Summary Highlights of NRC/DOE Technical Exchange and Management Meeting on Pre-Closure Safety

July 24-26, 2001
Las Vegas, Nevada

Introduction and Objectives

This Technical Exchange and Management Meeting on Pre-Closure Safety is one in a series of meetings related to the U.S. Nuclear Regulatory Commission (NRC) issue resolution and sufficiency review, and the U.S. Department of Energy (DOE) site recommendation decision. Consistent with NRC regulations on prelicensing consultations and a 1992 agreement with the DOE, staff-level resolution can be achieved during pre-licensing consultation. The purpose of issue resolution is to assure that sufficient information is available on an issue to enable the NRC to docket a proposed license application. Resolution at the staff level does not preclude an issue being raised and considered during the licensing proceedings, nor does it prejudge what the NRC staff evaluation of that issue will be after its licensing review. Issue resolution at the staff level, during pre-licensing, is achieved when the staff has no further questions or comments at a point in time regarding how the DOE is addressing an issue. The discussions recorded here reflect NRC's current understanding of DOE's Pre-Closure safety assessment. This understanding is based on all information available to date which includes limited, focused, risk-informed reviews of selected portions of recently provided DOE documents (e.g., system description documents and the Repository Safety Strategy).

Summary of Meeting

In its opening presentation, the NRC stated that the status of issue closure regarding the Pre-Closure Safety Area would not be discussed at this Technical Exchange and Management Meeting because: (1) a Pre-Closure Issue Resolution Status Report has not been issued, (2) the Yucca Mountain Review Plan has not been released, and (3) this is the first technical exchange and management meeting related to the Pre-Closure Safety Area where DOE/NRC agreements will be reached. The NRC stated that in a letter dated April 27, 2001, it highlighted a number of specific topics it was prepared to discuss during this meeting, but that it was not prepared to discuss every subtopic or acceptance criteria within a Pre-Closure Safety topic. Based on these discussions, the NRC and DOE reached a number of agreements on topics related to Pre-Closure Safety. The NRC/DOE agreements made at the meeting are provided in Attachment 1. The agenda and the attendance list are provided in Attachments 2 and 3, respectively. Copies of the presenters' slides are provided in Attachment 4. Highlights from the Technical Exchange and Management Meeting are summarized below.

Highlights

1) Opening Comments

In its opening comments, NRC provided a general overview of the Pre-Closure Safety topics (see "Overview of Pre-Closure Meeting" presentation given by James Andersen). In its presentation, the NRC provided the safety terms and definitions that would be used during the meeting and stated that Pre-Closure Safety is one of many NRC requirements. The NRC also

discussed its proposal to divide Pre-Closure Safety into ten topics as discussed in an NRC letter dated April 27, 2001. Under these ten topics, the NRC stated that it plans to define subtopics and/or acceptance criteria DOE would need to address in any future license application. These subtopics and/or acceptance criteria would be outlined in future Pre-Closure meetings, as well as the Yucca Mountain Review Plan. The NRC stated that it would not discuss the status of issue closure regarding any of these ten Pre-Closure Safety topics at this meeting because: (1) a Pre-Closure Issue Resolution Status Report has not been issued, (2) the Yucca Mountain Review Plan has not been released, and (3) this is the first technical exchange and management meeting related to the Pre-Closure Safety Area where DOE/NRC agreements will be reached. The NRC proposed that any agreements reached would fall under one of the ten Pre-Closure Safety topics and that each agreement identification number would take the same form as used for the Key Technical Issues. DOE agreed with this approach.

2) Development of the License Application Integrated Safety Analysis: Overview of the ISA Process and ISA Products

DOE provided a general overview of the Integrated Safety Analysis (ISA) Process and stated that the presentation would (1) describe how an ISA is developed to support a license application for a potential repository, and (2) lay the framework and context for discussion of specific ISA topics (see "Development of the Integrated Safety Analysis for a License Application" presentation given by Dennis Richardson). DOE stated that the ISA process starts with identification of all the hazards that could be present at the proposed repository. DOE then discussed how these internal and external hazards get analyzed with respect to their frequency of occurrence and consequences. The ISA process also has a feedback loop for DOE to implement an event prevention or mitigation strategy. This iterative process would then feed into the specific design criteria, site description documents, design evaluation/support, and the Q-list. The NRC had several questions on the overview. In particular, the NRC questioned why the internal and external event analysis blocks were treated separately. DOE responded that the reviews of internal and external events are not done separately, but are coupled and performed in parallel. The NRC questioned why a frequency assessment was not included in the external event analysis. DOE stated that it was being done, but was not shown in the overview slide. The NRC also questioned why the consequence analysis came before the selection of design basis events in the overview slide, but not on the slide discussing the ISA products. DOE responded that it did categorize the design basis events before performing a consequence analysis. DOE also stated that the ISA process is an iterative process. The NRC stated that in future presentations of the overview of the ISA process, it would be helpful if DOE considered implementing these comments in the revision of the block diagram. DOE stated that it would update the block diagram to better identify that (1) it will perform external event frequency assessment, (2) design basis event categorization be done before the consequence analyses, and (3) the external and internal hazards be treated in an integrated fashion.

DOE then discussed, in general, the ISA products it expected to prepare for inclusion into the license application. The NRC noted that it considered all the ISA products as part of the ISA, not just the final overall analysis. DOE agreed with this comment and referred to page 5 of the ISA presentation that illustrated the expected products that would be part of the ISA. DOE stated that it was currently developing an ISA Guide, which will describe the approach for developing an ISA, identify acceptable methods for analyzing and documenting Pre-Closure safety analysis, ensure ISA consistency with regulatory requirements, provide consistency and

uniformity in analyses, provide a basis for training, and facilitate communication between the design and licensing organizations. The NRC asked whether DOE would have one standard method or a range of quantitative and qualitative methods for analyzing and documenting Pre-Closure safety analyses. DOE stated that it would try to use a common method best suited for the proposed repository, but that it may use other methods if deemed more appropriate for a particular case (e.g., a more qualitative approach). The NRC questioned how the ISA guidance would be used in comparison to the Technical Guidance Document (TGD). DOE stated that the ISA guidance document would go into more detail than the TGD.

After additional internal discussions, the NRC asked DOE to clarify how external events were analyzed, specifically, if external event analyses would include identification and assignment of frequencies for event sequences, how external events were integrated with internal event analyses, and how external event analyses factored into design considerations. DOE stated that, in this respect, external event analyses would be treated in the same fashion as internal event analyses. DOE further stated that its process would integrate both internal and external event analyses.

3) Identification of Hazards and Initiating Events

Aircraft Crash Hazard

DOE provided responses to several NRC comments relating to aircraft hazards (see "Identification of Hazards and Initiating Events NRC Item 3(a) Aircraft Hazards" presentation given by Richard Morissette) as discussed below.

The first NRC comment was that the exclusion of aircraft crash from the list of potential human induced hazards that may affect the proposed repository is premature. DOE agreed with the NRC comment and stated that it had only completed preliminary analysis in this area, specifically to address site suitability. DOE agreed to include a more extensive evaluation in any future license application.

The next NRC comment pertained to DOE taking into account all types of aircraft flying in the vicinity of the proposed site. DOE stated that it would be developing a vicinity map with aircraft types and activities identified. DOE also stated that it would include both military and commercial aircraft, airways, and airports. The vicinity map would include commercial general aviation, DOE aircraft, and aircraft chartered by the DOE flying through airways and inside the restricted airspaces. DOE will also include the flight paths of military aircraft inside the restricted airspaces in addition to military training routes, target areas within the range, and use of airspace for different activities. DOE Yucca Mountain Project will analyze information collected by DOE/Nevada Operations on number of overflights by military aircraft through a seven mile square box centered on the Waste Handling Building and through the Nevada Test Site. NRC questioned whether the seven mile square box would include all the options currently being considered for surface facilities. DOE stated that it covers all current options.

The next NRC comment requested DOE to provide a reasonable projection into future flight activities, including the introduction of new types of aircraft and changes in military missions. DOE stated that it would work with the U.S. Air Force to obtain available information regarding future flight activities, aircraft types, and changes in military missions. DOE also stated that it

would obtain information from DOE/Nevada Operations regarding potential changes to flight activities in the DOE controlled airspace over the Nevada Test Site.

The next NRC comment pertained to the summation of probabilities from all types of aircraft from different operations taking place in the vicinity of the proposed site that has a potential to contribute a significant crash hazard. DOE stated that it would sum the annual crash frequencies from all operations that required quantitative crash frequency analysis within the vicinity.

NRC requested assessment of the flight modes of military aircraft in the vicinity of the proposed site. DOE agreed to collect this information and use it in the revised analysis. NRC questioned whether the DOE analyses would include emergency aircraft, ordnance on airplanes, and helicopters. DOE confirmed that it would appropriately account for these issues in its analyses. DOE also agreed to document the methodology used to develop the aircraft vicinity map including consideration of restricted airspace activities and nearby bombing range information. DOE indicated their intention to use a Uniform Overflight Density Model developed at Lawrence Livermore National Laboratory to assess the potential for aircraft hazards. This model takes credit for aircraft glide ratios in the event of aircraft engine failure. When asked if an agreement with the U.S. Air Force could be negotiated to control military flight activities near the Yucca Mountain site, DOE responded that it was premature to speculate on the potential for such an agreement at this time.

The next NRC comment was on consideration of air-to-ground and air-to-air combat training activities that may be carried out in the vicinity of the proposed site. DOE stated that it could collect information from the U.S. Air Force. After further discussions, the NRC and DOE reached one agreement in this area (see Enclosure 1 for details).

Tornado Missiles

DOE provided responses to several NRC comments related to tornado missiles and impact on waste package design (see “Identification of Hazards and Initiating Events NRC Item 3(e) Tornado Missile Hazards” presentation given by Douglas Orvis) as discussed below.

The first NRC comment pertained to characteristics of the missile not being commensurate with the bounding characteristics of the tornado missiles for the region. DOE stated that tornado missiles are not a hazard for disposal canisters/waste packages while they are inside the waste handling building or the subsurface facility. The necessary portions of the waste handling building would be designed to withstand credible tornado missiles. During the brief exposure time when a transporter carrying a waste package travels between the waste handling building and subsurface facilities, DOE’s preliminary screening analysis indicates that none of the disposal containers will be required to withstand the characteristics of a design-basis tornado missile because it is an incredible event scenario. NRC questioned the basis for the 1E-6 frequency of the missile generating design basis tornado. NRC stated that DOE should look at the whole class of events and needs to consider lower speed missiles and their impact on the waste packages rather than screening out all tornados because the probability of the largest one is below the cutoff. After further discussions, DOE and NRC reached one agreement in this area (see Enclosure 1 for details).

NRC questioned DOE's administrative procedures for responding to tornados. DOE stated that it would have administrative procedures for actions to take when tornados were predicted in the vicinity, but that it may not take credit for them in the ISA. The procedures may be used more as defense in depth. NRC questioned if retrieval was factored into DOE's tornado analysis. DOE stated that it was not presently included, but that it would have to update the analysis to take it into account should retrieval become necessary.

4) Identification of Event Sequences

DOE provided responses to several NRC comments relating to events screened out by design and justification of probability estimates (see "Identification of Event Sequences - NRC Item 4(a) and 4(b)" presentation given by Tom Dunn) as discussed below.

Events Screened Out by Design

DOE paraphrased the NRC position concerning the elimination by design of events that may result in a release. DOE stated that it could screen Pre-Closure design basis events based on a proposed design concept. The screening could be based on design features that reduce either probability or consequences and that it was consistent with the overall risk-informed performance-based philosophy in proposed 10 CFR Part 63. DOE further stated that the screening of design basis events must be defensible and that the uncertainties must be addressed to the extent they may impact either the categorization or the consequences of a potential design basis event.

Justification of Probability Estimates

DOE provided responses to NRC comments related to justification of probability estimates as discussed below. NRC asked for clarification as to how DOE treated failure data from nuclear industry and other commercial sources. DOE stated that both types of data will be used with appropriate justification for their use. DOE stated that it agreed with the NRC position that failure probabilities must be justified sufficient to support the design basis event categorization process. DOE stated that appropriate attention will be given to event scenarios that are near thresholds. The analysis would ensure that the technical basis supports the event categorization or that the categorization is conservative (e.g., an event that is of borderline beyond design basis event may be conservatively categorized as Category 2 and a borderline Category 2 may be conservatively categorized as Category 1).

The next NRC comment pertained to the use of point estimates of frequency of failure of different components in DOE's preliminary safety analysis. DOE stated that categorization of design basis events will be defensible, including the inputs and discussions on uncertainties and sensitivities associated with any failure rates or distributions of such rates. DOE stated that mean values will be used where applicable to categorize event frequencies. NRC questioned how beyond design basis events get captured in the design basis. DOE stated that it would analyze and include the systems, structures, and components in the design basis that would be relied on to push the probability or consequences below the regulatory limit. Items that are included in the design basis will be included in the potential license application. DOE stated other analyses would be available through document control and the licensing support network.

The next NRC comment pertained to probability estimates for component failures. DOE stated that it would, as appropriate, assign probability distributions to component failure rate estimates. These distributions will be used to estimate the mean component failure rate and the variability in the estimated failure rate.

The next NRC comment stated that if DOE obtains a probability distribution for the frequency of a Pre-Closure event sequence, the mean value of that distribution can be used to categorize the event sequence, provided that the probability distributions of the component failures are valid and appropriately account for uncertainty and variability. DOE stated that they interpret this to say that the mean is acceptable for categorizing an event. The NRC agreed and noted that if it is close to the border (i.e., between Category 1 and 2, or Category 2 and beyond design basis events), the uncertainty should be subject to further scrutiny.

After further NRC discussions, the staff stated that it agreed with DOE's general methodology in this area and that it would review future documents and provide any issues at that point. No agreements were needed at this time.

5) Consequence Analysis

DOE provided responses to several NRC comments related to consequence analysis (see "Consequence Analysis - NRC Item 5(a)" presentation given by Tom Dunn) as discussed below.

NRC provided a summary of its understanding of DOE's methodology for calculating doses under Category 1 and 2 design basis events (see NRC handout included in Enclosure 4). DOE agreed with NRC's understanding as explained in the following discussion.

NRC indicated that future DOE reports must document that no single Category 1 event sequence will result in a dose that exceeds the regulatory limits. DOE responded that the sum of the doses from normal operations and annualized (i.e., frequency-weighted) dose to the public from Category 1 events will be demonstrated to be below the regulatory limit. DOE will also demonstrate that the dose from any a single Category 1 event sequence will not exceed the regulatory limit and clarified that this comparison does not include the doses from normal operations.

After further NRC discussions, the staff stated that it agreed with DOE's general methodology in this area and that it would review future documents and provide any issues at that point. No agreements were needed at this time.

6) Identification of System, Structures, and Components (SSCs) Important to Safety and Waste Isolation

DOE divided this topic into four presentations. Each presentation is discussed below.

Identification of SSCs Important to Safety, NRC Items 6(a) and 6(b)

DOE provided responses to several NRC comments related to Q-List methodology and quality level categorization (see "Identification of SSCs Important to Safety NRC Items 6(a) and 6(b)" presentation given by Dealis Gwyn) as discussed below.

The first NRC comment pertained to DOE providing adequate justification for classifying SSCs as important to safety or not. NRC also provided examples of SSCs excluded from the Q-List without appropriate justification. DOE agreed with the comment and stated that it would provide adequate justification for the classification of all SSCs once the ISA is completed. DOE stated that the examples cited are not excluded from the Q-List; they have yet to be specifically classified.

The next NRC comment pertained to whether DOE's quality level classification process was based on the ISA process. DOE agreed that the classifications that support any license application need to be based on the ISA results which are not complete at this time. DOE stated that preliminary classification work was based on engineering judgment, project strategies and related assumptions of the roles of SSCs, and preliminary calculations. DOE then provided examples of preliminary classification. NRC had questions pertaining to the subsurface ventilation example. NRC questioned if the ventilation is needed to meet 10 CFR Part 20 requirements. DOE responded that ventilation does not appear to play a role in satisfying the requirements of 10 CFR Part 20 at this point, but that worker doses in the subsurface need to be assessed further. DOE added that ventilation is used more for cooling the waste packages and may increase post-closure performance. NRC also asked whether a technical basis existed which showed that ventilation could be lost for several weeks without compromising post-closure performance. DOE stated that the current basis is described in the Science and Engineering Report.

DOE then discussed its proposed criteria for risk informed classification analysis. NRC questioned how organ dose would be considered in the classification analysis. DOE responded that its formulas took organ dose into consideration, but that the chart was simplified to display only the principal performance objectives of the proposed 10 CFR Part 63.

The next NRC comment pertained to how DOE proposed to use the aggregated annualized dose expression along with importance analysis in the quality level classification of SSCs involved in event sequences. DOE agreed that the equations should be clarified and that project documents should be updated to reflect that clarification. DOE stated that contributions from surface and subsurface normal releases are included in the annualized dose; but DOE added a separate term for surface and subsurface normal operational release into the quality level classification equation for clarity. NRC questioned the terms of the equation and the units involved. DOE clarified the terms and stated that the units were annualized dose. DOE then discussed the process whereby "take-away" analyses for each SSC involved in an event sequence are used to obtain a quality level classification. DOE stated that the classification is based on the highest quality level identified from each event sequence that includes the SSC being evaluated. In response to an NRC question, DOE clarified that "take-away" analysis does not affect the values of the frequency-weighted and normal operation dose terms in the quality level classification equation.

The next NRC comment pertained to multiple Category 1 design basis events occurring in a single year. DOE stated that it will consider combinations of Category 1 design basis events occurring in a single year when performing SSC classifications and that additional dose terms for those multiple Category 1 event sequences would be included in the quality level classification equation.

The next NRC comment pertained to classifying the SSCs required to limit onsite worker doses as Quality Level 3 items. DOE stated that it believes that classifying items that limit onsite worker dose as Quality Level 3 will ensure that worker radiological risks are appropriately addressed. DOE further stated that items required for radiation worker safety are included on the Q-List as important to safety. NRC stated that with regard to power plant licensees, certain quality levels are typically placed on particular SSCs (e.g., reading of dosimetry badges). NRC asked if doses would be calculated for workers inside the waste handling building. DOE stated it had no problem adhering to NRC nuclear power plant licensing precedents. DOE stated that it plans to incorporate nuclear radiation worker safety practices that would eventually include worker dose analyses inside the waste handling building. NRC asked if a radiation protection program would be in place for all onsite employees and if personnel located on the Nevada Test Site and Nellis Air Force Range would be treated as radiation workers or members of the public. DOE stated that this determination had not yet been made.

The next NRC comment pertained to DOE's Quality Level 2 screening criteria and its consistency with proposed 10 CFR Part 63. DOE agreed that the classification procedure can be clarified to better link with the ISA approach and processes to be used in the license application. NRC asked when Quality Assurance Procedure QAP-2-3 would be revised. DOE stated that it would be done this calendar year.

The next two NRC comments pertained to the lack of justification for certain Quality Level 2 screening criteria identified in Quality Assurance Procedure QAP-2-3 (e.g., seismic 2/1 and fire as an initiating and/or interacting event). DOE stated that SSCs classified due only to interaction concerns (i.e., seismic 2/1) have been traditionally classified as nonnuclear safety related in the commercial nuclear power industry and placed in augmented quality assurance programs. NRC noted that the need for seismic 2/1 analysis should be minimized in the design process. DOE agreed. NRC also noted that when engineering judgment is used, the basis should be technically defensible and documented as part of the quality record. DOE agreed.

The next several NRC comments were discussed in this and earlier presentations.

Identification of SSCs Important to Safety - NRC Items 6(a) and 6(b): Examples

DOE provided several conceptual examples of quality level classification for SSCs important to safety (see "Identification of SSCs Important to Safety - NRC Items 6(a) and 6(b): Examples" presentation given by Douglas Orvis). DOE stated that following the development of event trees for credible initiating events and establishing event sequence frequencies, it will calculate offsite and occupational doses, as appropriate, to demonstrate compliance with the regulations. DOE then performs a "take-away analysis" of event sequences that include the SSC. The SSC is then classified consistent with design basis event sequence frequency reduction and dose mitigation importance. NRC commented that failure rate data from high quality equipment should not be used to justify a low quality classification. DOE agreed to the NRC comment.

The NRC had a number of clarifying questions. After further NRC discussions, the staff stated that it has a general understanding of the process but that the process needs to be more transparent. DOE agreed to make the process transparent in its revised Quality Assurance Procedure QAP-2-3 and ISA Guidance document.

Identification of SSCs Important to Safety - NRC Items 6(b), Concern 6

DOE provided a response to the NRC comment related to quality level categorization and risk measures (see "Identification of SSCs Important to Safety - NRC Items 6(b), Concern 6" presentation given by Douglas Orvis). DOE stated that it believes that it is not necessary to define or apply a measure of aggregate risk for the Pre-Closure operations, and that proposed 10 CFR Part 63 does not require this. Each event sequence end-state (frequency, dose) is represented by a point in the frequency-dose domain. DOE stated that it would demonstrate regulatory compliance by providing analyses and supporting technical bases that all credible event sequences are within the frequency-consequence boundaries defined by the proposed 10 CFR Part 63. DOE stated that it considers the insights gained from event-sequence frequency-dose calculations and sensitivity analyses, coupled with engineering judgment, to provide a robust risk-informed basis for determining the appropriate classification of SSCs. Regarding Regulatory Guides 1.174 and 1.176, DOE stated that the specific technical approaches in these Regulatory Guides are not directly applicable for important to safety SSC classification for the proposed repository. NRC commented that while these Regulatory Guides are not directly applicable, they still provide valuable generic guidance.

Identification of Items Important to Waste Isolation - NRC Items 6(b), Talking Point 6

DOE provided a response to the NRC comment related to waste isolation (see "Identification of Items Important to Waste Isolation - NRC Items 6(b), Talking Point 6" presentation given by Dennis Richardson). The NRC comment pertained to whether DOE intends to categorize SSCs important to waste isolation. DOE stated that the classification procedure includes criteria for classification of SSCs important to waste isolation into Quality Level 1, 2, 3, or conventional quality. Next, DOE provided the specific classification criteria and the applicable waste isolation questions related to each criterion. DOE discussed how the total system performance assessment (TSPA) is used to classify SSCs. DOE stated that if an item is shown in TSPA to be required to meet performance objectives, the item is classified as Quality Level 1; preserving initial conditions for TSPA is designated Quality Level 2; and monitoring used to demonstrate the site is performing within licensing specifications is designated Quality Level 3. In closing, DOE then presented some conceptual design examples for Quality Levels 1 and 3 waste isolation SSCs, and provided the preliminary classification and justification.

The NRC has developed a draft position paper on an acceptable approach to risk significance categorization of important to safety SSCs and made it available for this meeting (see Enclosure 4). The paper provides draft acceptance criteria that may become part of the Yucca Mountain Review Plan that is currently under preparation at the NRC. The paper has evaluated DOE's proposed methodology for Quality Level categorization. During this meeting, DOE responded to the concerns identified. NRC mentioned that it will revise the paper taking into consideration any comments by the DOE on the draft position paper. NRC commented that this meeting covered the overall approach to Quality Level categorization, but did not go into the implementation of a graded quality assurance program nor the relative differences among

levels of quality assurance implementation for Quality Levels 1, 2, and 3 SSCs. NRC reiterated its position that the 18 criteria in 10 CFR Part 50, Appendix B, are to be applied in a graded fashion, as appropriate, to all SSCs important to safety, whether or not grading is done.

After further NRC discussions, the NRC and DOE reached two agreements in Topic 6 (see Enclosure 1 for further information).

7) Level of Design Details: Differentiated Approach to Providing Information in the License Application

DOE discussed its internal license application guidance, products list, and level of design detail approach (see "License Application Level of Detail Discussion NRC Item 7(a)" presentation given by Stephen Cereghino). DOE discussed its license application guidance and stated that it is based on the Technical Guidance Document and will be captured in a "living" database that they consider to be a project management tool. DOE stated that this database will be revised based on the final 10 CFR Part 63 and Yucca Mountain Review Plan.

DOE then discussed the license application products list and stated that it would be based on its license application guidance and identifies products required to support preparation of a license application for construction authorization. DOE described a differentiated approach, update information, and four levels of detail for the different quality level SSCs in the license application. Information would be updated, as appropriate, by periodic amendments and at the time of the application to receive and possess waste. The differentiated approach pertains to different levels of information needing to be available for the construction authorization and for the application to receive and possess waste. DOE provided a number of topics that could be updated at the application to receive and possess waste including training, maintenance, and emergency planning. DOE also discussed its level of design detail approach for the license application. Graded approach pertains to the amount of information provided for SSCs commensurate with their safety significance, as indicated by the quality level assignments discussed in previous sessions. After this discussion, DOE and NRC stated that they would like to continue the dialogue in this area. NRC commented that information provided for commercial quality SSCs should be sufficient to justify their commercial quality classification and to evaluate their interactions with Quality Level 1, 2, and 3 SSCs.

NRC stated that it is in general agreement with the concept of (1) differentiated approach for information in the license application for construction authorization and the license application to receive and possess; and (2) level of design detail for SSCs in the license application. NRC noted that DOE is preparing internal license application guidance and a strategy for license application preparation. The NRC stated that it would be interested in reviewing DOE's license application guidance and would like to discuss it after the license application guidance document is revised to reflect 10 CFR Part 63 and the Yucca Mountain Review Plan. NRC would also like to discuss examples of implementation of graded level of detail of information to be provided in the license application. After these discussions, the NRC plans to finalize its paper on this topic (Note - NRC handed out the draft version of the paper at the beginning of the presentation and it is included in Enclosure 4).

8) Pre-closure Criticality Issues / Burnup Credit

DOE provided responses to several NRC comments related to the Preliminary Pre-Closure Safety Assessment for Monitored Geologic Repository Site Recommendation (see "Burnup Credit and Pre-Closure Criticality NRC Items 2(a) and 2(b)" presentation given by Thomas Doering) as discussed below.

Regarding the NRC comment associated with the use of burn-up credit in the design of the criticality control system of the waste packages for commercial spent nuclear fuel, DOE stated that this item reflects one of the open items in the Safety Evaluation Report for Disposal Criticality Analysis Methodology Topical Report. DOE further stated that Revision 1 of the Preclosure Criticality Analysis Process Report is currently scheduled for fiscal year 2003 and would include the approach for verification of fuel assembly burnup. DOE stated that burnup credit is only being sought for commercial spent nuclear fuel and that DOE believes that burnup information for the majority of the fuel developed and available through reactor records developed under an NRC accepted quality assurance program is the best source of assembly burnup information. NRC agreed that reactor records are a more accurate source of fuel assembly burnup data than physical measurements. However, NRC stated that its current position is that measurements are needed to verify the burnup indicated by reactor records, but that it would review DOE's approach after DOE submits Revision 1 of the Preclosure Criticality Analysis Process Report.

DOE then discussed NRC comments pertaining to flooding, probability of criticality, technical basis for beyond design basis events, and misload events. In each case, DOE stated that it would document appropriate risk-informed evaluations as part of the normal criticality safety evaluations. NRC stated that it would review these evaluations when they were provided.

As a result of further NRC discussions, the NRC and DOE reached one agreement in this area (see Enclosure 1 for further information).

9) Engineered Barrier System Design and Fabrication

DOE provided responses to several NRC comments related to the engineered barrier system design and fabrication (see "Engineered Barrier System Design and Fabrication NRC Item 7(e.1), 7(e.2), and 7(e.4)" and "Engineered Barrier System Design and Fabrication NRC Item 7(e.3) presentations given by Thomas Doering and Bruce Stanley) as discussed below.

The first NRC comments pertained to waste package drop issues. NRC commented that DOE needs to demonstrate that the mesh discretizations of the finite element models used to simulate the effects of waste package drop events are sufficient to provide reasonably convergent results that can be used to assess potential failure. DOE stated that benchmarking of the finite element analyses code against pour canister drop experiments has been performed and shows acceptable fidelity with test results. NRC questioned whether the pour canister is the proper analog, citing differences in materials of construction, dimensions, strain rate effects, etc. DOE stated that the pour canister benchmark evaluation allows DOE to see if the code is working properly for waste package design analyses. DOE addressed additional comments pertaining to the boundary conditions used in the waste package drop finite element models.

DOE addressed comments pertaining to the failure criterion for the waste package drop analysis. NRC asked if the structural integrity of the spent fuel was considered when establishing allowable drop heights. DOE stated that in the event of a drop, an assessment would be made as to whether the waste form must be re-packaged, but the primary consideration when establishing drop heights is the integrity of the waste package. DOE also noted that the re-packaging requirements have not yet been established, but will be based on long-term performance needs.

DOE addressed comments pertaining to orientations for the waste package drop scenarios. DOE stated that as part of the normal design process, design basis dynamic events will be re-evaluated as the designs for both the surface and subsurface facilities matures.

NRC asked if there has been any progress in quantifying the level of waste package reliability for the purpose of ISA and TSPA assessment as defined in Subsection 1.2.1.5 of the Uncanistered Spent Nuclear Fuel Disposal Container System Description Document. DOE stated that this requirement will be clarified in future revisions of the System Description Document. NRC asked about the operational procedures in the event of a waste package breach. DOE indicated that this has not been addressed and will be addressed in the future.

The next NRC comments pertained to waste package fabrication and welding issues. DOE addressed comments pertaining to chemical composition, microstructure, and allowances for variations in parameters that could affect Pre-Closure performance. NRC questioned the range of compositions reviewed and recommended that an appropriate set of tests be conducted to evaluate and justify that the effects of these variations are properly considered. DOE stated that samples being tested are made from a number of heats of material that cover a variety of compositions and therefore provide an understanding of material throughout the range of material composition.

DOE then addressed non-destructive evaluation methods. NRC questioned whether the non-destructive evaluation methods used to inspect the alloy 22 and 316 nuclear grade materials are sufficient and capable of detecting defects that may alter waste package mechanical properties. DOE stated that its fiscal year 2001 development program includes a study to identify the minimum flaw size that can be detected in alloy 22 material. DOE noted that the ASME flaw size criteria are being used for the study.

DOE addressed contamination controls and stated that production procedures have not yet been developed in this area, however, contamination control has been demonstrated through prototype welding. NRC stated that these are expected to be addressed in operational procedures. DOE agreed. DOE then addressed filler metal selection. DOE noted that samples being tested are made from a number of heats of this wire.

DOE then addressed several issues related to welding methods, environmental restriction, weld qualification tests, and weld joint design. DOE stated that it had not developed production procedures in these areas but would follow the ASME code. DOE also noted that this issue is partially addressed in CLST agreement CLST.2.05.

DOE addressed post-weld treatment and post-weld repair issues. DOE stated that studies of the laser peening process and induction annealing tests are ongoing and the results will be

documented. NRC questioned whether DOE had any initial thoughts regarding post-weld repair. DOE stated that it had not developed a production procedure or parameters at this time.

The next NRC comments pertained to fire design criteria. DOE addressed the fire design criteria and stated that the technical basis for classifying fire as a beyond design basis event is that significant fire hazards are intended to be precluded at the repository through the design of the SSCs. DOE stated that future analysis of any off-normal waste package events will be based on the Category 1 and 2 design basis event criteria defined in proposed 10 CFR Part 63. Once sufficient information is available on the design of the repository SSCs that interface with the waste package, the technical basis for off-normal waste package events will be documented.

The last NRC comments pertained to differential thermal expansion. DOE addressed whether provisions have been made for thermal expansion in the design of the gantry crane rails. DOE stated that, although not detailed at this time, a combination of fixed and slotted anchors will accommodate expansion. DOE also stated that the invert transverse beams are anchored on one end, and feature a slotted connection on the other end, allowing for expansion. DOE noted that the design is not yet complete and the invert configuration may change for license application.

As a result of additional discussions, the NRC and DOE reached four agreements in this area (see Enclosure 1 for details). With regard to agreement PRE.07.02, DOE indicated that this agreement only applies to Pre-Closure related activities because every post-closure model must already be validated to the extent described in the agreement. NRC pointed out that the spirit of agreement PRE.07.02 should extend to all important to safety and important to waste isolation SSCs, as appropriate, regardless of whether it is considered a pre- or post-closure item.

10) Public Comments

Ms. Judy Triechel (Nevada Nuclear Task Force) commented that she was familiar with aircraft crashes, particularly in this region. She stated that the U.S. Air Force does not live up to its agreements and she was aware of numerous instances in which the U.S. Air Force did not follow the rules and procedures it agreed to. Ms. Triechel stated that she believes aircraft hazards are a site suitability issue. Furthermore, due to the potential for future work on a missile defense system and other new defense initiatives, the suitability of the proposed site for a waste repository may be questionable.

Ms. Triechel also commented on the annualized dose requirement in proposed 10 CFR Part 63. Ms. Triechel stated that frequency should not be part of the dose number and that the results of accident analysis calculations should be provided in dose, not annualized dose. Ms. Triechel commented that by using the frequency-weighted and annualized dose numbers, the results would not be understood by the public.

Ms. Triechel commented on the difference between site recommendation and license application. She noted that with some of the agreements being scheduled in fiscal year 2003, it was hard to understand how DOE could make a site recommendation in 2001. Ms. Triechel

also questioned what DOE meant by the service life of the rail system. DOE stated that the service life meant the period of time until repository closure.

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