonstrate that low levels of risk are achievable, given an appropriate level of attention to managing the facility with a view to ensuring the health and safety of the public. Alternate HRA models could result in frequencies that are different. However, given the time scales involved and the simplicity of the systems, we believe that the conclusions of this study (namely the risks are low and the industry decommissioning commitments play an important role in determining that low level) are robust.

Certain assumptions may be identified as having the potential for significantly influencing the results. For example, the calculated time windows associated with the loss of inventory event tree are sensitive to the assumptions about the leak rate. The SPAR HRA method is, however, not highly sensitive to the time windows within the ranges determined to be plausible for the scenarios modeled. Consequently, the assumption of the large leak rate as 60 gpm to represent those leaks that require isolation is not critical. For the loss of inventory event tree, the assumption that the leak is self-limiting after a drop in level of 15 feet may be a more significant assumption that, on a site-specific basis, may be non-conservative and requires validation. The assumption that the preparation time of several days is adequate to bring off-site sources to bear may be questioned in the case of extreme conditions. However, the very conservative assumption that offsite recovery is guaranteed to fail would increase the corresponding event sequences by about an order of magnitude, which would still be a very low risk contributor. In conclusion, the staff considers that, by determining that the estimates for the sequence frequencies are equivalent to mean values, and in identifying those assumptions that could affect the numerical results, and in understanding the effects of these assumptions on the numerical results, the uncertainty analysis performed is sufficient to support the decision making process.

SPSB Public comment #24: moved to seismic section

SPSB Public comment #25: The staff's report is misleading when it states that there is about a factor-of-two reduction in prompt fatalities if the accident occurs after one year instead of thirty days. The real insight should be that compared to operating plants, the absolute value of prompt fatalities from zirconium fires at SFPs is a couple of orders of magnitude lower. In fact, the report does not justify a one-year delay in eliminating off-site emergency preparedness. Prompt fatalities are sufficiently reduced one month after reactor shutdown to support eliminating off-site emergency preparedness.

Response: The report does not focus on comparing the results of an accident at thirty days versus one year. The staff evaluated the risk to the public from spent fuel pool operation at decommissioning plants at one year and longer after final reactor shutdown. The basis for our recommendations on delaying reduction or elimination of off-site emergency preparedness is based on a number of factors, two of which are the estimated frequency of spent fuel pool zirconium cladding fires and the estimated consequences of such a fire.

SPSB Public comment #26: The use of Lawrence Livermore National Laboratory (LLNL) hazard curves at high ground motion values may not be credible. Even EPRI results are likely to be overly conservative at high ground motions. The requirement that some plants with higher SSE values perform detailed HCLPF assessments of their SFPs is not warranted. In conclusion, there should be no SFP screening level distinctions based on plant SSEs for the central and eastern U.S. All that is needed is that the sites pass the screening criteria (Appendix 5). For a few western sites, it is reasonable to require that the plants demonstrate a HCLPF of 2 X SSE.

Response: While it is possible that there is some conservatism in the EPRI and LLNL hazard curves at higher ground motions, the staff finds this prudent since the geologic record east of the Rocky Mountains is sparse and does not provide many examples of very large ground motions. The ERPI and LLNL hazard curves were made by different experts who gave their best judgement as to how to reflect the risks from seismic events at various nuclear power plant sites. They provided expert advice for high and low ground motions.

SPSB Public comment #27: moved to seismic section

SPSB Public comment #28: The human error probabilities (HEPs) used for the operator action "Operator Recovery Using Off-Site Sources" are too conservative.

Response: The HEPs for recovery using off-site sources were quantified with the assumption that the fuel handlers/plant operators will initially attempt to mitigate the upset condition using in-house resources, and having failed this, attempt recovery using off-site sources. This was based on input obtained from licensees during public meetings on this subject, and on the assumption that fuel handlers will initially avoid using raw water (i.e., water not chemically controlled) when possible. It was however assumed that licensee procedures and training are in place to ensure that off-site resources can be brought to bear (IDC # 2 and 4), and that these procedures explicitly state that if the water level drops below a certain level (e.g., 15 ft below normal level), the fuel handler must initiate recovery using off-site sources. The probability of this event was quantified under the assumption that there is a low dependence with preceding fuel handler failures. Given that the event is always coupled with other fuel handler failures, it would, in the staff's opinion, be inappropriate to argue for zero dependence. When looked at in the context of the complete cutsets, it can be seen that the likelihood of failure to respond to any of the initiating events (excluding seismic and heavy load drops) where meaningful responses are possible is indeed very low, as is evident from the very low sequence frequencies.

SPSB Public comment #29: Is it realistic to assume "good communication" with off-site emergency organizations once the plant is shutdown and "forgotten"?

Response: The staff assumes the need for off-site emergency response during seismic or severe weather events will only last for about five years. As the time after shutdown increases, the decay heat loads decrease and the longer the time it would take the pool to heat up and boil off if heat removal were lost. After one year, the decay heat levels are such that there is at least a week of delay between loss of cooling and spent fuel uncovery. Even following a seismic or severe weather event, the staff expects that a utility will be aware of the resources that are available in the area to provide pool cooling or inventory make up and that the utility will have assured the availability of the resources. In addition, the utility should have a plan for communicating with suppliers and government officials during such emergencies by means that would not be disrupted by such events (e.g., by portable radio). Industry commitments (IDC #2 and #3) provide assurance that good communication will be maintained.

SPSB Public comment #30: Will commitments lead to practices better than current? If not, use historic data.

Response: It is the staff's expectation that the commitments will in general provide guidance that assures that the good practices found at decommissioning sites visited by the staff will be implemented at future decommissioning sites. Some industry commitments and staff assumptions, such as IDC #1 (See Section 3.2) and SDA #2 (See Section 3.3) and SDA #3 (See Section 4.2.1), may be enhancements of capabilities currently practiced by existing decommissioning plants. Where possible (e.g., for some initiating event frequencies), the staff has used actual data from spent fuel pool events. The commitments provide a basis for the staff to conclude that the low human error probabilities associated with the loss of SFP cooling and loss of inventory events are justified. In addition, the commitments provide a bound on the risk associated with the two events that could rapidly drain the spent fuel pool (i.e., seismic and heavy load drop events.)

SPSB Public comment #31: The staff noted a recent event (January 2000) that occurred during shutdown, when SFP monitoring should have been a priority. This event should have raised the initiating event frequencies, not lowered them.

Response: Including the two recent loss-of-cooling events mentioned in Section 3.3.1 of the draft report would increase the initiating event frequency for loss of cooling accidents. However, since the fuel uncovery frequency from this event is very low (approximately 10^{-8} per year), the conclusion in the report that the loss of cooling events are not a major risk contributors is not affected. However, these recent events illustrate the importance of industry commitments, particularly IDC #5, which requires temperature instrumentation and alarms in the control room.

SPSB Public comment #32: The discussion in Section 3.3.2 states that many of the events listed in NUREG-1275, Volume 12 do not apply to a decommissioning facility. Therefore, adherence to IDCs #2, 5, 8, and 10 are not really important to establishing a low frequency of fuel uncovery.

Response: The commenter correctly noted that many of the initiating events from operating reactor spent fuel pool incidents that are discussed in NUREG-1275 do not apply to decommissioning facilities. The staff likewise did not include these events when estimating the frequency of events at decommissioning plants. To help assure that the frequency of these events does not end up being much higher than assumed by the staff in its risk assessment, the industry committed to various actions regarding procedures and planning for contingencies to limit, prevent, or mitigate loss of inventory and loss of cooling events.

SPSB Public comment #33: How did the staff come up with the factor of 100 reduction in the failure rate for heavy load drops for single-failure-proof systems?

Response: For a non-single-failure-proof handling system, the mean probability of a loss-of-inventory event was estimated based on NUREG-0612. In NUREG-0612, an alternate fault tree (Figure B-2, page B-16) was used to estimate the probability of exceeding the release guidelines (loss-of-inventory) for a non-single failure proof system. The mean value was estimated to be about 2.1×10^{-5} per year when corrected for the new Navy data and 100 lifts per year. A comparison of this mean value to the 2.0×10^{-7} per year mean value for the single-failure-proof crane shows a factor of 100 reduction.

SPLB Public Comment #1: Heavy objects, such as crane rail or masonry wall, falling into the SFP or taking out electricity during decommissioning activities.

Response:
The loss of electricity and the control of heavy loads were considered in the study. The loss of electricity would result in a loss of the spent fuel pool cooling system. Industry Decommissioning Commitment (IDC) # 1 and Staff Decommissioning Assumption (SDA) # 2 both deal with controlling heavy loads over the spent fuel pool. With regards to a masonry wall, any design feature specific to an individual plant would be dealt with on a case-by-case basis.

SPLB Public Comment #4: Since the National Severe Storm Center is predicting more frequent and more intense severe weather phenomena, shouldn't the size and velocity of wind-driven missiles and maximum height of storm surges be reassessed?

Response:
The agency can not change regulations based solely on predictions. However, if a licensee requests to change its licensing basis dealing with storms, such as tornados, or storm-generated missiles, then they would look at more recent data collected since the licensing of the plant. If an individual or organization believes that a rule should be changed, a rulemaking petition can be filed in accordance with 10 CFR 2.802.

SPLB Public Comment #7: All pools leak, dry storage is the only way for long term safety.
SPLB Public Comment #8: The NRC should identify all SFP's that leak. Degradation of the lines and concrete should be investigated. The leaks should be sealed.

Response to #7 & #8:
All pools do not leak. Further, the statement that all pools leak implies leakage to the environment. Most pools have a leak detection system between the steel liner and the concrete wall to identify and quantify if leakage from the liner occurs. This is not leakage to the environment. This water is collected by the system in the plant. This system allows licensees to monitor a situation and evaluate if there is a safety concern.

Dry storage casks are a viable option for spent fuel storage for licensees. Dry storage casks are currently approved for fuel that have been removed from the reactor for at least five years.

SPLB Public Comment #11: What happened to the commitment verbally agreed up on through a public stakeholder to install a single failure proof crane system using safety grade electrical equipment?

Response:
NEI verbally committed decommissioning plants to implement Phase II of NUREG-0612 (Control of Heavy Loads), which prescribed the use of single failure proof cranes or to implement a load drop analysis. NEI provided this commitment in writing on November 12, 1999. The commitment was included in the analysis and documented in the report as Industry Decommissioning Commitment #1.

DLPM Public Comment #4: The staff's spent fuel pool risk study only considered accidents scenarios that could lead to a spent fuel zirconium fire. A member of the public questioned what other design basis accidents are considered for decommissioning nuclear power plants beyond those addressed in the study?

Response: There are typically no new or unique conditions associated with decommissioning that result in the creation or possibility of a different type of accident not previously bounded by the design basis accidents considered for the plant while it was operating. When a licensee updates its Final Safety Analysis Report for decommissioning, a suite of accidents are considered that have a reasonable potential to adversely impact public health and safety. The offsite consequences of these accidents are very small and should not require offsite emergency response. Examples of the types of accidents that are considered by the licensees include

- Materials handling event (non-fuel)
- Radioactive liquid waste releases
- Accidents from handling spent resin
- Fire
- Explosions
- External events
- Transportation accidents.

In addition to plant specific assessments of the postulated accidents, the staff has performed some generic evaluations. Consideration of environmental impacts of such events has been provided in the "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," NUREG-0586.

DLPM Public Comment #5(b): What design basis accidents do we need to consider?

Response: Design basis accidents for decommissioning reactors are discussed in the response to the above comment **(Goes along with DLPM #4 Comment)**.

DLPM Public Comment #5(g): Design basis accidents need to be risk-informed and should address potential criticality. (**Goes along with DLPM #4 Comment**).

Response: Design basis accidents are addressed in Comment 4 above. The issue of nuclear criticality is addressed in Section 3.4.4 in the body of the report. **[TANYA PLEASE CHECK REFERENCE]**

DLPM Public Comment #15: A public stakeholder stated that industry decommissioning commitment (IDC) #5 should be revised to require direct measurement of SFP temperature and water level.

Response: The staff agrees and has incorporated this clarification in its sample regulatory language for emergency preparedness in the integrated decommissioning rulemaking plan, SECY-00-0145, issued on June 28, 2000.

TANYA WE Need to confirm that this is being addressed in the TWG report!

DLPM Public Comment #18: Dr. Hanauer was quoted in a 1975 memo to say, "you can make probabilistic numbers prove anything, by which I mean that probabilistic numbers prove nothing." If a respected technical advisor has expressed doubts about the NRC's use of probabilistic numbers, how is the NRC going to use probabilities convincingly to protect health and safety? A member of the public stated that, "this is an invalid way of measuring safety, and should not be used. Each day these reactors stay opened you are poisoning the environment. This is unacceptable."

Response: The issue of Dr. Hanauer's quote is addressed in public comment #17. The staff has already addressed the use of probabilities in Section 2.0 of the February 15th draft report. Overall, the NRC uses risk insights together with other factors to better focus licensee and regulatory attention on design and operational issues commensurate with their importance to health and safety.

DLPM Public Comment #21: A public stakeholder asked if the NRC had considered the events with the "second" worst offsite consequences at decommissioning plants. For example, in another country which has nuclear power plants, a fire in the bitumen storage (waste handling area) wass found to have the second worst, although limited, offsite consequences.

Response: The draft NRC study evaluated a spectrum of potentially severe spent fuel pool accidents that could lead to uncovery of the fuel. Separate from the draft report, the NRC did consider other, less severe accidents with offsite consequences. The rulemaking plan established for the first group of rule changes (i.e. the integrated rulemaking), recommends that licensees perform reviews at their facilities to ensure that there are no other possible accidents that could result in offsite consequences exceeding EPA Protective Action Guidelines before reductions may be made in emergency preparedness and insurance requirements.

SEISMIC

DE Public Comments # 1-3: Already addressed in the draft report. (Please indicate where they were addressed in the draft report).

DE Public Comment #4: Is addressed in the seismic check list as an item to be evaluated by a decommissioning applicant. (Where)

DE Public Comment #5:
The NRC should perform a rigorous engineering analysis of the effects of aging*[1] upon the spent fuel pool and its associated structures and equipment. Most SFPs were never designed to be quasi-permanent fuel storage facilities. Because there is, as of yet, no permanent place to store used fuel, SFPs have had to accept more fuel than they were originally designed to hold. To allow SFPS to continue to store spent fuel for an, as of yet, undetermined period of time requires, I suggest, a comprehensive look at aging.

Response:
Spent fuel pools at currently operating nuclear power plants are constructed with reinforced concrete walls and lined with liner plates. Through the use of the proposed seismic checklist, any degradation such as spalling of concrete or cracks and indications of rust and stains, etc., will be detected and appropriate corrective actions taken. Since concrete gains compressive strength with age and the strength of reinforcing bars does not change with age, provided that rebars are not degraded by corrosion, there should be no change in structural strength. There is no operating experience of degradation of spent fuel pool structures; consequently, it is not meaningful to perform engineering analysis using unsubstantiated assumptions.

DE Public Comment #6:
To my knowledge, not every spent fuel pool was designed to the seismic criteria in use today. The use of works like "robust" does not necessarily address seismic qualifications. The NRC should identify all spent fuel pools that were not initially designed to seismic criteria and explain their level of qualification, including the SF racks.

Response:
All spent fuel pools have undergone seismic and structural reevaluation, at least once, during licensing review of request for expanding the spent fuel storage capacity. Spent fuel pool structures, as well as the spent fuel racks undergo detailed analysis and staff review and approval process. Since all currently operating nuclear power plants have expanded their spent fuel storage capacity, they all meet their safe shut down earthquake criteria.

DE Public Comment #7:
Not all PWR buildings housing spent fuel are seismically qualified. The NRC should perform

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[1] * Aging could include degradation, failure, etc. of structures & equipment.

a worst case analysis of the result of a seismic event which collapses the spent fuel pool building, and/or drains the pool and/or damages the spent fuel. Both criticality and zirconium fires are of concern. The nine initiating events listed on p. 11 which could occur concurrently with the earthquake should also be considered if the events contribute to the worst case scenario.

Response:
The staff identified the following nine initiating event categories to investigate as part of the quantitative risk assessment on SFP risk:
Loss of Off-site Power from plant centered and grid related events
Loss of Off-site Power from events initiated by severe weather
Internal Fire
Loss of Pool Cooling
Loss of Coolant Inventory
Seismic Event
Cask Drop
Aircraft Impact
Tornado Missile

The initiating events indicated above are independent, and the event sequences that emanate from each event are carefully modeled in the event tree. This means that a seismic event tree would include the consideration of off-site and on-site power loss. In a PRA assessment no risk insight can be gained by considering worst case combination of truly random and independent events such as a seismic event and a tornado missile. However, the frequency of a combined seismic and tornado missile is much less than 10^{-8}. Also, with respect to other structures, such as crane girders and super-structures, they are covered in the seismic check list for the spent fuel pool structure.

DE Public comment #8:
The NEI seismic checklist requires a seismic engineer to review drawings in addition to conducting a walkdown of the SFP. It has been my experience that many electrical drawings of NAP's do not reflect the existing plant electrical installation. How is the seismic engineer going to verify drawings to the existing SFP building and pool if much of the pool is inaccessible? For instance, how does he verify concrete degradation under the steel liner? The NRC should require that specific areas be inspected and that these areas be accessible. If these areas are not accessible, then the checklist is not complete and susceptibility to seismic activity remains a concern.

Response:
The staff considers the review of construction drawings to be very important. Minimum reinforcing areas are dictated by the code and thick walls and slabs forming spent fuel pool structure are in many cases governed by minimum reinforcing requirements. Should there be any additional shear or flexural steel requirements, engineering calculations would indicate where they are need and how much is needed. Therefore, a review of drawings and design calculations would present a more complete picture. With respect to accessibility, cracks, spalling of concrete and stains and efflorescence are indications of a degradation in progress in inaccessible areas. In order to determine the root cause of the external signs, it is necessary to use more invasive procedures, such as chipping and breaking concrete, etc. This is not unique

to spent fuel pool structures, and there are several examples of this type of inspection in the operating experience of several plants.

DE Public Comment #9:

The NRC should specify why it is not cost effective to perform a plant-specific seismic evaluation for each spent fuel pool and what impact this has on safety. Because there are so many differently designed spent fuel pools, it is difficult to perceive how a generic approach could be acceptable without assembling a list of similar and/or identical designs and performing a seismic evaluation of the various groups which are assembled. Specific seismic evaluations for each plant or groups of similar/identical plants should be considered.

Response:
A significant body of work exists characterizing the strength and capacity of shear walls based on tests and analyses. The use of a generic parameter, with the underpinning of data, that is to be used solely for the purpose of screening is very appropriate and reliable. Provided that all the conditions in the checklist are met, only then a structure could be screened in. At sites where the prescribed seismic demand is greater than the 0.5g peak ground acceleration value or the 1.2g spectral acceleration value, a plant specific evaluation is to be conducted. The use of a screening parameter is a reliable way to determine the need for further evaluation. This concept was developed without any consideration of cost.

DE Public Comment #10 (formerly Appendix 5h #1):
A member of the public raised a concern about the potential effects of Kobe and Northridge earthquakes related to risk-informed considerations for decommissioning

Did any of the NUREGs that you looked at take into account new information coming out of the Kobe and Northridge events? Particularly as we are learning more about risks associated with those two particular seismological events that were never even considered when plants were sited; particularly, though I can't frame it in the seismological language, from a lay understanding, it's clear that new information was gained out of Kobe and Northridge events suggesting that you can have seismological effects of greater consequence farther afield than at the epicenter of the event."
[during the Reactor Decommissioning Public Meeting on Tuesday, April 13, 1999, in Rockville, MD.]

Response
The two NUREGs mentioned by a member of the public were written in the middle and late 1980s and used probabilistic seismic hazard analyses performed for the NRC by Lawrence Livermore National Laboratory (LLNL) for nuclear power plants in the central and eastern U.S. Since then, LLNL has performed additional probabilistic hazard studies for central and eastern U.S. nuclear power plants for the NRC. The results of these newer studies indicated lower seismic hazards for the plants than the earlier studies estimated. If the probabilistic hazard studies were to be performed again, hazard estimates for most sites would probably be reduced further than the LLNL 1993 study due to: new methods of eliciting information, newer methods of sampling hazard parameters' uncertainties, better information on ground motion

attenuation in the U.S. and a more certain understanding of the seismicity of the central and eastern U.S.

The design basis for each nuclear power plant took into account the effects of earthquake ground motion. The seismic design basis, called the safe shutdown earthquake (SSE), defines the maximum ground motion for which certain structures, systems, and components necessary for safe shutdown were designed to remain functional. The licensees were required to obtain the geologic and seismic information necessary to determine site suitability and provide reasonable assurance that a nuclear power plant could be constructed and operated at a site without undue risk to the health and safety of the public.

The information collected in the investigations was used to determine the earthquake ground motion at the site, assuming that the epicenters of the earthquakes are situated at the point on the tectonic structures or in the tectonic provinces nearest to the site. The earthquake which could cause the maximum vibratory ground motion at the site was designated the safe shutdown earthquake (SSE). This ground motion was used in the design and analysis of the plant.

The determination of the SSEs had to follow the criteria and procedures required by NRC regulations and apply a multiple hypothesis approach. In this approach, several different methods were applied to determine each parameter, and sensitivity studies were performed to account for the uncertainties in the geophysical phenomena. In addition, nuclear power plants have design margins (capability) well beyond the demands of the SSE. The ability of a nuclear power plant to resist the forces generated by the ground motion during an earthquake is thoroughly incorporated in the design and construction. As a result, nuclear power plants are able to resist earthquake ground motions well beyond their design basis and far above the ground motion that would result in severe damage to residential and commercial buildings designed and built to standard building codes.

Following large damaging earthquakes such as the Kobe and Northridge events, the staff reviewed the seismological and engineering information obtained from these events to determine if the new information challenged previous design and licensing decisions. The Kobe and Northridge earthquakes were tectonic plate boundary events occurring in regions of very active tectonics. The operating U.S. nuclear power plants (except for San Onofre and Diablo Canyon) are located in the stable interior portion of the North American tectonic plate. This is a region of relatively low seismicity and seismic hazard. Earthquakes with the characteristics of the Kobe and Northridge events will not occur near central and eastern U.S. nuclear power plant sites.

The ground motion from an earthquake at a particular site is a function of the earthquake source characteristics, the magnitude and the focal mechanism. It is also a function of the distance of the facility to the fault, the geology along the travel path of the seismic waves, and the geology immediately under the facility site. Two U.S. operating nuclear power plant sites can be considered as having the potential to be subjected to the near field ground motion of moderate to large earthquakes. These are the San Onofre Nuclear Generating Station (SONGS) near San Clemente and the Diablo Canyon Power Plant (DCPP) near San Luis Obispo. The seismic design of SONGS Units 2 and 3 is based on the assumed occurrence of a magnitude 7 earthquake on the Offshore Zone of Deformation, a fault zone approximately 8 kilometers from the site. The design of DCPP has been analyzed for the postulated occurrence of a magnitude 7.5 earthquake on the Hosgri Fault Zone, approximately 4 kilometers from the site. The response spectra, used for both the SONGS and the DCPP, was evaluated against the actual spectra of near field ground motions of a suite of earthquakes gathered on a worldwide basis.

The individual stated, "... it's clear that new information was gained out of Kobe and Northridge events suggesting that you can have seismological effects of greater consequence farther afield than at the epicenter of the event." A review of the strong motion data and the damage resulting from these events do not bear out the validity of this concern at SONGS and DCPP.

The staff assumes that the individual alluded to the fact that the amplitudes of the ground motion from the 1994 Northridge earthquake were larger in Santa Monica than those at similar and lesser distances from the earthquake source. The cause of the larger ground motions in the Santa Monica area is believed to be the subsurface geology along the travel path of the waves. One theory (Gao et al, 1996) is that the anomalous ground motion in Santa Monica is explained by focusing due to a deep convex structure (several kilometers beneath the surface) that focuses the ground motion in mid-Santa Monica. Another theory (Graves and Pitarka, 1998) is that the large amplitudes of the ground motions in Santa Monica from the Northridge earthquake are caused by the shallow basin-edge structure (1 kilometer deep) at the northern edge of the Los Angles Basin. This theory suggests that the large amplification results from constructive interference of direct waves with the basin-edge generated surface waves. Earthquake recordings at San Onofre and Diablo Canyon do not indicate anomalous amplification of ground motion. In addition, there have been numerous seismic reflection and refraction studies of the site areas for the site evaluations, and for petroleum exploration and geophysical research. They, along with other well-proven methods, were used to determine the nature of the geologic structure in the site vicinity, the location of any faults, and the nature of the faults. None of these studies have indicated anomalous conditions, like those postulated for Santa Monica, at either SONGS or DCPP. In addition, the empirical ground motion database used to develop the ground motion attenuation relationships contains events recorded at sites with anomalous, as well as typical ground motion amplitudes. The design basis ground motion for both SONGS and DCPP were compared to 84th percentile level of ground motion obtained using the attenuation relationships and the appropriate earthquake magnitude, distance and geology for each site. The geology of the SONGS and DCPP sites do not cause anomalous amplification, therefore, there is no "new information gained from the Kobe and Northridge events," which raises safety concerns for U.S. nuclear power plants.

In summary, earthquakes of the type that occurred in Kobe and Northridge are different from those that can occur near nuclear power plants in the central and eastern U.S. The higher ground motions recorded in the Santa Monica area from the Northridge earthquake were due to the specific geology through which the waves traveled. Improvements in our understanding of central and eastern U.S. geology, seismic wave attenuation, seismicity, and seismic hazard calculation methodology result in less uncertainty and lower hazard estimates today than have previous studies.

<u>DE Comment #11</u>: (formerly Appendix 5h #2)

During the July workshop, members of the public raised concerns about the hazard of the fuel transfer tube interacting with the pool structure during a large earthquake. There was also another concern about the effect of aging on the spent fuel pool liner plate and the reinforced concrete pool structure.

Transfer tubes are generally used in PWR plants where the fuel assembly exits the containment structure through the tube and enters the pool. These transfer tubes are generally located inside a concrete structure that is buried under the ground and attached to the pool structure through a seismic gap and seal arrangement. These layouts and arrangements can vary from one PWR plant to another, and the seismic hazard caused by transfer tubes should be examined on a case-by-case basis. This is included in the seismic checklist.

DE Comment #12: (formerly Appendix 5h #3)

During the July workshop, members of the public raised concerns about the effect of aging on the spent fuel pool liner plate and the reinforced concrete pool structure.

Irradiation-induced degradation of steel requires high neutron fluency, which is not present in the spent fuel pools. Operating experience has not indicated any degradation of liner plates or the concrete that can be attributed to radiation effects.

With aging, concrete gains compressive strength of about 20% in an asymptotic manner and spent fuel pool structures are expected to have this increased strength at the time of their decommissioning. Degradation of concrete structures can be divided into two parts, long term and short term. The long-term degradation can occur due to freezing and thawing effects when concrete is exposed to outside air. This is the predominant long-term failure mode of concrete; observed on bridge decks, pavements, and structures exposed to weather. Degradation of concrete can also occur when chemical contaminants attack concrete. These types of degradation have not been observed in spent fuel pools in any of the operating reactors. Additionally, inspection and maintenance of spent fuel pool structures are within the scope of the maintenance rule, 10 CFR 50.65, and corrective actions are required if any degradation is observed. An inspection of the spent fuel pool structure to identify cracks, spalling of concrete, etc., is also recommended as a part of the seismic checklist. Significant degradation of reinforced concrete structures would take more than 5 years or so, the time necessary to lose decay heat in the spent fuel. Substantial loss of structural strength requires long-term corrosion of reinforcing steel bars and substantial cracking of concrete. This is not likely to happen because of inspection and maintenance requirements.

The short-term period of concern for the beyond-design-basis seismic event can be considered to last no more than several days. Any seepage of water during this time will not degrade the capacity of concrete. Degradation of concrete strength would require loss of cross-section of reinforcing bars due to corrosion, and a period of several days is too short to cause such a loss.

Degradation of the liner plate can occur due to cracks that can develop at the welded joints. Seepage of water through minute cracks at welded seams has been minimal and has not been observed at existing plants to cause structural degradation of concrete. Nevertheless, preexisting cracks would require a surveillance program to ensure that structural degradation is not progressing.

Based on the discussion above, it can be assumed that the spent fuel pool structure will be at its full strength at the initiation of a postulated beyond-design-basis event.

SPLB Public Comment #5: How can there be no SFP degradation issues if type 304 stainless steel employed in fuel racks and assemblies is known to exhibit stress-corrosion cracking in oxygenated or stagnant borated water?

Response:
Type 304 stainless steel material is susceptible to stress corrosion cracking in oxygenated water environment at relatively high temperature conditions. At the temperature levels that exist in the spent fuel pools, stress corrosion cracking of the spent fuel racks made of stainless steel is not a concern, and there has been no report of any actual incidence of stress corrosion cracking of spent fuel racks. The stagnant, borated condition of the spent fuel pool water is not a significant factor in inducing stress corrosion cracking of the racks. Most spent fuel assemblies are clad with zirconium and are not known to be susceptible to stress corrosion cracking.

SPSB Public Comment #20: **(Goutam response)**

Comments on Seismic Designs:
A significant seismic event which damages and drains the SFP is also likely to wreak havoc upon the local infrastructure. How has NRC considered the availability of local resources as identified by IDC #2, #3, and #4? Should the local infrastructure be destroyed?

Response
Seismic capacity of spent fuel structures against catastrophic failures, such that a very rapid loss of water can be assumed, is very high - substantially above their safe shutdown earthquake levels. Consequently, high ground motion levels are necessary to initiate failures. At those large earthquake levels, emergency evacuation cannot be assumed to be effective. However, such large earthquakes are extremely rare events, so the risk is less than the safety goal.

SPSB Public comment #20 **(GLENN's RESPONSE)**: An earthquake large enough to cause severe damage to a spent fuel pool would wreak havoc upon the local infrastructure. How has NRC considered the availability of local resources as identified by IDC #2, #3, and #4?

Response: The response by local, state, or national authorities needed at the spent fuel pool site will depend on the actual or potential damage to the spent fuel pool. For earthquakes below at least three times the peak ground acceleration of the design bases earthquake, the spent fuel pool should be robust enough to prevent any rapid drain down. The most likely damage would be to the support systems that provide cooling to the pool. The large inventory of water above the spent fuel should provide adequate time (it would take about a week without pool cooling before boiling would occur) for repairing or bringing in replacement pumps and heat exchangers. Seismic events with accelerations greater than three times the design bases earthquake would result in catastrophic damage to the surrounding area. At such acceleration levels, the spent fuel pool would likely begin to suffer catastrophic damage and mitigation of the draining of the pool is not possible. Evacuation would be the only mitigating action that could be taken.

SPSB Public comment #22: The seismic risk was treated in a conservative manner. Risk-informed decision making regarding spent fuel pool zirconium fire issues should use realistic analysis, including uncertainty assessment.

Response: The assessments of the frequency of fuel uncovery from seismic events were performed using the Lawrence Livermore National Laboratory (LLNL) seismic hazard curves. The LLNL hazard curves are generally conservative with respect to those generated by EPRI. This is a result of different expert judgements. An assumed HCLPF (high confidence of low probability of failure) value of 0.5g was used in the seismic analysis. The HCLPF value was chosen on the basis that it was the value that was felt to be attainable by a plant that met the seismic checklist (see Appendix 5). It was recognized by the staff that the HCLPF value at a plant could be greater than 0.5g (i.e., the plant might actually have a higher capacity than the minimum predicted if the checklist were met.) However, in the absence of plant-specific assessments of fuel pool capacities, this is a good approximation, which is bounding. The draft report also states that the approach used to evaluate the frequency gives a slightly conservative estimate of the mean value that would be calculated from a convolution of the hazard curve and the fragility curve. Since the treatment of uncertainties is an inherent part of the development of the hazard curves and the fragility curves, this mean value does indeed address uncertainties. While it can be concluded that the frequency of fuel uncovery from seismic events is potentially conservative, it is not considered by the staff that this will impact the quality of the decisions that will be made on a generic basis using this information.

SPSB Public comment #24: For all central and eastern U.S. nuclear power plant sites and for some western U.S. nuclear power plant sites, all that is necessary to have an adequately safe spent fuel pool with respect to seismic-induced risk is for the pool to meet the requirements of the seismic checklist. Several western U.S. sites may need to demonstrate a high confidence with low probability of failure (HCLPF) of 2 X SSE.

Response: The staff agrees that, for most sites throughout the U.S., meeting the enhanced seismic checklist (Appendix A5) is sufficient to demonstrate acceptable seismic risk for decommissioning spent fuel pools. However, four sites east and two sites west of the Rocky Mountains are beyond the scope of a simple screening evaluation; these sites must perform a plant-specific seismic risk evaluation of their spent fuel pools if relaxation of EP, indemnification, or safeguards is desired.

SPSB Public comment #27: The value of three times the SSE for the SFP HCLPF should not be a hard and fast acceptance criteria, since this is only a screening criteria.

Response: The staff agrees that this value is only a screening criterion. In Appendix 5g the staff discusses potential mitigation measures that can be taken by a plant that does not pass the seismic checklist. Options offered include delay in requesting an exemption, correction of the identified areas on non-compliance with the checklist, or performance of a plant-specific seismic risk analysis to demonstrate that the risk associated with a catastrophic failure of the pool is at an acceptable level.

SPLB Public Comment #9: The NRC should determine the qualifications and degradation of spent fuel racks.

Response:
Spent fuel rack designs are reviewed and approved by the NRC. Additionally, when a licensee changes its technical specification for amount of fuel allowed to be stored in the pool, a NRC review and approval is required. The staff technical reviewers are provided guidelines in NUREG-0800, Standard Review Plan (SRP). The SRP incorporates the regulations specified in the Code of Federal Regulations, Appendix A, General Design Criteria, which require safe handling and storage under normal and accident conditions.

SECURITY/EP/RESIN FIRE/ SAFETY CULTURE

IOLB Public Comment #1: Section 4.3.2, "Security" of the draft report casts a shadow on the entire 10 CFR 73.51 rulemaking and needs to clarify the scope of the safety issues. The last paragraph in Section 4.3.2 should be clear and completely identify the scope and basis of the ISFSI safety concerns from the radiological sabotage and theft identified in 10 CFR 73.1. Finally, the last paragraph appears to contradict the May 15, 1998, NRC rulemaking on Physical Protection for Spent Nuclear Fuel and High-Level Radioactive Waste, Federal Register Vol. 63, No. 94 Pages 26955 - 26963.

Response:
The NRC staff agrees that Section 4.3.2, Security, as written, appears to be inconsistent with the changes to Part 73 as described in FRN 26955 dated May 15,1998. The description of risk associated with potential criticality and fuel heat up is for spent nuclear fuel (SNF) recently discharged from the reactor vessel and not SNF stored at an ISFSI. The staff acknowledges that this section needs to be rewritten to properly described the staff's understanding of these two risks.

The staff believes that, as written, 10 CFR 73.51 provides proper physical protection for the storage of all spent nuclear fuel (wet or dry storage) at an ISFSI. The design basis threat for radiological sabotage of power reactors under 10 CFR 73.1 is not considered appropriate for the types of facilities subject to 73.51, and therefore, a separate protection goal is defined for these facilities. The protection goal states that "The physical protection system must be designed to protect against loss of control of the facility that could be sufficient to cause radiation exposure exceeding the dose as described in 10 CFR 72.106 and referenced by 73.51(b)(3)."

With regard to protection against malevolent use of land-based vehicles, NRC continues to believe that there is no compelling justification for requiring a vehicle barrier as perimeter protection at this time. The staff will however, continue to review the requirements to ensure that proper level of security is provided for new cask designs and other changing technologies.

IOLB Public comment 2: With new personnel and decommissioning personnel, what methods are available to instill or ensure the same "safety culture" as during operation?

Response:
There are several methods of instilling/ensuring "safety culture" in new personnel employees at both operating and decommissioning facilities. Methods include management policies and procedures, training, and qualification. OSHA requires employers to provide employees with safety training and education. 29 CFR 1926.21(b)(2) requires training in the recognition and avoidance of unsafe conditions, 29 CFR 1926.21(b)(3) requires training in the safe handling and use of poisons, caustics, and other harmful substances, 29 CFR 1926.21(b)(5) requires training in the safe handling and use of flammable liquids, gases, or toxic materials, and 29 CFR 1926.21(b)(6) requires confined or enclosed space training. In addition, 10 CFR 50.120 requires training and qualification of nine categories of personnel involved with spent fuel pool maintenance and support. The training programs for the nine categories of personnel should include occupational safety and radiation protection training. While NRC and OSHA require

training, it is incumbent upon the licensee to provide the training and instill/ensure upon the workers the proper "safety culture."

<u>IOLB Public comment #3</u>: The report concludes that there is no methodology currently available to access probabilities of terrorist activity or behaviors which might culminate in attempted sabotage of spent fuel. We disagree. For instance, Sandia National Laboratories, a key contractor employed by the NRC on security matters, has applied a probabilistic approach to security in decommissioning on the Maine Yankee docket. We encourage the staff to review this report.

<u>Response:</u>
The staff disagrees with this comment and again states there is no methodology available to access the probability of terrorist activity. The report in question, its identity verified through NEI, is "A Vulnerability Analysis of a Proposed Security Plan for the Maine Yankee Power Plant," dated January 9, 1998. The purpose of this report was twofold: first, it presents the results of an analysis of the effectiveness of the proposed physical security system in preventing or mitigating an attempt by the design basis threat adversaries attempting radiological sabotage, and second, it presents the results of a study to determine the need for a vehicle barrier systems. This report does not predict the probability of terrorist activities or behaviors. The staff has read this report, and conducted an on site inspection (June 8, 1999) of its technical findings and found them to be deficient. It is recommended that NEI read this report.

<u>IOLB Public comment #4</u>: The decommissioning rule should specify that the licensee is excused from 10 CFR 50.47 offsite EP requirements after the short-lived nuclides important to dose have undergone substantial decay resulting in offsite dose consequences due to license basis accidents of less than 1 rem (the EPA protective action guideline).

<u>Response:</u>
The staff has considered the decay time of short lived nuclides and the offsite dose consequences along with the risks of both design basis accidents and beyond design basis events in efforts to determine an appropriate point at which requirements for offsite EP could be relaxed. The staff also considered the effects of the substantial decay heat and longer lived nuclides available in stored spent fuel which could result in offsite dose consequences. In consideration of these effects and the associated risks, the staff has proposed the one year decay time before considering relaxation of offsite emergency planning requirements.

<u>IOLB Public comment #5</u>: What does "reducing unnecessary regulatory burden" mean in practice, when it comes to emergency planning? What kind of reductions are foreseen for the following: manpower onsite/offsite, emergency equipment, communication means, alarm means, notification of personnel/public, EP, plans, KI, EPZ radius?

<u>Response:</u>
The specific reductions in the areas mentioned is a subject that is beyond the intent of this study. Generally speaking, it is anticipated that onsite manpower could be reduced early in the decommissioning process provided adequate personnel are available to provide emergency

response duties. Offsite manpower needs, equipment, communication, alarms, notifications, plans, and planning areas, would be relaxed consistent with the relaxation of requirements for offsite emergency planning. The consideration of the use of KI would not be necessary when iodine releases are no longer a concern.

IOLB Public comment #6: It's conspicuously absent from your review of risk in this overall subject, that we (the staff) haven't looked at the issue of sabotage and terrorism. (comment from a member of the public)
SPLB Public Comment #12: The draft report omitted acts of sabotage and vandalism. Emergency evacuation plans should be prepared with this consideration of terrorism.
SPLB Public Comment #13: Atherton comment: It is suggested that NRC "err on the side of safety" since terrorist acts can not be specifically addressed. [Ref. 7]

Response:
The commenters are correct that security is identified, but not highlighted, in the report. The report is a technical study to quantify the risks as it relates to the draining of a decommissioned spent fuel pool and the issue of a zirconium fire. Its was not intended to address security in any detail. The integrated rulemaking, which is an outgrowth of the technical study, addresses safeguards as one of the major components of the decommissioning integrated rulemaking. An entire section is devoted to security with none of the requirements less than those currently required in 10CFR 73.51. A rulemaking package is before the Commission which details the schedule for the rulemaking. As with any rulemaking, there will be opportunities for the public to comment on the security requirements the staff is recommending.

IOLB Public comment #7: A commenter requested that the consequences of an offsite radiological release from an onsite fire involving radioactive material from a resin container fire; fire in a waste storage building; and fire in a container vehicle with waste stored in it that could trigger emergency response mechanisms, be re-evaluated.

Response:
This evaluation is beyond the scope of this study which is focused on spent fuel pool accident risk.

IOLB Public comment #8: Discuss protection of plant workers, particularly for less severe accidents such as pool uncovery without a zirconium fire.

Response:
Existing regulatory requirements address the need for emergency plans to consider protective actions and a means for controlling exposures in an emergency for emergency workers as well as the public.

IOLB Public comment #9: Asked about calculations for radiation dose experienced by members of the fire brigade responding to resin fires.

Response:

Comments #8 and #9 are very similar in nature, the comments ask about the protection of emergency responders onsite. In accordance with existing emergency planning requirements, each site has established procedures for the protection of works responding to emergency situations. Generally, these procedures include the consideration of radiological conditions when responding to events.

SPLB Public Comment #6: The draft report should be revised to include credible hazards to plant workers at permanently closed plants.

Response:
While the staff is concerned about the worker safety at decommissioning plants, this study focused on spent fuel pool accidents. There are many topics related to spent fuel accidents; all aspects or other types of accidents were not included in the study. OSHA and NRC regulations require safety training and education, including safe handling and use of poisons, caustics, flammable liquids, gases and toxic materials; radiation protection; and occupational safety. Worker safety will be looked at under the consolidated rulemaking for decommissioning plants. This study will be considered when worker safety is addressed.

SPLB Public Comment #10: The NRC should determine the proper methods of extinguishing a possible zirconium fire.

Response:
At the present time, the state-of-art for zirconium fire experiments has not advanced to researching the various methods for extinguishing. Additional research would need to be performed to investigate acceptable methods, required quantities, conditions of use, and guidelines. Due to the low probability of the event, this research is not recommended at this time.

DLPM Public Comment #8: A member of the public stated that since more radioactive materials are being handled [during decommissioning] than at an operating plant, and under conditions more likely to lead to inadvertent exposures, why are licenses left without the supervision of resident inspectors, or at least radiation protection personnel?

Response: During operation of a reactor, radioactive material is produced by neutron absorption by various materials. These radioactive materials are handled in many ways, including liquids contained in pipes and tanks and radioactive solids contained in plastic bags or specialized containers. After the reactor is shut down, no additional radioactive material is produced and the radioactive material decay process reduces the total amount of radioactive material over time. The handling of radioactive material after shutdown is controlled in the same manner as before shutdown. Supervision of radioactive material handling is performed by the licensee before and after reactor shutdown with the oversight of licensee radiation protection personnel. Region-based NRC inspectors provide a periodic verification that the licensee is handling radioactive materials within the bounds of the current regulations. NRC experience over the last few years with the current region-based reactor decommissioning inspection process has shown that the oversight process is working well to ensure both public health and safety and protection of plant workers.

DLPM Public Comment #10: A member of the public stated that little of what operators or reactor inspectors have learned is applicable to decommissioning. NRC needs personnel specifically trained in and dedicated to decommissioning.

Response: Significant changes take place during the transition from an operating plant to a decommissioning plant. However, many decommissioning activities are similar to activities conducted during plant operation. For example, the complete removal of components and systems, radiological waste shipments, fuel handling operations, and spent fuel pool system operations and maintenance which occur during decommissioning are very similar to activities that occurred during plant operation and refueling outages. Objectives during decommissioning, such as, protecting the spent fuel from sabotage and maintaining the spent fuel pool operational, were also accomplished during plant operation. The training received by operators and inspectors associated with radiological fundamentals, system operations, etc., still applies during decommissioning.

Although there is not an NRC inspector on-site during all of decommissioning, as there is during plant operation, there is a group of inspectors in each region who are specifically assigned to oversee plants undergoing decommissioning, and who make routine visits to the site (commensurate with the quantity and significance of the ongoing work). Each plant in decommissioning is also assigned to a project manager located at NRC Headquarters. These project managers are assigned to a section that is responsible only for decommissioned power reactors.

THERMALHYDRAULICS

SRXB Public Comment #9: The draft study is deficient in that it ignores the phenomenon associated with partial draindown of SFP that will suppress convective heat transfer by presence of residual water at the base of fuel assemblies. [Ref. 8]

Response: The partial drain down scenario may extend the critical decay time well beyond 5 years. Current calculations indicate that decay times in excess of 20 years may be needed to preclude fuel damage from a partial drain down.

SRXB Public Comment #10: The draft study is deficient in that partial draindown will lead to a steam-zirc reaction producing hydrogen gas which could reach explosive concentrations in the atmosphere of the spent fuel building, potentially leading to a breach of that building.

Response: Steam oxidation will release hydrogen. The hydrogen concentrations or the consequences of any subsequent hydrogen burn or explosion have not been calculated.

SRXB Public Comment #11: The energy of reaction for air oxidation in the draft report is incorrect.

Response: The draft report is correct. The author of the comment has made a fundamental error. There are 92 grams of Zirconium in a mole. The authors calculation is based on 92 kg in a mole.

SRXB Public Comment #13: The ACRS has difficulties with the time at which the risk of zirconium fires becomes negligible. Issues related with the formation of zirconium-hydride precipitates in the fuel cladding are spontaneously combustible in air. Spontaneous combustion of zirc-hydrides would render moot the issue of "ignition" temperature which is the focus of the staff analysis of air interactions with exposed cladding. The staff neglected the issue of hydrides and suggested that uncertainties in the critical decay heat times and the critical temperatures can be found by sensitivity analysis. Sensitivity analysis with models lacking essential physics and chemistry would be of little use in determining the real uncertainties.

Response: Fuel cladding can contain high concentrations of zirconium hydride at the oxide-cladding interface in high burnup fuel. The effect of zirconium hydride on cladding oxidation rates is unknown at this time. If the oxide layer stays intact the reaction rates should be similar to cladding oxidation rates without zirconium hydride since the rate is determined by the diffusion of oxygen through the zirconium oxide layer. The effect of the hydrogen reaction product on the oxide film and oxidation rate is unknown. It is possible that cladding rupture at a temperature near 700 °C may lead to autoignition of the cladding due to the reaction of oxygen with zirconium hydride. Air oxidation experiments with high burnup cladding are needed to resolve the reaction rate and autoignition issues.

SRXB Public Comment #14: The staff analysis of the interaction of air with cladding has relied heavily on geriatric work. New findings through a cooperative international program PHEBUS FP provide information relating to the well-known tendency for zirconium to undergo breakaway oxidation in air whereas no tendency is encountered in steam or in pure oxygen. Other findings relate to how nitrogen from air depleted of oxygen will interact exothermically with zircaloy cladding. The ACRS does not accept the staff's claim that it has performed "bounding" calculations of the heatup of Zircaloy clad fuel even when it neglects heat losses.

Response: Breakaway oxidation can have a significant impact. Breakaway oxidation has been observed to occur in experiments Ref [6,7] measuring oxidation rates of zirconium and zircaloy-4 in air. Breakaway oxidation has not been observed in pure oxygen. The lower temperature limit for breakaway oxidation in zircaloy-2, zircaloy-4 or any advanced zirconium alloy is unknown. An experimental program would be required to quantify the effect of this potentially important physical phenomenon. The experiments should examine the effect of fuel burnup on this phenomenon. The limited data available indicates that the lower temperature limit for breakaway oxidation in zircaloy-4 is lower than the lower limit observed in pure zirconium but the lower limit has not been determined. The mechanisms that induce breakaway oxidation are unknown at the present time. Therefore data should be taken under conditions that are as prototypical as can be achieved.

SRXB Public Comment #15: Since the staff has neglected any reaction with nitrogen and did not consider breakaway oxidation, it had not made an appropriate analysis to find this "ignition temperature". (from the ACRS)

Response: It has been shown that the presence of nitrogen increases the rate of oxidation of zirconium. The oxidation rate is a weekly increasing function of nitrogen fraction over a wide range of relative nitrogen fractions. [Ref 6] The reaction rate of nitrogen with zirconium is approximately 20 times lower than the oxidation rate. The energy of reaction of zirconium with nitrogen is also less than the energy of reaction with oxygen. Therefore, the heat input from the nitrogen reaction should be a small perturbation to the oxidation heat input except for very low oxygen concentrations and in that case the fuel has already reached its failure point and a large release is underway.

SRXB Public Comment #16: The search for ignition temperature may be the wrong criterion for the analysis. The staff should be looking at the point at which cladding ruptures and fission products can be released. One arrives at a lower temperature criteria for concern over the release of radionuclides. (From the ACRS)

Response: Cladding rupture can release gap gases. Additionally the interaction of the fuel with air can cause the release of fuel fines and fission products such as ruthenium trapped in the fuel that will provide a source term that significantly exceeds the classical gap release.

SRXB Public Comment #17: The staff focuses on eutectic formations when intermetallic reactions are more germane to the issues at hand.

Response: RES has not provided the information needed to evaluate this.

SRXB Public Comment #18: Depending on fuel burnup/storage array details, the development of standard methods is needed for consistent application of regulations.

Response: There is no current technical basis to support a standard methodology for T/H analysis.

SRXB Public Comment #19: Gap release temperature too conservative for success criteria.

Response: The criteria for gap release may also be the threshold for releasing fuel fines and Ruthenium. (See 16)

SRXB Public Comment #20: Fire propagation to low powered fuel unlikely.

Response: Sufficient research has not been performed to rule out propagation to even the lowest powered assemblies and past (GSI 82) did not evaluate potentially significant effects such as the impact of rubble from failed assemblies on fire propagation. In any event the uncertainty in the source term is probably exceeded by the uncertainty in the PRA.

SPLB Public Comment #3: Could foreign materials with lower ignition temperatures enter a drained SFP and catch fire, thus raising the temperature of SF to the point of rapid zirconium oxidation?

Response:
Licensees have programs to keep any unintended objects (called foreign objects) from entering the spent fuel pool. Retrievable foreign objects that fall into the pool are moved to designated storage areas within the pool. The staff does not have any evidence to show that the current foreign object exclusion program are unacceptable. The staff determined that additional analysis is not merited at this time.

SPLB Public Comment Responses (Not sure what specific technical area these responses fall under - may need to be separated into the other technical areas).

SPLB Public Comment #1: moved to PRA section

SPLB Public Comment #2: repeat question to SPSB #7

SPLB Public Comment #3: moved to T/H section

SPLB Public Comment #4: moved to PRA section

SPLB #5 moved to seismic section

SPLB Public Comment #6: moved to Safety Culture section

SPLB Public Comment #7 & 8: moved to PRA section

SPLB Public Comment #9: moved to Seismic section

SPLB Public Comment #10: moved to Safety Culture section

SPLB Public Comment #11: moved to PRA

SPLB comments #12 and #13 refer to terrorism - repeat / moved to IOLB #6

DLPM Public Comment Responses (Not sure what specific technical area these responses fall under - may need to be separated into the other technical areas).

DLPM Public Comment #1: moved to Rulemaking section

DLPM Public Comment #2& 3: Moved to Rulemaking
DLPM Public Comment #4: moved to PRA section

DLPM Public Comment # 5: At the November 8, 1999, Commission meeting, Paul Blanch stated that SECY 99-168 doesn't cover all decommissioning issues. Specifically, he was concerned about the following issues:

(a) moved to Rulemaking
(b) **Moved to PRA section with DLPM Comment**
(c) Moved to Rulemaking
(d) Moved to Rulemaking
(e) moved to Rulemaking
(f) moved to Rulemaking
(g) **Moved to PRA Section with DLPM Comment 4**

DLPM Public Comment #6 &7: moved to Rulemaking Section

DLPM Public Comment #8: moved to Safety Culture section

DLPM Public Comment #9: moved to Rulemaking Section

DLPM Public Comment #10: moved to Safety Culture section

DLPM Public Comment #1-14: moved to Rulemaking section

DLPM Public Comment #15: moved to PRA section

DLPM Public Comment #16 & 17: moved to Rulemaking section

DLPM Public Comment #18: moved to PRA section

DLPM Public Comment #19: moved to Rulemaking section

DLPM Public Comment #21: moved to PRA section

DLPM Public Comment 22: Tanya **DELETE This ITEM!!!** Copies of the requested documents were mailed to SKI on June 30, 2000.

RULEMAKING & NRC PROCESS CONCERNS: (Questions from Souther Cal. were already addressed in Decomm. Rulemaking Plan while addressing NEI concerns. Dick Dudley asked us to pull responses from their rulemaking so we stay consistent. This file is located in DECOM.GRP. The responses below may need some refining)

Rulemaking Public Comment #1: For EP, the integrated decommissioning rule should specify that the licensee is excused from 10 CFR 50.47 requirements after a period of one-year from final shutdown. The basis for this recommendation is drawn directly from the technical material presented, and little can be gained by closer analysis. [Ref. 13] **Answer provided in the Decommissioning Rulemaking Plan (DR), Att. 2, "EP", NEI comment #9**

Response: The staff has recommended in its rulemaking plan that at least 1 year of spent fuel decay has elapsed before offsite EP be discontinued as supported by the conclusions of the staff's technical risk study.

Rulemaking Public Comment #2: For Security, the integrated decommissioning rule should allow licensees to be excused from 10 CFR 73.55 requirements upon a showing that the consequences of sabotage can not exceed a defined dose to the public at the site boundary. [Ref. 13] **Answer already provided in DR, Att. 2, "Safeguards"**

Response: The staff agrees that 10 CFR 73.55 should be modified to a level commensurate with the risk associated with safeguarding permanently shutdown plants, but not to a level less than that provided for an ISFSI as described in 10 CFR 73.51.

While the new regulation does not require that the spent fuel pool be a vital area, it will correct the existing problem in the 10 CFR 73.55 regarding the implementation of protected areas and isolations zones. The new rule will have a protected area and limited use of isolation zones.

Rulemaking Public Comment #3: For Insurance, the obligation for secondary financial protection should end at such time that a determination can be made that clad surface temperatures greater than 570C can not occur in a dry configuration. The calculation of this temperature should be by approved methodology. However as supported in the technical report, in the absence of any calculation, the obligation should end after a period which is less than five years. The capacity required of primary financial protection should be reduced after the period of time determined as above for secondary financial protection. [Ref. 13] **Answer already provided in DR, Att. 2, "Insurance," NEI comments #2, #6**

Response: Since the zirconium fire scenario would be possible for up to several years following shutdown, and since the consequences of such a fire are severe in terms of property damage and land contamination, the staff position is that full onsite liability coverage must be retained for five years or until analysis has indicated that a zirconium fire is no longer possible.

For those licensees who choose to analytically demonstrate the non-viability of a zirconium fire, the staff is now analyzing comments provided by the Advisory Committee for Reactor Safeguards to determine the threshold temperature for rapid oxidation. The staff will also evaluate the need for preparing regulatory guidance for such analytical calculations during the rulemaking process.

The NRC believes that the amount of primary financial protection required should be determined by the consequences and not the probability of the worst "reasonably conceivable" accident. The low probability of such an accident is considered by insurers who may reduce the premiums for the required coverage to account for the reduced risk at decommissioning plants.

DLPM Public Comment #1: At the decommissioning spent fuel pool risk public workshop held on July 15-16, 1999, David Lochbaum, of the Union of Concerned Scientists, stated, "It is difficult to figure out how this effort fits into the overall big picture of what the NRC is doing on decommissioning."

Response: The focus of the decommissioning spent fuel pool risk study was intentionally limited to address potential severe accidents associated only with spent fuel. An additional rulemaking effort, termed the regulatory improvement initiative, is planned by the NRC and will include a comprehensive look at all decommissioning regulations to determine if any additional changes are required. An overall assessment of decommissioning issues will be addressed during this subsequent effort.

DLPM Public Comment #2: At the decommissioning spent fuel pool risk public workshop held on July 15-16, 1999, Ray Shadis stated, "Look at all of the activities that happen during decommissioning when developing regulations, not just a narrow view of the spent fuel pool."

Response: The focus of the decommissioning spent fuel pool risk study was intentionally limited to address potential severe accidents associated only with spent fuel. An additional rulemaking effort, termed the regulatory improvement initiative, is planned by the NRC and will include a comprehensive look at the decommissioning regulations to determine if any additional changes are required. Other activities that take place at decommissioning sites will be considered during this subsequent effort.

DLPM Public Comment #3: At the decommissioning spent fuel pool risk public workshop held on July 15-16, 1999, Ray Shadis stated that he was confused on the way Part 50 is being applied in places where Part 72 might be more applicable.

Response: Although 10 CFR Part 50 was developed with the operating power reactors in mind, many of the requirements still apply to decommissioning power reactors. Decommissioning nuclear power plant licensees remain subject to their Part 50 license after they have permanently shut down and have offloaded all fuel from the reactor to the spent fuel pool. The Part 50 license allows for safe storage of spent fuel in a spent fuel pool during operation and the staff believes that license remains adequate for spent fuel pool storage during decommissioning. The staff does not require a Part 50 licensee to obtain a Part 72 license for spent fuel storage in a spent fuel pool. When a licensee chooses to store spent fuel in an independent spent fuel storage installation, then the appropriate requirements of Part 72 will be applicable. All reactor decommissioning activities will remain under the Part 50 license until the decommissioning is completed and the license is formally terminated.

In SECY-99-168, dated June 30, 1999, the NRC staff proposed to the Commission that all NRC regulations under Title 10 be reviewed and modified as necessary to ensure proper applicability to decommissioning. At the direction of the Commission, the staff is currently assessing the regulations that may need modification to more effectively address decommissioning reactors.

DLPM Public Comment # 5: At the November 8, 1999, Commission meeting, Paul Blanch stated that SECY 99-168 doesn't cover all decommissioning issues. Specifically, he was concerned about the following issues:

(a) Although NRC and EPA disagree on site remediation criteria, Mr. Blanch stated that either level would provide reasonable assurance to the public of undue risk.

Response: Resolution of the disagreement between NRC and EPA on release criteria is not within the scope of the current rulemaking effort.

(b) **Moved to PRA section with DLPM Comment**

(c) Why does the NRC apply Part 50 (reactor) regulations to decommissioning reactors when the rules in Part 72 for storage of high-level waste are more clearly outlined? Part 50 regulations are not appropriate for long-term storage of high-level waste.

Response: The NRC believes that the 10 CFR Part 50 regulations applicable to decommissioning reactors are sufficient to assure public health and safety. Further assurance of the adequacy of these regulations will be provided in the near future as part of the decommissioning regulatory improvement effort in which a comprehensive review of all applicable NRC regulations will be undertaken. This issue is also addressed in the response to Comment 3 above.

(d) What is the applicability of 10 CFR Part 26 fitness-for-duty regulations to decommissioning reactors?

Response: Fitness-for-duty at decommissioning facilities is one of the issues that will be evaluated by the decommissioning regulatory improvement initiative.

(e) Quality assurance, emergency planning, fire protection, and application of codes and standards differs from site to site. Right now the decommissioning industry is being regulated by exemption to Part 50.

Response: The NRC is planning to propose new emergency planning rules for decommissioning reactors to eliminate the need for addressing the issue on a plant-specific basis by processing exemptions. A final regulatory guide on decommissioning reactor fire protection programs is expected to be issued in a few months. The remaining issues will be addressed by the decommissioning regulatory improvement initiative.

(f) The issue of onsite disposal of clean waste (rubblization) needs clarification.

Response: Although outside the scope of the spent fuel pool risk study, development of NRC policy on rubblization is now ongoing in the Office of Nuclear Materials Safety and Safeguards.

(g) **Moved to PRA Section with DLPM Comment 4**

DLPM Public Comment #6: Mr. David Stewart-Smith felt that decommissioning nuclear power plants should be evaluated for fires in the low level waste storage (LLW) area. Mr. Stewart-Smith states that large amounts of LLW could be stored in onsite LLW storage areas if offsite waste disposal sites are lost by a licensee "mid-stream" during the decommissioning process.

Response: As part of the staff's broad-scope decommissioning regulatory improvement effort, the staff will ensure that regulations are in place that would reasonably preclude threats to the public health and safety from accidents that are significantly less severe than a spent fuel pool zirconium fire but perhaps more probable, such as the LLW fire described above. To address the specific concern of Mr. Stewart-Smith, 10 CFR 50.48 requires decommissioning nuclear power plant licensees to maintain a fire protection program to address fires which could cause the release or spread of radioactive materials which could result in a radiological hazard. In addition, nuclear power plants are also subject to the Commission's regulations for byproduct materials under 10 CFR Part 30. Specifically, 10 CFR 30.32(i) would require a licensee to maintain an appropriate EP program for radioactive materials stored onsite in quantities in excess of those specified in 10 CFR 30.72, "Schedule C - Quantities of Radioactive Material Requiring Consideration of the Need for an Emergency Plan for Responding to a Release." As part of the staff's recent effort on the integrated decommissioning rulemaking plan, the staff considered other less severe accidents with offsite consequences. The rulemaking plan recommends requiring licensees to perform reviews at their facilities to ensure that there are no other possible accidents that could result in offsite consequences exceeding EPA Protective Action Guidelines before reductions may be made in emergency preparedness and insurance requirements.

DLPM Public Comment #7: Ray Shadis stated his desire for an adjudicatory hearing and a prior NRC review/approval step at the onset of the decommissioning process.

Response: This issue of a hearing and NRC review and approval prior to decommissioning has been previously considered by the Commission. The Commission addressed the issue in the statements of consideration for the rulemaking for decommissioning published July 29, 1996, in the *Federal Register* (61 FR39278) by stating: "...initial decommissioning activities (dismantlement) are not significantly different from routine operational activities such as replacement or refurbishment. Because of the framework of regulatory provisions embodied in the licensing basis for the facility, these activities do not present significant safety issues for which an NRC decision would be warranted." Therefore, an NRC review and approval process that allows a public hearing before decommissioning begins is not necessary. Instead, in the 1996 rulemaking the Commission decided to offer a public hearing opportunity later in the decommissioning process at the license termination stage when issues such as to the adequacy of site cleanup could be raised.

DLPM Public Comment #9: Ray Shadis felt that the NRC should hire a contractor to determine why/how 10 CFR Part 50 was contorted to fit decommissioning reactors with the duct tape of 10 CFR 50.82 to avoid adjudicatory processes with regulatory handles.

Response: When the NRC issued decommissioning regulations in 1988, it was assumed that decommissioning would normally take place after the facility's operating license expired. The licensee was obligated to submit a preliminary decommissioning plan 5 years before the license expired. The preliminary decommissioning plan contained a cost estimate for decommissioning and an up-to-date technical assessment of the factors that could affect planning for decommissioning. This included (1) the choice of decommissioning alternative selected, (2) the major technical actions necessary to carry out decommissioning safely, (3) the current situation with regard to disposal of high-level and low-level radioactive waste, (4) the residual radioactivity criteria, and (5) other site-specific factors that could affect decommissioning planning and cost.

The 1988 rule also required that no later than 1 year before expiration of the license (or within 2 years of permanent cessation of operations for plants closing before their license expires), a licensee had to submit an application for authority to decommission the facility. The application was to be accompanied by or preceded by a proposed decommissioning plan. The proposed decommissioning plan was to include (1) the choice of the alternative for decommissioning with a description of the activities involved, (2) a description of controls and limits on procedures and equipment to protect occupational and public health and safety, (3) a description of the planned final radiation survey, (4) an updated cost estimate for the chosen alternative and a plan for ensuring the availability of adequate funding, and (5) a description of the technical specifications, quality assurance provisions, and physical security plan provisions in place during decommissioning. A supplemental environmental report that described any substantive environmental impacts that were anticipated but not already covered in other environmental impact documents was also required.

The NRC would review the decommissioning plan and would approve it by issuing an order if the plan demonstrated that the decommissioning would be performed in accordance with regulations and there were no security, health, or safety issues. The NRC would also require that notice be given to interested persons. However, the NRC could add other conditions and limits to the plan that it deemed appropriate. The license would then be terminated if the NRC determined that the decommissioning had been performed in accordance with the approved decommissioning plan and the order authorizing decommissioning, and if the final radiation survey and associated documentation demonstrated that the facility and site were suitable for release for unrestricted use.

In August 1996 the regulations were revised for several reasons. First, the experience gained in the early decommissioning activities associated with several facilities did not reveal any activities that required NRC review and approval of a decommissioning plan. Second, environmental impacts associated with decommissioning those early facilities resulted in impacts consistent with those evaluated in the "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," NUREG-0586. And finally, experience gained from reviewing numerous decommissioning oversight activities at a number of these facilities also indicated that the decommissioning activities were in general no more complicated than activities normally undertaken at operating reactors without prior and specific NRC approval. The revised rule redefined the decommissioning process and required licensees to provide the

NRC with early notification of planned decommissioning activities at their facilities went into effect. The rule made the decommissioning process more efficient and uniform. It provided for greater public awareness and clarified the opportunity for participation in the decommissioning process. It also gave plant personnel a clearer understanding of the process for changing from an operating organization to a decommissioning organization.

DLPM Public Comment #11: Untrained NRC public representatives frequently misinform the public, particularly about the opportunities for a hearing on reactor decommissioning.

Response: The NRC endeavors to train all NRC employees for their specific work assignments. In the event that misinformation is inadvertently communicated by an individual staff member, the NRC staff upon identifying the misinformation provides the correct information in the most expedient manner.

DLPM Public Comment #12: Ray Shadis cited several specific examples of interactions with NRC staff that he felt demonstrated improper or inaccurate information provided by NRC staff members.

Response: In the course of oral communication with the public in an open and unrestrained fashion, errors, miss-spoken words, and misunderstandings will occur by the individuals from the public and the NRC staff. The NRC endeavors to minimize these miss communications from our staff, but should they occur, NRC staff will act to correct them by the most expedient means available.

DLPM Public Comment #13: At the November 8, 1999, Commission meeting, Ray Shadis said that the time delays experienced by licensees who must submit individual heatup analyses and applications for exemption from NRC regulations could be mitigated by preparation of such documentation well in advance of decommissioning.

Response: It is true that decommissioning licensees who have planned reactor shutdown schedules far in advance would be able to submit exemption requests and conduct supporting thermal-hydraulic analyses in advance of reactor shutdown so that lengthy regulatory delays could be minimized. However, plants that shut down unexpectedly would not be able to submit such analyses in advance. The NRC believes that it should promulgate new decommissioning regulations that ensure public health and safety, reduce unnecessary regulatory burden and increase the efficiency and effectiveness of operations for both licensees and the NRC.

DLPM Public Comment #14: In a March 15, 2000, letter to the NRC, David Lochbaum of the Union of Concerned Scientists, said that the NRC staff owes its stakeholders the courtesy of addressing their concerns, particularly when comments are solicited by the NRC staff. Otherwise, the NRC staff must stop actively soliciting public comment when it has no intention of considering.

Response: At the July 15-16, 1999 public workshop on decommissioning spent fuel pool risk, Mr. Lochbaum raised a concern that the NRC evaluate potential hazards that decommissioning accidents could impose upon plant workers. When the NRC issued its final draft report, Mr. Lochbaum's issue was not specifically addressed in the comment evaluation section. However, the NRC had received an industry decommissioning commitment that licensees would provide a remote method of adding water to spent fuel pools that would reduce potential risk to plant workers and which resulted from the issue Mr. Lochbaum had raised. The NRC seriously considers public comments received on all issues within its jurisdiction. In this case, the staff regrets the appearance that a public comment had been ignored. In order to ensure that proper consideration was given to all stakeholder comments, the NRC staff reviewed all written comments received and examined transcripts of public meetings to ensure that all issues had been addressed. An evaluation of Mr. Lochbaum's initial concern on potential impacts to plant workers expressed at the July 1999 public workshop is included in the **IOLB Section of the REPORT** ?????**TANYA TO PROVIDE REFERENCE**?????????.

DLPM Public Comment #16: Peter James Atherton requested on April 10, 2000, that the comment period on the spent fuel pool risk report be extended by 3 months.

Response: The original 45 day comment period ended on April 7, 2000. In a public meeting on May 9, 2000, NRC managers told Mr. Atherton that the comment period would be extended until June 9, 2000.

DLPM Public Comment #17: The NRC should identify and address possible conflicts of interests, and differing professional opinions as to the use of PRA (probabilistic risk assessment). For instance, Dr. Hanauer was quoted in a memo to say, "you can make probabilistic numbers prove anything, by which I mean that probabilistic numbers mean prove nothing."

Response: It is the policy of the Commission to maintain a working environment that encourages the employees to make known their best professional judgements even though they may differ from a prevailing staff view. An objective of this policy is to ensure full consideration and prompt disposition of differing opinions and views by affording an independent, impartial review by qualified personnel.

Dr. Hanauer was a respected NRC technical advisor in the 1970's. However, in the two and a half decades since his statement was quoted ("you can make probabilistic numbers prove anything, by which I mean, that probabilistic numbers prove nothing"), there have been significant advances in risk assessment methodologies. In that time frame, the NRC has also gained a great deal of experience in applying these methodologies to the regulatory arena, which has led to improved safety. The NRC has determined that PRA is an acceptable technology and uses it in a manner that complements a deterministic approach and supports the traditional defense-in-depth philosophy.

DLPM Public Comment #19: Peter James Atherton stated that the NRC should make references used in the spent fuel pool risk study available at no cost.

Response: The NRC policy is that all pertinent regulatory information is made available to the public via the Public Document Room and/or through the Agency Document and Management System (ADAMS) where this information is available for inspection at no charge. However, during the period of this study, the NRC took additional actions to provide Mr. Atherton with free copies of all routine correspondence and of numerous studies and reports that he specifically requested. Additionally, the NRC provided free copies of the draft spent fuel pool risk study to all interested persons who attended the July 1999 public workshop and to all other members of the public who requested it.

DLPM Public Comment #20: Peter James Atherton commented that changes to decommissioning regulations should be made on an interim basis, to be reviewed again at some future date.

Response: The NRC does not plan to issue interim regulations for decommissioning. Rulemaking is a methodical and deliberately lengthy procedure to ensure that a rule is not issued without due process. Provisions for public comment as well as independent review committees afford ample opportunity to examine a rulemaking prior to issuing a new rule. Any person who believes an NRC regulation is no longer applicable may petition the Commission to issue rescind, or amend that regulation in accordance with 10 CFR 2.802.