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COMPARISON OF THE NUCLEAR REGULATORY COMMISSION AND U.S. DEPARTMENT OF ENERGY REVIEW GUIDANCE FOR THE INTEGRATED SAFETY ANALYSIS OF THE TANK WASTE REMEDIATION SYSTEM

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EXECUTIVE SUMMARY

The Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) guidance for integrated safety analyses (ISA) of tank waste remediation system (TWRS) facilities and processes is compared to determine whether the guidance is sufficiently consistent to support a smooth transition from DOE regulation to NRC regulation if such a transition is directed. The comparison revealed differences in the purposes and procedures contained in the NRC and DOE documents. The NRC standard review plan for fuel cycle facilities (draft NUREG-1520) is directed toward evaluation of a complete license application (LA), while the DOE ISA guidance is directed only toward evaluation of safety requirements documents and integrated safety management plans submitted by TWRS privatization contractors. However, direct comparison may be made between the DOE guidance for reviews of the safety requirements document and chapter 4.0 of Draft NUREG-1520. These two guidance documents differ in the level of detail specified for review in the extent to which they specify acceptable ISA methodology. NRC's Integrated Safety Analysis Document (NUREG-1513), which describes several generally accepted ISA methods and provides guidance for their selection, is presented in a much greater level of detail. The DOE philosophy for TWRS privatization standards approval review describes how the TWRS privatization contractors will select the safety standards and requirements to which the Contractors will operate and, therefore, provides little insight of ISA methodology.

Although the scope of this report did not include an overall evaluation of ISA methodologies, the population of ISA methodologies is limited, and the ISAs that will be performed by the TWRS privatization contractors are likely to be consistent with the guidance suggested by Draft NUREG-1520 and Draft NUREG-1513.

1 INTRODUCTION

In anticipation of legislation directing the Nuclear Regulatory Commission (NRC) to become the regulator for the Hanford, Washington, Tank Waste Remediation System (TWRS) at the Hanford Site in Washington state, the NRC has initiated a program to ensure a smooth transition of the oversight responsibilities from the U.S. Department of Energy (DOE). An important aspect of the TWRS program is the Integrated Safety Analyses (ISA) that will be conducted of TWRS facilities and processes. The NRC tasked the Center for Nuclear Waste Regulatory Analyses (CNWRA) to compare the guidance contained in the following NRC and DOE documents:

- Philosophy for TWRS Privatization Standards Approval Reviews (Philosophy Paper) (U.S. Department of Energy, 1997a)
- Discussion Paper for DOE/RU Review of the Safety Requirements Document and Integrated Safety Management Plan Submitted by the TWRS Privatization Contractor (Discussion Paper) (U.S. Department of Energy, 1997b)
- Chapter 4.0, Integrated Safety Analysis, of the Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility (Draft NUREG-1520) (Nuclear Regulatory Commission, 1995a)
- Integrated Safety Analysis Guidance Document (Draft NUREG-1513) (Nuclear Regulatory Commission, 1995b).

The objective of the comparison was to evaluate the adequacy of the conceptual approach described in the two DOE documents and any supporting documents with respect to NRC guidance on conducting ISAs provided in chapter 4.0 of Draft NUREG-1520. The comparison was also to evaluate the topical requirements and attributes in section 5.0 of the DOE Discussion Paper for consistency with NRC acceptance criteria as provided in Draft NUREG-1520 and amplified in Draft NUREG-1513.

The comparison of the NRC and DOE documents is presented in three parts. First, synopses of the four source documents are provided discussing scope and applicability, general approach, and level of detail. Second, direct comparisons of NRC Draft NUREG-1520, chapter 4.0 and the DOE Discussion Paper are made with respect to topical coverage and level of detail. Finally, the implications of the DOE TWRS guidance on ISA for the NRC regulatory framework are discussed. The DOE supporting documents were determined not to be relevant to ISA methodology and were not included in the analysis.

2 SYNOPSES OF THE NUCLEAR REGULATORY COMMISSION AND U.S. DEPARTMENT OF ENERGY INTEGRATED SAFETY ANALYSES GUIDANCE DOCUMENTS

2.1 STANDARD REVIEW PLAN FOR THE REVIEW OF A LICENSE APPLICATION FOR A FUEL CYCLE FACILITY (DRAFT NUREG-1520), CHAPTER 4.0, INTEGRATED SAFETY ANALYSIS

2.1.1 Scope and Applicability

Draft NUREG-1520 chapter 4 provides the standard review plan (SRP) for review of fuel cycle facility license applications after the applicant has performed an ISA. It is intended to evaluate all phases of the ISA process; site, facility, and process descriptions; compilation and maintenance of hazard and process information; ISA team training and qualification; selection and justification of the ISA method; description of ISA results; description of hazards controls; and continued maintenance of an up-to-date ISA. Draft NUREG-1520 may also be used to perform prelicensing reviews and as guidance to licensees.

2.1.2 General Approach

Draft NUREG-1520 identifies acceptable methods for complying with the regulatory requirements of 10 CFR Part 70 (draft) in the context areas of review, acceptance criteria, and review procedures. Particularly in its acceptance criteria, Draft NUREG-1520 identifies specific information and compliance demonstrations that should be included in a license application (LA). Applicants are not obligated to follow the guidance of Draft NUREG-1520, but differing approaches must be adequately justified and would likely require more staff review time. Draft NUREG-1520 does not address ISA management and planning which is covered in the DOE Discussion Paper (see section 2.4.2). The NRC may consider adding ISA management and planning as another area of review.

2.1.3 Level of Detail

Draft NUREG-1520 provides a high level of detail, in many cases citing specific technical criteria and methods. Draft NUREG-1513 is referenced as supplemental guidance.

2.2 INTEGRATED SAFETY ANALYSIS GUIDANCE DOCUMENT (DRAFT NUREG-1513)

2.2.1 Scope and Applicability

Draft NUREG-1513 provides NRC guidance to applicants and licensees for meeting 10 CFR Part 70 requirements for ISAs. It addresses selection of an ISA method, choosing an ISA team, and conducting an ISA. Draft NUREG-1513 is referenced in Draft NUREG-1520 as a source for acceptance criteria for the selection of the hazard analysis and accident analysis methods.

2.2.2 General Approach

Draft NUREG-1513 describes several generally accepted techniques that may be used to analyze process hazards. Information from various industry sources was used to prepare Draft NUREG-1513, with particular emphasis on techniques adopted by the American Institute of Chemical Engineers (1992). It is consistent with Occupational Safety and Health Administration (OSHA) (1992) and the U.S. Environmental Protection Agency (EPA) (1993) regulations.

2.2.3 Level of Detail

Draft NUREG-1513 provides a high level of detail, sufficient for an applicant to perform an ISA and document the results. It provides a detailed flowchart of the hazard analysis method selection process taken from the American Institute of Chemical Engineers and contains several example analyses.

2.3 PHILOSOPHY FOR THE TWRS PRIVATIZATION STANDARDS APPROVAL REVIEWS RL/REG-97-0X, REVISION A, FEBRUARY 21, 1997

2.3.1 Scope and Applicability

This document (Philosophy Paper) establishes the general DOE policy for identifying key TWRS safety requirements and provides the foundation for DOE safety standards approval, including the approach to developing review guidance. TWRS privatization contractors will select the standards and requirements applicable to their processes and activities, and DOE will evaluate and approve the selected standards and requirements prior to construction authorization.

2.3.2 General Approach

The Philosophy Paper addresses topics related to DOE acceptance of TWRS contractor safety standards including standards-based integrated safety management, development of the authorization basis, identification of primary safety requirements, definition of the DOE-stipulated standards process (standards identification process), preparation of the safety requirements document (SRD) submittal package, the integrated safety management plan (ISMP) submittal package, SRD/ISMP coupling, SRD/ISMP revision, and guidance philosophy. This document emphasizes the nonprescriptive way that DOE is managing the TWRS privatization. Rather than DOE imposing specific requirements that must be conservative and therefore potentially excessive and inefficient, the contractors must choose and justify their selection of safety standards. The DOE objective is to use standards and requirements that are efficient, economical, and tailored to the specific application. The Philosophy Paper does not provide review procedures or acceptance criteria.

2.3.3 Level of Detail

This is a high-level document that has no detailed guidance for conducting ISAs. It describes, in very general terms, the types of documents that will be required of the TWRS privatization contractors to support their selection of safety requirements.

2.4 DISCUSSION PAPER FOR DOE/RU REVIEW OF THE SAFETY REQUIREMENTS DOCUMENTS AND THE INTEGRATED SAFETY MANAGEMENT PLAN SUBMITTED BY THE TWRS PRIVATIZATION CONTRACTOR RL/REG-97-0X, FEBRUARY 1997

2.4.1 Scope and Applicability

The DOE Discussion Paper provides guidance for two TWRS contractor deliverables that address the planning portion of the ISA: the SRD and the ISMP. With respect to the SRD, the Discussion Paper addresses process and facility descriptions, hazards assessment, hazards control strategy, the identification process, rationale and justification, the confirmation process, SRD format and content, standards and principles, the approval process, and certification by the contractor.

With respect to the ISMP, the Discussion Paper addresses key safety related activities, the standards based management process, SRD compliance, regulatory interfaces, the flow and schedule of safety related work and deliverables, the self-assessment program, roles and responsibilities, and compliance with 29 CFR 1910.119. The Discussion Paper also emphasizes that the TWRS contractor-selected safety management processes must be (i) standards based, (ii) tailored to the specific hazards associated with the work processes, and (iii) ensure compliance with applicable laws and regulations.

2.4.2 General Approach

The Discussion Paper provides criteria for the SRD and ISMP required of the TWRS contractors. In particular, the portion associated with the SRD addresses many ISA subjects, although at a more general level than in Draft NUREGs 1520 and 1513. Consistent with the approach described in the Philosophy Paper, the Discussion Paper avoids prescribing the ISA methods to be used.

2.4.3 Level of Detail

The Discussion Paper provides criteria for the SRD and ISMP at a general level of specificity. It does not provide review procedures or acceptance criteria.

3 DETAILED COMPARISON OF THE NUCLEAR REGULATORY COMMISSION AND U.S. DEPARTMENT OF ENERGY INTEGRATED SAFETY ANALYSIS GUIDANCE

The synopses in section 2 of this report indicate that the NRC and DOE guidance documents address different programmatic functions (review of an LA versus identification of safety standards) and reflect different (almost opposing) perspectives for identifying acceptable ISA methods. Generally speaking, the DOE documents are conceptual (i.e., philosophy and discussion papers) and the NRC documents are detailed (i.e., review plan and ISA guidance). Since Draft NUREG-1513 addresses selection and application of specific ISA methods, it cannot be directly compared to either the Philosophy Paper, the Discussion Paper, or the referenced supporting documents. (The referenced supporting documents were briefly reviewed and determined not to be relevant to ISA methodology.) Similarly, the DOE Philosophy Paper does not address review of an LA and cannot be compared to Draft NUREG-1520.

Only Draft NUREG-1520 and the DOE Discussion Paper can be directly compared; specifically chapter 4.0 of Draft NUREG-1520 and section 5 of the Discussion Paper dealing with the SRD review. Both describe ISA methodology selection and implementation.

Draft NUREG-1520, Chapter 4.0 provides areas of review, acceptance criteria, and review procedures. Section 5 of the Discussion Paper provides topical requirements and attributes that define DOE expectations for fulfillment of the requirements. [The topical requirements are taken directly from the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors (U.S. Department of Energy, 1996).] Attributes include descriptions and submittal expectations in terms of the format and organization of the information to be submitted. The acceptance criteria from Draft NUREG-1520 and the attribute descriptions from the Discussion Paper provide the primary basis for comparison.

For each of the areas of review of Draft NUREG-1520, Chapter 4.0, the text of the sections entitled Areas of Review, Review Procedures, and Acceptance Criteria are presented with the corresponding text of the Discussion Paper, section 5.0, and the results of the comparison.

3.1 SITE DESCRIPTION

3.1.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the site description (see Section 1.3, Site Description) with respect to those factors that could affect safety, such as geography, meteorology (e.g., high winds, flood potential), seismology, and demography."

"Review Procedure: The staff reviews the applicant's description of the site for the nuclear materials processing facility to determine if adequate information is presented to provide an understanding of those factors that could pose a hazard to the facility. Specific external hazards (such as location of nearby airports, rail lines, port facilities, other nuclear or chemical facilities, dams, rivers, etc.) should be identified in the application by the reviewer. The reviewer should also look for identification of severe weather conditions and other external factors such as hurricanes, earthquakes, floods, tornadoes, etc., that are specific to the site."

"Acceptance Criteria: The description of the site where processing of nuclear material will take place is considered acceptable if the following safety-related information is included or referenced in the application:

(a) A brief description of the site geography, including its location relative to prominent natural and man-made features such as mountains, rivers, airports, population centers, possibly hazardous commercial and manufacturing facilities, etc.

(b) Population information based on recent census data show population distribution as a function of distance from the facility.

(c) A discussion of natural phenomena (e.g., tornadoes, hurricanes, earthquakes) and other external events that could have an adverse impact on safety. The discussion should indicate which events are considered to be incredible and the basis for that determination."

3.1.2 DOE Discussion Paper

"5.1.3.5 Attribute 5—Site Description: The Contractor will submit a summary description of the site sufficient to support hazards identification, hazards characterization, and risk-informed decision making to control the hazards. This description should include, as appropriate, a summary of the site geography, demography, meteorology, hydrology, geology, and seismology. Man-made external events that contribute to the hazards to the facility workers or could contribute to the "release" of the hazards associated with the facility should be included."

3.1.3 Comparison Results

The NRC and DOE guidance is equivalent.

3.2 FACILITY DESCRIPTION

3.2.1 Draft NUREG-1520 Chapter 4.0

"Area of Review: The staff reviews the facility description with respect to features that could affect potential accidents and their consequences. Examples of these features are facility location, facility design information, and the location and arrangement of buildings on the facility site."

"Review Procedure: The staff reviews the applicant's description of the facility to determine if the features that could affect potential accidents and their consequences are adequately discussed. The reviewer should verify that information describing the location and arrangement of buildings at the site and their distance from the site boundary is provided. The reviewer should determine that design criteria for the facility are justified on the basis that (1) they are sufficient to withstand the effects of credible external events that could occur at the site or (2) the consequences of such credible external events are acceptable, given their expected frequency of occurrence."

"Acceptance Criteria: For purposes of the ISA, the description of the facility is considered acceptable if the features that are considered important to safety are identified and described. If such

information is available elsewhere in the LA, reference to the appropriate sections is considered acceptable. The information provided should adequately support an overall understanding of the facility structure and its general arrangement as it pertains to the ISA. As a minimum, the features that should be identified and briefly described are as follows:

(a) The facility location and the distance from the site boundary.

(b) Design information regarding the ability of the facility to withstand the effects of credible external events identified in section 4.4.1.c.

(c) The location and arrangement of buildings on the facility site."

3.2.2 DOE Discussion Paper

"5.1.3.3 Attribute 3—Facility Description: The Contractor will submit a summary description of the facility. This description should include the purpose and function of each building, a summary of design information regarding the facility's resistance to the effects of external events, the location and arrangement of the buildings on the site and their distance from the facility fence and the site boundary, and a summary of other features (if any) that could affect hazards identification, hazards characterization, and risk-informed decision making to control the hazards."

3.2.3 Comparison Results

The NRC and DOE guidance is equivalent.

3.3 PROCESS DESCRIPTIONS

3.3.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the description of each process analyzed as part of the ISA. Specific areas that are reviewed are basic process function and theory, major components—their function and operation, process design and equipment, and process operating ranges and limits."

"Review Procedure: The staff reviews the applicant's description of each process analyzed in the ISA to determine that it provides an adequate understanding of process function and theory, as well as major component function and operation. The staff also reviews information provided on process design, equipment, and instrumentation to determine that it is insufficient to understand the results of the ISA."

"Acceptance Criteria: The description of the processes analyzed as part of the ISA are considered acceptable if the following features are identified and briefly described. If the information is available elsewhere in the LA, reference to the appropriate sections is considered acceptable. The information provided should adequately support an overall understanding of the facility process operations as they pertain to the ISA:

(a) Basic process function and theory. This information should include a general discussion of the basic theory of the process.

(b) Major components—their function and operation. This information should include the general arrangement, function, and operation of major components in the process. It should include process schematics showing the major components and instrumentation and, if appropriate, chemical flowsheets showing compositions of the various process streams.

(c) Process design and equipment. This information should include a discussion of process design, equipment, and instrumentation that is detailed enough to understand the results of the ISA. It should include detailed equipment schematics.

(d) Process operating ranges and limits. This information should include the operating ranges and limits for all measured variables (e.g., temperatures, pressures, flows, and compositions) used in engineered or administrative controls safe operation of the process. The process operating limits and ranges are considered acceptable if they are consistent with those assumed in the ISA."

3.3.2 DOE Discussion Paper

"5.1.3.2 Attribute 2—Systems Descriptions: The Contractor will submit descriptions of its planned tank waste treatment systems. These descriptions should include the basic functions of the systems and the key components/equipment involved. These descriptions, along with operating characteristics and approximate operating ranges and limits, should be sufficient to support hazards identification, hazards characterization, and risk-informed decision making to control the hazards."

3.3.3 Comparison Results

Draft NUREG-1520 provides specific acceptance criteria (e.g., requiring detailed equipment schematics and process operating ranges and limits). In contrast, the Discussion Paper is general and goal oriented, requiring descriptions "sufficient to support hazards identification, hazards characterization, and risk-informed decision making."

3.4 MAINTENANCE OF PROCESS SAFETY INFORMATION

3.4.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the applicant's commitment to compile and maintain a current and accurate set of process safety information (PSI) including information on the hazardous materials, technology, and equipment used in each process. This activity should be explained in detail in the applicant's description of its configuration management program [section 3.1 of this standard review plan (SRP)]."

"Review Procedures: The staff reviews the applicant's commitment to compile and maintain current and accurate PSI on hazardous materials, process technology, and process equipment."

"Acceptance Criteria: For purposes of conducting an ISA, the applicant's PSI is considered acceptable if a commitment is provided that, at a minimum, the following information is maintained current and accurate:

(a) Hazardous material information including toxicity information, permissible exposure limits, physical data, reactivity data, corrosivity data, and thermal and chemical stability data.

(b) Process technology information including block flow diagram or simplified process flow diagram, process chemistry, maximum intended inventory, and safe upper and lower limits for such items as temperatures, pressures, flows, and compositions.

(c) Process equipment information including materials of construction, piping and instrumentation diagrams (P&IDs), electrical classification, relief system design and design basis, ventilation system design, design codes and standards employed, material and energy balances, and safety systems (e.g., interlocks, detection, and suppression systems)."

3.4.2 DOE Discussion Paper

Not directly addressed.

3.4.3 Comparison Results

The Discussion Paper does not explicitly identify a requirement to maintain process safety information accurate and current.

3.5 INTEGRATED SAFETY ANALYSIS TEAM TRAINING AND QUALIFICATION

3.5.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the description of the applicant's requirements for ISA team training and qualifications."

"Review Procedure: The staff reviews the applicant's description of the ISA team to determine the makeup of the team and qualifications of the team leader and team members. The reviewer should determine if the qualifications of the team meet the acceptance criteria in section 4.5.3.5."

"Acceptance Criteria: The ISA team is considered acceptable if the following criteria are met:

(a) The ISA team shall have a team leader who is formally trained and knowledgeable in the ISA methodology chosen for the hazard and accident evaluations. In addition, the team leader shall be able to demonstrate a thorough understanding of all process operations and hazards under evaluation, but should not be the cognizant engineer or expert for that process.

(b) At least one member of the ISA team shall have specific and detailed experience in the process under evaluation.

(c) A variety of process operating and engineering design experience should be represented across the team. Radiation safety, nuclear safety, fire protection, and chemical safety disciplines should also be represented.

(d) The applicant shall provide a commitment to assign a manager to provide overall administrative and technical direction for the ISA."

3.5.2 DOE Discussion Paper

"5.4.3.3 Attribute—Management Credentials: The Contractor should provide the credentials of the process manager and each member selected to serve on the process management team along with its assessment of these credentials against the qualifications delineated in section 5.4.3.2."

"5.4.3.4 Attribute 4—Identification Team Credentials: The Contractor will provide the credentials of each member selected to serve on the standards identification team along with its assessment of these credentials against the qualifications delineated in section 5.4.3.2. A description of each member's knowledge of the specific work to be performed and of similar work should be provided. A description of their work experience on relevant projects and an indication of the success of those projects also should be included. Any involvement in other standards committees should be indicated. In addition, their technical training such as degrees and specialized training should be described."

"5.6.3.1 Attribute I—Team Charter: The Contractor will provide the specific charter under which the independent review team (IRT) operated. The charter should include the team's scope and responsibilities."

"5.6.3.2 Attribute 2—Team Selection Criteria: The contractor will describe the requirements and selection criteria for the Individual Review Team. Consideration should be given to including an appropriate DOE (non-RU) member on this team. A description of the independence of the team should be included."

"5.6.3.3 Attribute 3—Delineation of Assignments: The Contractor will provide for each member of the Individual Review Team, a delineation of specific areas for which the individual was responsible."

"5.6.3.4 Attribute 4—Specification of Credentials: The Contractor will provide the technical credentials of each member selected to serve on the Independent Review Team. A description of each member's detailed knowledge of the specific work to be performed and any relevant knowledge of similar work should be provided. A description of their work experience on relevant projects and an indication of the success of those projects also should be included. Any involvement in standards committees should be indicated. In addition, their technical training such as degrees and specialized training should be described."

3.5.3 Comparison Results

The Discussion Paper requires descriptions of specific information similar to the information required by Draft NUREG-1520, but it does not establish acceptance criteria for personnel training and qualification such as those in the NUREG-1520.

3.6 INTEGRATED SAFETY ANALYSIS METHOD USED AND JUSTIFICATION FOR SELECTION

3.6.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the ISA method used and the justification for its selection. For purposes of this review, the ISA begins with an identification of hazards (chemical, radiological, criticality, etc.) that may present a potential threat to the public, facility workers, and the environment. Based on an analysis of these hazards, the ISA identifies a set of individual accidents (defined as a sequence of unplanned events with undesirable consequences) that could result from the hazards. The accidents thus transform the threat from the hazards into consequences. The review of the ISA methodology includes evaluating the following specific areas

(a) The method used by the applicant for hazard identification.

(b) The method used by the applicant for hazard analysis and accident identification.

(c) The method used by the applicant for consequence determination.

(d) The method used by the applicant for accident evaluation sequence construction and evaluation."

"Review Procedure: The staff reviews the applicant's description of the ISA methodology selected to verify that the applicant has provided a cogent description of the methodology (i.e., the methods used for hazard identification, hazard analysis and accident identification, accident consequence determination, and accident analysis) and the bases for its choice. The reviewer verifies that the acceptance criteria in section 4.5.3.6 are satisfied."

"Acceptance Criteria: The descriptive summary of the ISA methodology is considered acceptable if the reviewer determines that the applicant has provided a cogent description of the methodology (i.e., the methods used for hazard identification, hazard analysis and accident identification, accident consequence determination, and accident sequence evaluation) and the bases for its selection. Specific acceptance criteria for the ISA methodology are:

(a) The hazard identification method selected is considered acceptable if it:

(i) Provides a list of materials (radioactive, fissile, flammable, and toxic) and/or conditions that could result in hazardous situations (e.g., loss of containment of licensed nuclear material). The list should include maximum intended inventory amounts and the location of the hazardous materials at the facility.

(ii) Determines potential interactions between materials or between materials and conditions that could result in hazardous situations.

(b) The hazard analysis method selected is considered acceptable if,

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(i) Its selection is consistent with the guidance provided in NUREG-1513 (1995). Justification and references for methods not addressed in NUREG-1513 should be provided.

(ii) It analyzes the hazards identified in section 4.4.6.a. Any hazards eliminated from further consideration should be identified and justified.

(iii) It provides reasonable assurance that all significant accident sequences (including the controls used to prevent or mitigate the accidents) that could result in radiological and certain chemical consequences are identified.

(iv) It takes into account the interactions of identified hazards and proposed controls to ensure that the overall level of risk at the facility is minimized.

(v) It addresses all modes of operation including startup, operation, shutdown, and maintenance.

(vi) It addresses hazards resulting from process deviations (e.g., high temperature, high pressure), internal (to the facility) initiators (e.g., fires, explosions), and possible credible external events (e.g., floods, high winds, earthquakes, airplane crashes). Justification should be provided for a licensee's determination that certain events are incredible and, therefore, not subject to analysis in the ISA.

(c) For each accident identified in section 4.5.3.6.b that has been demonstrated or assumed to result in a criticality event or have consequences in excess of the thresholds given in 10 CFR 70.41(9)(ii), an accident analysis method should be used to demonstrate the adequacy of controls implemented to provide protection. The accident analysis method is considered acceptable if:

(i) Its selection is consistent with the guidance provided in NUREG-1513 (1995). Justification and references for methods not addressed in NUREG-1513 should be provided.

(ii) It is able to demonstrate adherence to the double contingency and double protection principles (see section 4.5.3.8) and the absence of common mode failures."

3.6.2 DOE Discussion Paper

"5.1.3.6 Attribute 6—Operational Scenarios: The Contractor will submit a summary description of the intended operational scenarios, including anticipated events (internal and external), sufficient to support hazards identification, hazards characterization, and risk-informed decision making to control the hazards. This description should include startup, shutdown, maintenance/equipment change-out, processing cycles (if batch-type), and off-normal events, particularly as they relate to hazards that differ from those associated with steady-state operation and as they relate to different deployment of operating personnel."

"5.2.3.1 Attribute 1—Methodology: The Contractor will describe the hazards analysis approach/methodology used to identify and characterize the hazards associated with its planned waste processing activities. The description is expected to include methodology, selection criteria for participants, and justification for the selection of the approach."

"5.2.3.2 Attribute 2—Comprehensiveness: The Contractor will provide sufficient documentation of the hazards assessment approach for its planned waste processing activities to demonstrate that the assessment is comprehensive, addressing all its planned activities and associated postulated events through the life cycle (preoperation testing, operational modes, deactivation, etc.)"

"5.2.3.3 Attribute 3—Hazards Characterization: The Contractor's hazards assessment should produce results that permit risk-informed judgments to be made on the need for and importance of hazards controls. Further, the results will address the Contractor's facility workers, Hanford Site workers, the public, and environmental pathways to the public."

"5.2.3.4 Attribute 4—Assessment Scope: The Contractor's hazard assessment approach should identify and characterize a broad set of hazards, including radiological, nuclear, toxicological, explosion, fire, falling objects, electrical, and so on, which could potentially harm workers (facility and/or site) or the public directly, or indirectly through the initiation of hazardous events and/or damage to hazard control features."

"5.2.3.5 Attribute 5—Control Strategy Facilitation: The hazards assessment should be performed in sufficient detail to permit the Contractor to utilize a graded approach in the formulation of effective and efficient control strategies for each identified hazard."

"5.2.3.6 Attribute 6—Assessment Results: The Contractor should clearly present the results of its identification, analysis, and characterization of the hazards for its entire tank waste processing endeavor. This should include the full spectrum of results showing the distribution of hazards in the facility for various operational states, the distribution of identified hazardous events by severity and hazard type, and the categories of hazards that require differing levels of controls because of their risk."

"5.2.3.7 Attribute 7—Assessment Bases: The Contractor will clearly describe the basis for the assessment and characterization of each hazard in terms of (as applicable) hazardous material inventories at risk, release mechanisms (energy sources for example), material transportability, transport paths and assumed transport mechanisms, assumed barriers to delivery of the hazard to a designated receptor, health impact considerations used (e.g., dose levels, toxicity of chemicals, etc.), assumed location of receptors, assumed prevention/mitigation features or measures, etc."

3.6.3 Comparison Results

Draft NUREG-1520 contains specific acceptance criteria, including reference to Draft NUREG-1513, for hazard analysis method selection and accident analysis method selection. The Discussion Paper requires descriptions with specific types of information, but does not establish acceptance criteria for the methods described.

3.7 INTEGRATED SAFETY ANALYSIS RESULTS

3.7.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the narrative description and the tabular summary of the results of the ISA with respect to the following specific areas:

(a) Description of the hazards and the resulting potential accidents caused by deviations from normal operations, internally initiated events (e.g., explosions, fires), and externally initiated events (e.g., floods, high winds, earthquakes).

(b) Description of the unmitigated consequences of a postulated accident to facility workers and the public.

(c) Comparison of the unmitigated consequences of each accident with the defined "consequences of concern" defined in 10 CFR Part 70. This regulation states that the licensee's program must:

> '...provide reasonable assurance that (i) for normal and off-normal conditions, the requirements of Part 20 are satisfied and unplanned criticalities are avoided; and (ii) for accident conditions, it is unlikely that any member of the public offsite will receive a total radiation dose of .05Sv (5 rem) total effective dose equivalent, an intake of 30 milligrams of uranium in soluble form, or an exposure to hydrogen fluoride in air equivalent to immersion for 30 minutes in a concentration of 25 milligrams per cubic meter.'

(d) Description of each significant potential accident sequence (i.e., an accident sequence with consequences that exceed the thresholds in 10 CFR Part 70) starting with the initiating event through the accident end state."

"Review Procedure: The staff reviews the narrative and tabular summary of the results of the ISA to determine if the information provided is complete and satisfies the acceptance criteria in section 4.5.3.7. The information reviewed includes

(a) A listing of hazardous materials and conditions; also a table showing interactions between materials and between materials and conditions that could result in a hazardous situation.

(b) A listing of the potential accidents that could result from the hazards identified in section 4.5.3.7.a including the consequences of each accident.

(c) For each accident identified in section 4.5.3.7.b that has been demonstrated or is assumed to have consequences in excess of those identified in 10 CFR 70, a logic diagram (or other appropriate technique) that identifies the independent failure events required to cause the accident."

"Acceptance Criteria: The narrative description and tabular summary of the results of the ISA are acceptable if the following criteria are met:

(a) The hazard identification method should provide:

(i) A list of materials (radioactive, fissile, flammable, and toxic) or conditions that could result in hazardous situations. The list should include maximum intended inventory amounts and the location of the hazardous materials at the site.

(ii) A table showing potential interactions between materials or between materials and conditions that could result in hazardous situations.

(b) The hazard analysis method should provide a tabular summary description of the potential accidents that could result from deviations from normal operations, internally initiated events (e.g., explosions, fires), and externally initiated events (e.g., floods, high winds, earthquakes). The description should list deviations from normal operations, the causes of such deviations, the unmitigated consequences of the resulting accidents, the controls or barriers expected to prevent or mitigate the accidents, and the level of quality and reliability established for each control. The listing should clearly indicate the linkage between each individual cause, the resulting consequence, and the control(s) used to prevent or mitigate the consequence. The magnitude of each consequence may either be evaluated (see section 4.5.3.7.c) or may be assumed to exceed the consequences of concern stated in 10 CFR 70.

(c) The application of the consequence evaluation method(s) to the accidents identified in section 4.5.3.7.b should be demonstrated by the applicant in the appropriate safety chapters of the LA (i.e., "Nuclear Criticality Safety," "Chemical Safety").

(d) For each accident identified in section 4.5.3.7.b that has been demonstrated or assumed to have consequences in excess of those identified in 10 CFR 70 the accident analysis methodology should clearly identify, using logic diagrams or other appropriate techniques, the independent failure events required to cause the accident. This information is needed to demonstrate adherence to the double contingency and double protection principles (see section 4.5.3.8) and the absence of common mode failures."

3.7.2 DOE Discussion Paper

"5.2.3.6 Attribute 6—Assessment Results: The Contractor should clearly present the results of its identification, analysis, and characterization of the hazards for its entire tank waste process endeavor. This should include the full spectrum of results showing the distribution of hazards in the facility for various operational states, the distribution of identified hazardous events by severity and hazard type, and the categories of hazards that require differing levels of controls because of their risk."

"5.2.3.7 Attribute 7—Assessment Bases: The Contractor will clearly describe the basis for the assessment and characterization of each hazard in terms of (as applicable) hazardous material inventories at risk, release mechanisms (energy sources for example), material transportability, transport paths and assumed transport mechanisms, assumed barriers to delivery of the hazard to a designated receptor, health

impact considerations used (e.g., dose levels, toxicity of chemicals, etc.), assumed location of receptors, assumed prevention/mitigation features or measures, etc."

3.7.3 Comparison Results

Draft NUREG-1520 identifies specific information to be included in the description of ISA results to a much greater degree than does the Discussion Paper.

3.8 ADMINISTRATIVE AND PHYSICAL SAFETY CONTROLS

3.8.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the description of the administrative controls, engineered safety features, and physical barriers used to maintain safe operation of the facility to ensure that, for each accident sequence, the number and quality of controls are commensurate with staff acceptance criteria. Such criteria are based on the consequence level the controls are intended to prevent or mitigate."

"Review Procedure: The staff reviews the administrative and physical safety controls identified in the ISA to determine if they satisfy the acceptance criteria provided in section 4.5.3.8. These criteria specify the number, quality, and reliability of the controls needed to prevent or mitigate the consequences of identified accidents."

"Acceptance Criteria: The barriers or controls used to ensure safe operation of the facility are considered acceptable if there is reasonable assurance that they will prevent or mitigate the accident sequences identified in section 4.5.3.7.b and section 4.5.3.7.d. Such assurance will be provided by adherence to criteria governing the type, number, quality, and reliability of the individual safety features. Specific acceptance criteria for ensuring the adequacy of facility controls follow:

(a) For an accident sequence that results in a criticality event, adherence to double contingency should be demonstrated. Adherence to double contingency requires that at least two unlikely and independent events are necessary to enable the occurrence of a criticality. In addition to adherence to double contingency, the quality and reliability of controls used to prevent the criticality event must be of the highest level as defined by the applicant in accordance with section 3.3 of this SRP.

(b) For an accident sequence other than a criticality that results in consequences equal to or greater than the accident consequences stated in 10 CFR Part 70, the "double protection" principle should be demonstrated. The double protection principle states that at least two unlikely and independent events are necessary to enable the unmitigated consequences of the accident to be realized. Similar to a potential criticality sequence, the controls used to prevent such a sequence should be of the highest quality and reliability (as defined by the applicant in accordance with section 3.3 of this SRP). However, unlike a criticality sequence, the controls may be used to mitigate the consequences of the accident rather than to protect against its occurrence. If such controls are chosen, the mitigated consequences of the accident must be demonstrated to be below the consequence thresholds stated in 10 CFR 70.

(c) For an accident sequence that results in consequences less than the accident consequences stated in 10 CFR 70, but which exceed the requirements of 10 CFR Part 20, at least a single unlikely event must occur before the unmitigated consequences of the accident are realized. Any control(s) used to mitigate or prevent the consequences of such an accident should be of acceptable quality (as defined by the applicant in accordance with section 3.3 of this SRP). If mitigation control(s) are implemented, the mitigated consequences of the accident must be demonstrated not to exceed the requirements of 10 CFR 20."

3.8.2 DOE Discussion Paper

5.3 Hazards Control Strategies: (This section of the Discussion Paper discusses control strategies, but does not call for description of the actual control measures to be taken.)

3.8.3 Comparison Results

The Discussion Paper requires the SRD to describe hazards control strategies, but it does not require a full description of the administrative and physical controls that are required in Draft NUREG-1520. The Discussion Paper is directed toward an early phase TWRS deliverable, much before the point when control methods would be identified.

3.9 ADMINISTRATIVE CONTROLS

3.9.1 Draft NUREG-1520 Chapter 4.0

"Areas of Review: The staff reviews the administrative controls for conducting and maintaining the ISA to ensure its overall integrity as a continuously current and accurate design basis for the facility safety program. Specific review areas include the applicant's procedures for ISA performance and update, review responsibility, documentation of the ISA, and record maintenance. Such procedures should be a part of the applicant's CM program."

"Review Procedure: The staff reviews the administrative controls that are proposed to ensure the integrity of the ISA. The reviewer verifies that the controls include procedures for ISA performance and update, review responsibility, documentation, and record maintenance."

"Acceptance Criteria: The description of the administrative controls used to ensure the integrity of the ISA is considered acceptable if an acceptable system of configuration management is identified and described. Such a system would include management policies, organizational responsibilities, administrative controls, and procedures governing the performance, review, and approval of the initial ISA and any revisions to the ISA. Administrative controls should ensure the independence of reviewing organizations and individual reviewers. Procedures should be established to control records and supporting documentation pertaining to the ISA."

3.9.2 DOE DISCUSSION PAPER

Not addressed.

3.9.3 Comparison Results

The Discussion Paper does not address administrative controls to maintain the integrity of the ISA.

3.10 SUMMARY

In summary, the Discussion Paper generally does not establish acceptance criteria equivalent to those in Draft NUREG-1520. The Discussion Paper reflects the DOE philosophy of allowing the TWRS privatization contractors to identify and justify the standards applicable to their activities and processes.

4 CONCLUSIONS

The evaluations of the NRC and DOE ISA guidance documents, with a direct comparison of Draft NUREG-1520 chapter 4.0 and section 5.0 of the DOE Discussion Paper, indicate that the NRC and DOE guidance documents have different purposes, are to be applied at different stages of the ISA process, address different levels of detail, and present different approaches for identifying acceptable ISA methods. These differences may be so significant that the ISA performed by the TWRS privatization contractors may not meet the specific acceptance criteria of Draft NUREG-1520 or may not be consistent with the guidance of Draft NUREG-1513. The NRC has relied on industry standards from the American Institute of Chemical Engineers (1992) and regulatory guidance from the OSHA (1992) and the EPA (1993) in identifying acceptable hazards and accident analysis methods in Draft NUREG-1513. Furthermore, the Introduction to Draft NUREG-1520 states that the acceptance criteria are intended to communicate the underlying objectives of the regulatory requirements, but that the acceptance criteria do not represent the only means of satisfying the objective. Therefore, because the sources of ISA methodology available to the TWRS privatization contractors are likely to encompass the full range of generally accepted ISA methods, it is concluded that the TWRS privatization contractors are likely (but are not assured) to select methods consistent with those identified in Draft NUREGS-1513 and satisfy the criteria of Draft NUREG-1520.

5 REFERENCES

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