RL/REG-98-03
Revision 0

DOE Regulatory Unit Evaluation Report of the BNFL Inc. Integrated Safety Management Plan

March 1998

Office of Radiological, Nuclear, and Process
Safety Regulation of TWRS Privatization Contractors

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PREFACE

The Department of Energy's (DOE) Richland Operations Office (RL) issued the TWRS Privatization Request for Proposal (RFP) for Hanford Tank Waste Remediation System (TWRS) Privatization in February 1996. Offers were requested to submit proposals for the initial processing of the tank waste at Hanford. Some of this radioactive waste has been stored in large underground storage tanks at the Hanford Site since 1944. Currently, approximately 56 million gallons of waste containing approximately 240,000 metric tons of processed chemicals and 250 mega-curies of radionuclides are being stored in 177 tanks. These caustic wastes are in the form of liquids, slurries, saltcakes, and sludges. The wastes stored in the tanks are defined as high-level radioactive waste (10 CFR Part 50, Appendix F) and hazardous waste (Resource Conservation and Recovery Act).

Under the privatization concept, DOE will purchase waste treatment services from a contractor-owned, contractor-operated facility under a fixed-price contract. DOE will provide the waste feedstock to be processed but maintain ownership of the waste. The contractor must: a) provide private financing; b) design the equipment and facility; c) apply for and receive required permits and licenses; d) construct the facility and bring it on-line; e) operate the facility to treat the waste according to DOE specifications; and f) deactivate the facility.

The TWRS Privatization Program is divided into two phases, Phase I and Phase II. Phase I is a proof-of-concept/commercial demonstration-scale effort the objectives of which are to a) demonstrate the technical and business viability of using privatized contractors to treat Hanford tank waste; b) define and maintain adequate levels of radiological, nuclear, process, and occupational safety; c) maintain environmental protection and compliance; and d) substantially reduce life-cycle costs and time required to treat the tank waste. The Phase I effort consists of two parts: Part A and Part B.

Part A consists of a twenty-month development period to establish appropriate and necessary technical, operational, regulatory, business, and financial elements. This will include identification by the TWRS Privatization Contractors and approval by DOE of appropriate safety standards, formulation by the Contractors and approval by DOE of integrated safety management plans, and preparation by the Contractors and evaluation by DOE of initial safety assessments. Of the twenty-month period, sixteen months will be used by the Contractors to develop the Part-A products and four months will be used by DOE to evaluate the products.

Part B consists of a demonstration period to provide tank waste treatment services by one or more of the TWRS Privatization Contractors who successfully complete Part A. Demonstration will address a range of wastes representative of those in the Hanford tanks. Part B will be 10 to 14 years in duration. Within Part B, wastes will be processed during a 5- to 9-year period and will result in treatment of 6 to 13 percent of the Hanford tank waste.

Phase II will be a full-scale production phase in which the remaining tank waste will be processed on a schedule that will accomplish removal from all single-shelled tanks by the year 2018. The objectives of Phase II are to a) implement the lessons learned from Phase I; and b) process all tank waste into forms suitable for final disposal.

A key element of the TWRS Privatization Contracts is DOE regulation of radiological, nuclear, and process safety through the establishment of a specifically chartered, dedicated Regulatory Unit (RU) at RL. This regulation by the RU is authorized by the document entitled Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors (referred to as the Policy) and implemented through the document entitled Memorandum of Agreement for the Execution of Radiological, Nuclear, and Process Safety Regulation of the TWRS Privatization Contractors (referred to as the MOA). The Policy is signed by the Under Secretary of Energy; the Manager, RL; the Assistant Secretary for Environment, Safety and Health (ASEH); and the Assistant Secretary for Environmental Management (ASEM). The MOA is signed by the Manager, RL; the ASEH; and the ASEM. The nature and characteristics of this regulation are also specified in these documents. The MOA details certain interactions among RL, the ASEH, and the ASEM as well as their respective roles and responsibilities for implementation of this regulation.

The authority of the RU to regulate the TWRS Privatization Contractors is derived solely from the terms of the TWRS Privatization Contracts. Its authority to regulate the Contractors on behalf of DOE is derived from the Policy. The nature and scope of this special regulation (in the sense that it is based on terms of a contract rather than formal regulations) is delineated in the MOA, the TWRS Privatization Contracts, and the four documents (listed below), which are incorporated into the Contracts. This special regulation by the RU in no way replaces any legally established external regulatory authority to regulate in accordance with their duly promulgated regulations nor relieves the Contractors from any obligations to comply with such regulations or to be subject to the enforcement practices contained therein.

The Policy, the MOA, the TWRS Privatization Contracts, and the four documents incorporated in the Contracts define the essential elements of the regulatory program, which will be executed by the RU and to which the TWRS Privatization Contractors must conform. The four documents incorporated in the Contracts (and also incorporated in the MOA) are

Concept of the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0005,

DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0003,

Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors, DOE/RL-96-0006, and

Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization, DOE/RL-96-0003.

In the execution of the regulatory program, the RU will consider not only the relevant approaches and practices of DOE but also those of the Nuclear Regulatory Commission (NRC). The Policy states that

"It is DOE's policy that TWRS privatized contractor activities be regulated in a manner that assures adequate radiological, nuclear, and process safety by application of regulatory concepts and principles consistent with those of the Nuclear Regulatory Commission."

To this end, the RU will interact with the NRC (under the provisions of a memorandum of understanding with the NRC) during development of regulatory guidance and during execution of the regulatory program to ensure implementation of this policy.

All documents issued by the Office of Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors are available to the public through the DOE/RL Public Reading Room at the Washington State University, Tri-Cities Consolidation Information Center, Room 101L, 100 Sprout Road, Richland, Washington, 99352.

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Executive Summary

This Evaluation Report documents the evaluation of the BNFL Inc. *Integrated Safety Management Plan* (ISMP), BNFL-5193-ISP-01, Revision 0. The ISMP was submitted to the U.S. Department of Energy, Richland Operations Office (RL), Office of Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors (Regulatory Unit [RU]) on September 26, 1997. The ISMP is one part of the BNFL Standards Approval (SA) Package identified by Table S4-1 of the U.S. Department of Energy (DOE) Contract with BNFL Inc. (DE-AC06-96RL13308).

The DOE regulatory approach for TWRS Privatization (TWRS-P) activities requires that the Contractor take an active role in identifying and recommending the standards and requirements that will be used to achieve adequate safety for its specific activities. These standards and requirements, and the standards-based integrated safety management program that will be employed to meet them, are documented in the SA Package. With submittal of the BNFL SA Package, the RU began the first of six major regulatory actions (i.e., Standards Approval). The purpose of the SA regulatory action is to approve the Contractor-recommended set of radiological, nuclear, and process safety standards and requirements documented in its Safety Requirements Document (SRD) and to approve the Contractor's standards-based integrated safety management program documented in its ISMP. These documents serve as the basis for the Contractor's subsequent safety-related activities.

This report documents the review of the BNFL ISMP that was performed in accordance with the *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package*, RL/REG-97-07.[1] The SA regulatory action was conducted in accordance with *DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, DOE/RL-96-0003.[2] The reviewers systematically evaluated the ISMP and formulated a set of detailed conclusions. These conclusions are based on the ISMP approval criteria in DOE/RL-96-0003 and support the RU Regulatory Official's (RO) determination of whether the ISMP should be approved.

The review was conducted in two steps:

1. A 7-day Acceptability Review to determine whether the SA Package (and the ISMP as a component) was acceptable for Detailed Review.

2. A 14-week Detailed Review culminating in this Evaluation Report.

The 7-day Acceptability Review was conducted from September 26, 1997, through October 3, 1997. At the conclusion of this review, the BNFL ISMP was determined to be acceptable for Detailed Review. The Detailed Review was conducted from October 3, 1997, through January 12, 1998. This review was performed by a 22-member review team who evaluated the information and commitments provided in the ISMP. The team used the approval criteria in DOE/RL-96-0003 and the review guidance in RL/REG-97-07; formulated RU review questions for BNFL; and made conclusions regarding the extent to which the ISMP satisfied the approval criteria in DOE/RL-96-0003.

1. *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package*, RL/REG-97-07, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, July 1997.

2. *DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, DOE/RL-96-0003, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, February 1996.

The review team identified deficiencies in BNFL's submittal with respect to the following approval criteria (DOE/RL-96-0003, Section 3.3.1, "Standards Approval"):

> "The selected safety management processes documented in the ISMP are standards based and are appropriately tailored to the hazards associated with the Contractor's proposed facility, its operation, and its deactivation; [and]
>
> The selected safety management processes documented in the ISMP properly and adequately address management of process hazards;"

These criteria were evaluated considering the full BNFL SA submittal and the Initial Safety Assessment (ISA). As noted in Section 3.5 of this document, the BNFL ISMP contains appropriate features of integrated safety management. However, in examining the ISA, which reflects execution of the process defined in the ISMP, the reviewers determined BNFL has not followed the rigorous process of identifying and characterizing hazards, developing control strategies, and documenting the set of standards and requirements necessary to ensure implementation of the control strategies specified in DOE/RL-96-0003.[3] BNFL's process is also not always consistent with the approach documented in their ISMP. This is particularly evident in BNFL's treatment of the hazards associated with criticality and hydrogen evolution.

BNFL's designation and use of Design Class (DC) I and II with respect to structures, systems and components (SSCs) is another example of inadequately following the integrated safety management process that tailors control strategies to risk.

Because these deficiencies deviate from the precepts of integrated safety management and the process as described in the Contract, they are significant and must be corrected. The result of these process deficiencies is a large number of open issues which limit the ability of the RU to establish the adequacy of the BNFL safety basis. These issues are documented in the *Initial Safety Evaluation Report*, RL/REG-98-09.[4] BNFL must take action prior to Part B to ensure their integrated safety management process is implemented as required by the Contract. This will ensure that future iterations of their hazards analysis process will identify all potential hazards. Additionally, BNFL must redefine the classification of SSCs so that the contractual definition of "important to safety" and the intent of integrated safety management are met.[5]

The review team identified the following additional conditions for approval. These actions are within the scope of Part A activities and must be completed prior to starting any preliminary design activities affected by the actions:

1. BNFL shall revise the submitted ISMP to incorporate modifications committed to by BNFL in its responses to the RU's questions during review of the SA Package.

3. *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privitization*, DOE/RL-96-0003, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, February 1996.

4. *DOE Regulatory Unit Initial Safety Evaluation Report of the BNFL Inc. Initial Safety Assessment*, DOE/RL-98-09, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 1998.

5. In "Response to RL/REG-98-01 DRAFT DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document and RL/REG-98-03 DRAFT DOE Regulatory Unit Evaluation Report of the BNFL Inc. Integrated Safety Management Plan,'" BNFL letter W338-98-0011, Donald W. Edwards, BNFL Inc. to D. Clark Gibbs, DOE Richland Operations Office, Regulatory Unit, Richland, Washington, dated March 3, 1998, BNFL committed to change their design classification scheme. This must be incorporated in the ISMP.

2. BNFL shall revise Section 3.3 of the ISMP to clearly describe an authorization basis management process that conforms to the RU position described in RL/REG-97-13, *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*.[6] (Section 3.2.2.3 "Authorization Basis")

3. BNFL shall submit a revised Quality Assurance Plan (QAP) for RU review and approval. (Section 3.1.3, "10 CFR 830.120 Evaluation")

4. BNFL shall submit a schedule, including specific dates, for safety-related activities. (Section 3.8, "Scheduling of Safety Related Activities")

5. BNFL shall modify the ISMP to provide a description of their plans to implement defense in depth. (Section 3.2.2.1, "Defense-in-Depth"; see also DOE/RL-98-09)

6. BNFL shall revise the ISMP to either (1) indicate that BNFL Inc. accepts ultimate responsibility for safety, or (2) clarify that the General Manager's ultimate responsibility for safety is equivalent to the Contractor's responsibility. (Section 3.2.2.2, "Safety Responsibility" and Section 3.2.3.1.3, "Process Safety Responsibility")

6. *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*, RL/REG-97-13, Revision 2, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, December 1997.

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1.0 Introduction and Purpose

The Standards Approval (SA) regulatory action is being conducted in accordance with DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0003.[1] DOE/RL-96-0003 provides the process to be followed during the SA regulatory action and the criteria to be met by the BNFL Integrated Safety Management Plan (ISMP). Major steps of the regulatory action include the following:

- Receipt of Contractor Standards Approval (SA) package
- Acceptance Review of SA Package
- Detailed Review of SA Package including submittal of questions to the Contractor
- Receipt of Contractor responses to questions
- Contractor-hosted meeting with the Regulatory Unit (RU)
- Preparation of draft Safety Requirements Document (SRD) and ISMP evaluation reports
- Public and Contractor comment on the draft evaluation reports
- Finalize and issue evaluation reports.

This Evaluation Report documents the results of the first six steps listed above. The Evaluation Report provides recommendations regarding approval of the BNFL ISMP. The RU's review of the ISMP was planned and executed in accordance with the RL/REG-97-05, *BNFL Inc. Standards Approval Review Planning Handbook*.[2] The technical basis for the RU's review is contained in RL/REG-97-07, *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package*.[3] RL/REG-97-07 also was made available to BNFL for information purposes.

The completeness and adequacy of the BNFL SA Package for technical review was determined by an Acceptability Review. The Acceptability Review was based on the SA input requirements listed in DOE/RL-96-0003, Section 4.1.2, relative to the ISMP. Upon completion of the Acceptability Review, the Detailed Review was performed following the SA approval criteria outlined in RL/REG-97-07, in accordance with those criteria listed in DOE/RL-96-0003.

The results of the RU's review of the ISMP are presented in this Evaluation Report and have been organized to be compatible with the approval criteria listed in Section 2 of this report. This Evaluation Report will be provided to the Regulatory Official (RO) who determines approval of the ISMP.

1.1 Overview of BNFL Proposed Facility

The Contractor proposed two options for the BNFL TWRS-P facility. These options are referred to as the low-activity waste (LAW)-only option and the high-level waste (HLW)/LAW option. Both are designed to process the waste feeds (liquids with low solids content) specified as Envelopes A, B, and C in the Contract. In addition, the HLW/LAW option is designed to process the waste feed (a solids-bearing liquid slurry) specified as Envelope D in the Contract.

1. DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0003, Rev. 0, February 1996.

2. *BNFL, Inc. Standards Approval Review Planning Handbook*, RL/REG-97-05, Rev. 0, 1997.

3. *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package*, RL/REG-97-07, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, July 1997.

The LAW-only plant is designed to process the waste feed into low- and high-activity fractions and to immobilize the low-activity fraction in a glass waste form that meets the Contract specifications. The facility design includes provisions for interim storage, and return to DOE, of high-activity fractions (solids entrained in the feed, strontium, transuranic [TRU] elements, technetium, and cesium). The HLW/LAW plant also is designed to separate the waste feed into low- and high-activity fractions, as well as immobilize both fractions in glass waste forms that meet specifications in the Contract. In this case, the separated high-activity fractions from processing of Envelopes A, B, and C are blended with envelope D and incorporated into the high-level glass products. Due to the many facility and processing similarities between the two options, the HLW/LAW option is described in the following paragraphs; differences for the LAW-only option are noted.

The BNFL TWRS-P facility comprises a radioactive waste treatment building and several supporting structures (an immobilized waste container shipping building, a melter assembly building, an empty container storage building, a wet chemical storage building, a glass formers storage building, a service building, and an administration building). The waste pretreatment and vitrification processes are housed in remotely operated hot cells within the radioactive waste treatment building. The major processing steps include the following:

- Feed receipt
- Feed evaporation
- Solids removal by ultrafiltration
- Cesium and technetium removal by ion exchange
- Cesium recovery as a solid (LAW-only option)
- Melter feed preparation
- LAW vitrification
- HLW vitrification
- Vitrification offgas treatment.

The waste feed to the plant will be provided by the U.S. Department of Energy (DOE) to an existing double-shell tank (241-AP-106). From there waste will be transferred by the Contractor, in suitable batch sizes, through an underground pipe to feed receipt tanks in the BNFL TWRS-P Radioactive Waste Treatment Building. At the front end of the Contractor's process, ultrafiltration and feed evaporation steps are designed to separate the waste into concentrated solids and liquid fractions and to adjust the liquid stream to a constant 7M sodium concentration for subsequent processing. For Envelope C, a precipitation step is included before ultrafiltration to remove strontium and TRU elements with other solids in the ultrafiltration step. The liquid stream is then processed through cation and anion exchange resins to remove cesium and technetium before it is concentrated and blended with glass-forming additives in the LAW melter feed preparation part of the process. To minimize the volume of HLW, the concentrated solids fraction is washed to remove dissolvable components that are blended with the separated cesium and technetium and glass-forming additives in the HLW melter feed preparation part of the process. The blended feeds are fed as slurries to the joule-heated ceramic melters that are to be used for LAW and HLW vitrification. The glass melt is poured from the LAW and HLW melters into the LAW and HLW product containers. The offgas from the melters includes steam, air, acid gases (principally nitrogen oxides), radioactive gases and entrained aerosols. The offgas treatment systems process these offgases-to produce a gaseous effluent that can be discharged to the atmosphere without exceeding environmental discharge limits.

The LAW-only option differs from the HLW/LAW option in that the separated solids slurries and cesium are returned to DOE. The cesium is loaded onto a crystalline silicotitanate (CST) ion-exchange material, dried, and enclosed in sealed containers before it is returned. Separated technetium is stored as a concentrated solution in the BNFL TWRS-P facility.

2.0 Review Process

The ISMP review process is based on RL/REG-97-07, which provides a method for review and approval of the ISMP portion of the Contractor's SA Package. The ISMP describes the Contractor's management system that ensures control of the agreed-upon work definition. RL/REG-97-07 presents review considerations, termed "attributes," that the reviewers used to reach conclusions on the adequacy of the ISMP. Reviewers also considered other information drawn from their individual experience and expertise in formulating their conclusions.

2.1 ISMP Review Approach

The reviewers systematically evaluated the BNFL ISMP using the criteria established in DOE/RL-96-0003. The review process consisted of two steps:

1. A 7-day Acceptability Review to determine whether the SA Package (and the ISMP as a component) was acceptable for Detailed Review.

2. A 14-week Detailed Review culminating in this Evaluation Report.

The Acceptability Review was based on the SA input requirements relative to the ISMP, as stated below:

"The Standards Approval submittal package shall consist of the following documentation:

11) The Contractor's ISMP, which shall

   a. Define the key safety-related activities to be performed by the Contractor;

   b. Specify the standards-based management processes to be used by the Contractor to ensure that radiological, nuclear, and process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained;

   c. Ensure that the Contractor is in compliance with DOE Nuclear Safety Regulations, in conformance with the DOE-stipulated top-level safety standards and principles, and in compliance with the SRD;

   d. Define the Contractor's interfaces with other regulatory regimes such as environmental protection, occupational safety, and safeguards and security, and define the processes for resolving conflicting requirements at these interfaces and for ensuring safety adequacy at these interfaces (i.e., ensuring that safety "gaps" do not occur);

   e. Specify the expected flow and schedule of the Contractor's safety-related work and deliverables, including interactions with the Regulatory Unit;

   f. Describe the self-assessment functions to be employed by the Contractor;

g. Describe the Contractor's approach for tailoring its radiological, nuclear, and process safety deliverables and actions commensurate with the nature and level of hazards associated with its waste processing activities; and

h. Identify roles, responsibilities, and authorities for defining, implementing, and maintaining safety."

For purposes of the Detailed Review, performed upon completion of the Acceptability Review, the reviewers used RL/REG-97-07, Section 4, which followed the SA approval criteria from DOE/RL-96-0003, as restated below:[4]

"The approval of the Contractor's proposed ISMP will be issued upon determination by the Director of the Regulatory Unit that:

1. The program documented in the ISMP complies with all applicable laws and regulations;

2. The program documented in the ISMP conforms to the top-level radiological, nuclear, and process standards and principles contained in DOE/RL-96-0006;

3. The selected safety management processes documented in the ISMP are standards based and are appropriately tailored to the hazards associated with the Contractor's proposed facility, its operation, and its deactivation;

4. The selected safety management processes documented in the ISMP properly and adequately address management of process hazards;

5. The program documented in the ISMP contains appropriate features of integrated safety management (i.e., integration among safety, design, and operations interests; integration over the life cycle of the activities; and integration into work planning and performance);

6. The interfaces among regulatory regimes are appropriately addressed to ensure that adequate protection is fully achieved;

7. Safety documentation processes delineated in the ISMP provide for appropriate document control and maintenance;

8. Scheduling of the safety-related activities as described in the ISMP, including generation of regulatory submittals, is consistent with Figure 2 of this document;

9. Self assessment elements documented in the ISMP are appropriate; and

10. Safety definition, implementation, and maintenance roles, responsibilities, and authorities defined in the ISMP are clear and appropriate."

The Detailed Review also provided the opportunity for the reviewers to provide questions to the Contractor for clarification. BNFL provided responses to the reviewers' questions, and dependent upon their responses, certain dispositions were made as to the acceptability of those responses. The reviewers'

4. DOE/RL-96-0003, Section 3.3.1, items 1-10, p. 5.

evaluation was based on the material presented by BNFL in its ISMP, as well as BNFL's responses to the review team questions, and was accomplished by the following steps:

1. Extracting relevant information from the Contractor's submittal,
2. Summarizing information as it applied to the elements of the review approach,
3. Performing the evaluation according to the ISMP Review Guidance, and
4. Formulating and documenting the evaluation conclusions.

Following the review, the reviewers formulated a set of detailed conclusions from the evaluation of the ISMP. These conclusions are based on the ISMP approval criteria, listed in this section, and support the determination by the RO. The conclusions reached from the review process associated with all of the approval criteria and attributes were aggregated and integrated to formulate the review conclusions. On the basis of the aggregated review conclusions, the overall findings on satisfaction of the elements of the ISMP approval criteria were formulated. In turn, the findings provided the basis for the recommendation to the RO to approve or disapprove the ISMP, as discussed in Section 4.0 of this Evaluation Report.

2.2 ISMP Review Chronology

The review process was initiated before receipt of the SA Package with a formal training class and study of pertinent requirements and guidance material. The major milestones throughout the review period are shown in Table 2.2-1.

Table 2.2-1. Chronology of BNFL SA Package Review.

Milestone	**Date(s) 1997**
Receipt of SA Package from BNFL	September 26
Acceptance of SA Package by DOE	October 3
RU review team requests for additional information (Questions)	October 17, 24, 31
BNFL responses	November 11
Disposition of BNFL responses by RU review team sent to BNFL	November 26
BNFL follow-up responses to review team disposition	December 8
Significant meetings/events • RU review team orientation • BNFL public presentation of SA Package submittal • BNFL SA Package presentation to RU review team • Submission of NRC questions to BNFL	 September 22 September 25 September 26 December 8

2.3 Team Composition and Expertise

Table 2.3-1 below provides the names, level of education, and expertise of the SA Package Review Team. The BNFL SA Package review team was assembled under the leadership of Mr. Robert C. Barr.

Table 2.3-1. Review Team Membership Education and Expertise. (2 sheets)

SA Package Review Team Member	Education/Expertise
Robert Barr	B.S. Organic and Inorganic Chemistry. Senior Reactor Operator Certified, Nuclear Engineering Officer (USN); Certified NRC Senior Resident Inspector for Pressurized and Boiling Water Reactors. More than 25 years of nuclear experience.
Clark Vanderniet	B.I.S., M. Ed., Senior Reactor Operator Certified; Certified NRC Senior Resident Inspector for Pressurized and Boiling Water Reactors; Certified DOE Nuclear Safety Assessor. More than 25 years of nuclear experience.
Rey Bocanegra	B.A. Chemistry, M.S. Nuclear Engineering, M.S. Health Physics. Part I HP Certification; Certified DOE Facility Representative; NQA-1 Lead Nuclear Auditor; DOE Certified Accident Investigator. More than 12 years of radiation protection expertise.
Jay Boudreau	B.S./M.S./Ph.D. in Engineering. Member, National Research Council; senior policy support to U.S. Government. More than 20 years experience in safety analysis, including hazards analysis, probabilistic risk analysis, and systems analysis.
Frank Chen, P.E.	B.S./M.S./Ph.D. in Nuclear Engineering. Senior Reactor Operator. 17 years experience in nuclear industry; expertise in nuclear safety, design, operations, analysis, radiation shielding, dose calculation, thermal hydraulics, safety education, emergency preparedness, hazard evaluation.
Thomas Colandrea, P.E.	B.S. Metallurgical Engineering, M.S. Engineering Science and Metallurgy, MBA; P.E. (California). ASQC Certified Quality Engineer, Reliability Engineer, and Quality Auditor; ISO 9000 Certified Lead Auditor; ASQC Fellow. 35 years experience in Nuclear QA and metallurgical engineering.
James Cunnane	Ph.D. Nuclear & Radiochemistry. 22 years of nuclear facility experience. Expertise in radiochemistry, vitrification of radioactive waste, safety analysis including consequence analysis, and TWRS vitrification.
Michael Elliott	B.S./M.S. Chemical Engineering. 11 years experience in environmental process development including ceramic melters, radioactive glass fabrication and leaching, and development of waste glasses and vitrification systems.
Pranab Guha, P.E.	M.S. Electrical Engineering; P.E. (Pennsylvania). Expert in electrical and control systems design, failure mode and effects analysis of electrical and electromechanical systems for safety and reliability.
Roy Hardwick	B.S./Ph.D. Chemical Engineering. Two chemical process patents. 30 years experience in chemical process system safety analysis and documentation, development and scale-up, chemical plant design, process operations and control.
Donald G. Harlow	B.S. Chemical Engineering. Special skills in process engineering and process control. Expertise in Hanford Site nuclear chemical and mixed-waste processing operations including TWRS, B Plant, PUREX, PU Finishing Plant.

Table 2.3-1. Review Team Membership Education and Expertise. (2 sheets)

SA Package Review Team Member	Education/Expertise
Mary Haughey	B.A. Engineering, B.S. Mechanical Engineering and Material Science. Experience in mechanical equipment design for commercial reactors; NRC technical reviewer for equipment qualification; Supervisory engineer for reactor restart; NRC licensing Project Manager.
John Hockert	B.S. Physics, M.A/Ph.D. Nuclear Physics. NQA-1 Certified Auditor. More than 7 years with NRC Office of Nuclear Material Safety and Safeguards; managed Pantex Plant Hazards Assessment; extensive experience in regulatory oversight, safety analyses, and compliance plan development.
Thomas Hull	B.S. Chemical Engineering, M.S. Management. Navy Certified Nuclear Plant Chief Engineer. Expertise in team management, conduct of operations, and TWRS privatization development.
Neal Hunemuller	B.S. Nuclear Engineering. Certified NRC Operator Licensing Examiner; Licensed NRC Senior Operator. More than 15 years experience in commercial nuclear power and in the NRC
Dennis Kubicki	B.S. Fire Protection, M.S. Safety. Certified fire fighter. Previous fire safety experience with Maryland State Fire Marshall's Office, General Services Administration, NASA, NRC, DOE; expertise in fire protection.
C.K. Liu	Ph.D. Nuclear Radiochemistry. NQA-1 Lead Nuclear Auditor. 15 years experience as manager of a radiochemistry laboratory for the EPA; expertise in the areas of chemical process safety, nuclear process chemistry, health physics.
Jeff Martin	B.S./M.S./Ph.D. Nuclear Engineering. More than 20 years experience in reactor and nuclear facility safety, regulation, and analysis including advanced fast reactors, new production reactor, and Russian nuclear material storage.
Matthew Moeller	B.A. Mathematics, M.S. Environmental Health; HP Society Fellowship; 1992 Health Physicist of the Year for the Health Physics Society (Columbia Chapter). 17 years experience supporting DOE & NRC. Expertise in radiation protection regulation, enforcement, consequence assessment.
Joseph Perez	B.S./M.S. Chemical Engineering. More than 15 years experience in vitrification process development and design including full-scale equipment design, flowsheet studies, feed stream simulation, test design, and equipment maintenance and operation.
Subir Sen	B.S./M.S./Ph.D. Structural Engineering; Registered P.E.; Participant in NRC's Severe Accident Phenomena Study and member of the National Code Committee developing design codes for nuclear facilities. 22 years experience in the design, safety analysis, and risk evaluation of nuclear power plants and other nuclear facilities.
Brian Vonderfecht	B.S./Ph.D. Nuclear Physics. Proficient in accident modeling and safety document preparation. 12 years experience in developing fault-tree and event-tree failure modes for complex plant systems and in analyzing plant failure events.

3.0 Findings

The reviewers assessed the ISMP by extracting relevant information from the Contractor's submittal and summarizing the information as it applied to the elements of the review approach. The reviewers evaluated the information according to the ISMP Review Guidance, and, based on their review, formulated and documented the evaluation conclusions in this Evaluation Report. The following sections detail and provide the bases for the review conclusions:

1. Compliance with Applicable Laws and Regulations
2. Conformance to Top-Level Safety Standards and Principles
3. Tailored, Safety Management Processes
4. Management of Process Hazards
5. Integrated Safety Management Features
6. Regulatory Interfaces
7. Document Control and Maintenance
8. Scheduling of Safety-Related Activities
9. Self-Assessment Program
10. Roles, Responsibilities, and Authorities.

Each of the sections discuss the applicable evaluation criteria (Requirements); attributes employed by the reviewers in performing the review (Review Methodology); evaluation performed by the reviewers (Evaluation), which includes the bases for determining whether the ISMP met the evaluation criteria; and the conclusions and recommendations developed from the review (Conclusions). The subsequent sections detail and provide the bases for the review conclusions.

3.1 Compliance with Applicable Laws and Regulations

Requirements

In accordance with the Contract provisions, TWRS privatization is required to meet the provisions of applicable laws and regulations. DOE/RL-96-0003 specifically states that the ISMP shall include the planning elements of the implementation plans required by DOE regulations, particularly 10 CFR 830, "Nuclear Safety Management."[5] Pursuant to DOE/RL-96-0003, the RO must determine that the set of standards documented in the SRD includes all requirements of applicable laws and regulations, and that the program documented in the ISMP complies with all applicable laws and regulations. This review for adherence to applicable laws and regulations focused on the nuclear safety regulations issued by DOE in response to the Price-Anderson Amendments Act of 1988.[6] Specifically, these include the requirements of 10 CFR 820, "Procedural Rules for DOE Nuclear Activities," 10 CFR 830, and 10 CFR 835, "Occupational Radiation Protection."

10 CFR 820 codifies the procedures to be used in applying the substantive regulations relating to nuclear safety—specifically, those regulations identified in Parts 830 and 835, which have been published, and those proposed to be published in Part 834. 10 CFR 820 defines the procedures to be followed by DOE and its contractors, subcontractors, and suppliers with respect to reporting, enforcement, civil penalties, compliance orders, interpretations, exemptions, and criminal penalties. It does not impose substantive

5. DOE/RL-96-0003, Section 3.3.1, p. 4.

6. Price-Anderson Amendments Act of 1988.

requirements such as the requirements to develop and implement programs for Quality Assurance (QA) and radiation protection found in Parts 830 and 835. The procedural requirements of 10 CFR 820 will be invoked in specific circumstances. For example, the identification of a potential noncompliance of a substantive nuclear safety rule and subsequent activities with respect to investigation by DOE, including enforcement conferences and impositions of civil penalties, fraudulent reporting, or identification of a need for an exemption to the nuclear safety rules.

10 CFR 830 establishes the requirements for the safe management of DOE contractor and subcontractor work at DOE's nuclear facilities. A number of substantive rules is proposed to be issued in 10 CFR 830; however, only one substantive set of requirements, Section 830.120, "Quality Assurance Requirements," is published final in 10 CFR 830 at this time. In addition, 10 CFR 830 contains general requirements to be applied to nuclear safety management activities.

10 CFR 835 promulgates the primary standards for occupational radiation protection of workers at DOE facilities. It requires the contractor to develop a Radiation Protection Program (RPP) in accordance with the requirements of 10 CFR 835. The RPP is to be reviewed and approved by the RU.

Requirements promulgated in rules such as those in 10 CFR 820, 830, and 835 are laws. Therefore, they are applicable whether or not they are specifically included in a contract or in commitments from a contractor.

Review Methodology

The reviewers assessed the ISMP to determine if BNFL had defined an adequate management process for ensuring compliance with laws and regulations. The applicable laws and regulations are those were DOE has enforcement jurisdiction and that relate to radiological, nuclear, and process safety. The reviewers considered the following:

- Whether BNFL appropriately identified the laws and regulations applicable to its integrated safety management processes.
- The adequacy of the BNFL management processes to ensure compliance with laws and regulations that may change or come into effect during the project life cycle.
- Whether BNFL should include the effects of additional laws and regulations not included in the SRD.
- Whether the ISMP incorporates a process to ensure compliance with 10 CFR 830 and 10 CFR 835.

The reviewers placed particular emphasis on statutory compliance and the contractor's program and provisions to ensure compliance.

3.1.1 10 CFR 820 Evaluation

Section 11.1 of the ISMP states that the BNFL Project Manager will be responsible for implementing the Contractor requirements of 10 CFR 820 during the design and construction phases. Section 11.2 of the ISMP states that the Plant Manager will be responsible for the implementing the Contractor requirements

of 10 CFR 820 during the operating phase. In response to questions BNFL committed to adding a new Section to the ISMP, which will commit to providing training and procedures for the following activities:

1. Identifying, reporting, correcting, and tracking non-compliances
2. Preparing, reviewing, and approving implementation plans for the nuclear safety requirements
3. Requesting and receiving exemptions to nuclear safety rules
4. Identifying roles and responsibilities of the TWRS-P and DOE staff implementing 10 CFR 820
5. Establishing procedural rules for nuclear activities.

3.1.2 10 CFR 830 Evaluation

Sections 830.1 through 830.7 of 10 CFR 830 contain the general provisions of Part 830. Section 830.120 contains the substantive requirement relating to QA. Other substantive sections have been proposed, but not published in final form.

Sections 830.1 through 830.7 define the general requirements to be applied to the substantive sections of the nuclear safety management rules in 10 CFR 830. To date, only one substantive rule is included in Part 830, "Quality Assurance Requirements," which will be addressed in the next section of this evaluation report.

10 CFR 830.1 through 830.3 define the scope, exclusions, and the definitions for the nuclear safety management rules. 10 CFR 830.4 defines general responsibilities with respect to implementation of the substantive rules. 10 CFR 830.6 requires the Contractor to maintain complete and accurate records to substantiate compliance with the nuclear safety management rules. 10 CFR 830.7 defines responsibilities with respect to applying the graded approach to substantive rules, which indicate that the graded approach should be used. Implementation of these general requirements should be incorporated into the discussion of implementation of the specific substantive rules. However, it is likely that for some sections, (i.e., 10 CFR 830.2, "Exclusions," 10 CFR 830.3, "Definitions," and 10 CFR 830.4, "General Rule") there will be no separate discussion for implementation. In such cases, unless the Contractor intends to deviate from the requirement and requests an exemption, it is assumed that the Contractor intends to comply with the requirement as written. If an exemption has not been granted approval, such compliance is required by law.

The subjects of "records" and "graded approach" are addressed in the Quality Assurance Plan (QAP) with respect to the requirements of 10 CFR 830.120. However, it should be noted that the term "tailored approach" appears to be used interchangeably with the term "graded approach" throughout the SRD and the ISMP. In particular, the term tailored approach was used in place of graded approach in the BNFL SRD, Section 7.0, Safety Criteria 7.2-1, 7.5-1, and 7.6-1, which address commitments to draft rules. Graded approach is defined in 10 CFR 830.3 of the rules. However, the term "tailored approach" is not defined in the rules and has been used within DOE to define a different process.

When a graded approach is applied, the Contractor adjusts the rigor of the application of a requirement as appropriate to the application but continues to meet the requirement. For example, if a requirement states that all valves in a certain system shall be performance tested, but does not specify the frequency, the Contractor may apply a graded approach by using a higher testing frequency to valves with more safety significance. The term tailoring is frequently used differently. To illustrate using the same example, if a

standard states that all valves in a certain system shall be tested and the Contractor determines that only selected valves with higher safety significance will be tested, that is tailoring. An exemption is required if a Contractor uses the tailoring process, as described herein, with respect to a rule requirement.

3.1.3 10 CFR 830.120 Evaluation

Section 2.2, "Compliance with 10 CFR 830.120, 'Quality Assurance Requirements,'" of the ISMP indicates that the BNFL QAP for the TWRS-P project meets the requirement of 10 CFR 830.120. Section 2.2 also includes a commitment to describe in the Initial Safety Analysis Report (ISAR), the essential features of the QAP and planned actions to demonstrate and ensure that the TWRS-P project meets the requirements of 10 CFR 830.120 as presented in the BNFL QAP. Section 1.3.9 "Quality Assurance Program" of the ISMP states that BNFL developed its QAP in compliance with the requirements of 10 CFR 830.120. Table 1-4, "Application of Quality Assurance Program Requirements for QL-1, QL-2, and QL-3 Structures, Systems, and Components" in the BNFL ISMP provides a matrix showing the extent to which BNFL applies specific QAP requirements to each of three quality levels (QL) in terms of the criteria of 10 CFR 830.120. It also provides a series of notes in the "Remarks" column to further clarify the extent of application of selected QAP requirements to QL-2 and QL-3 structures, systems, and components (SSCs).

The QA implementation plan required by 10 CFR 830.120 is provided in Appendix A of the ISMP, and states that the implementation plan was developed to support Part A activities of the TWRS-P project. Section 2.1.6 of Appendix A states that BNFL is committed to implementing a QAP that meets all requirements of 10 CFR 830.120. The BNFL graded approach to the application of the QAP requirements is described in Section 2.7 of Appendix A in terms of the QL associated with the safety classification of each SSC. A definition of the three quality levels (i.e., QL-1, QL-2, and QL-3) also is provided in Section 2.7 of Appendix A of the ISMP.

The reviewers evaluated the adequacy of Table 1-4 of ISMP for compliance with the requirements of 10 CFR 830.120. The results of this evaluation and the issues identified by the reviewers regarding this table are reported in Section 4.1.3.2.1.1 of the *DOE Regulatory Unit Evaluation Report of the BNFL, Inc. Safety Requirements Document* (the BNFL SRD Evaluation Report), and will not be repeated here.[7] With the exception of these issues, the reviewers found that Table 1-4 adequately applied the QA criteria of 10 CFR 830.120 to SSCs commensurate with the importance of their safety function.

The *Evaluation Report for the BNFL, Inc. Initial Quality Assurance Program* (BNFL QAP Evaluation Report) documents the evaluation of the BNFL QAP by the RU.[8] This evaluation demonstrated that the BNFL QAP complies with the requirements of 10 CFR 830.120. However, the reviewers noted that the BNFL QAP Evaluation Report only considered those aspects of the BNFL QAP that address Part A activities. As identified in Section 4.2.3.1.6 of the SRD Evaluation Report, it was not clear to the reviewers when the Part B QAP and its implementation plan would be submitted to the RU (Review Question 76). BNFL responded by proposing to submit the Part B QAP and its implementation plan to the RU 60 days before Part B contract award.

7. *DOE Regulatory Unit Evaluation Report of the BNFL, Inc. Safety Requirements Document*, RL/REG-98-01, draft, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, February 1998.

8. *Evaluation Report for the BNFL, Inc. Initial Quality Assurance Program*, RL/REG-97-01, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, January 1997.

The BNFL QA implementation plan reflected in Appendix A of the ISMP was assessed by the reviewers to determine compliance with 10 CFR 830.120 and adherence to the QAP. The reviewers identified three issues regarding this implementation plan:

- The first issue (Review Question 72)—Contrary to a commitment in the BNFL QAP, the QA implementation plan does not describe how BNFL and its principal subcontractors meet each of the applicable criteria of 10 CFR 830.120. BNFL responded by providing tabular summaries identifying the implementing policies and procedures that apply to BNFL and each of its principal subcontractors.

- The second issue (Review Question 78)—The QA implementation plan contains little or no information regarding: (a) when and how the activities described in the BNFL QAP will be accomplished; or (b) the schedules, milestones, and activities necessary to implement 10 CFR 830.120. As identified in Section 4.2.3.1.6 of the SRD Evaluation Report, BNFL committed to provide the needed information in the Part B QAP and its implementation plan that will be submitted to the RU.

- The third issue (Review Question 136)—The definitions for QL-1 and QL-2 in the QA implementation plan differ substantially from those used elsewhere in the ISMP. BNFL responded by stating its agreement that the definitions are inconsistent and will be corrected.

3.1.4 10 CFR 835 Evaluation

Section 2.3, "Compliance with 10 CFR 835, Occupational Radiation Protection," of the ISMP provides a description of an RPP implementing the requirements of 10 CFR 835 including plans, schedules, and other measures for achieving compliance with the requirements of 10 CFR 835. The ISMP provides adequate commitments to programmatic compliance with the nuclear safety requirements of 10 CFR 835.

Conclusions

BNFL did not include a specific commitment to 10 CFR 820 in the SRD. Also, the commitments in the ISMP do not include a broad statement of commitment to 10 CFR 820. However, unlike 10 CFR 830 and 10 CFR 835, 10 CFR 820 contains procedural rules, not substantive rules. The DOE does not require or expect the Contractor to provide an implementation plan for 10 CFR 820. In fact, the majority of the provisions in 10 CFR 820 define the actions and procedures to be followed by DOE in certain defined circumstances. Should circumstances occur at the TWRS-P facility which would require the Contractor to follow the procedures defined in 10 CFR 820, such as an enforcement action or the need for an exemption to the nuclear safety rules, the Contractor would be expected to do so at that time. The Contractor's commitment in its ISMP to provide training and procedures with respect to 10 CFR 820 should be sufficient to prepare them for such circumstances. Consequently, the reviewers recommend approval of the contract requirement with respect to conformance to 10 CFR 820 for the current phase of the SRD and the ISMP.

The general requirements of sections 830.1 through 830.7 are to be addressed in implementation documents for the substantive sections of the rule requirements. Therefore, the reviewers recommend approval of the contract requirement with respect to an acceptable commitment to meet Sections 10 CFR 830.1 through 830.7 (provided the subjects are properly addressed in 10 CFR 830.120 with respect to the current phase of the SRD and the ISMP).

The reviewers recommend approval of the ISMP with respect to an acceptable commitment to meet 10 CFR 830.120, "Quality Assurance Requirements." This recommendation is made on the basis of the review of information and commitments provided in the SRD and the ISMP, as well as the supplementary information and commitments provided in response to review questions from the RU. The RU will continue to assess the commitments to 10 CFR 830.120 as the design progresses and enters new phases of construction and operation, particularly with respect to the QA implementation plan and the QAP.

The reviewers recommend approval of this contract requirement with respect to programmatic commitment to meet 10 CFR 835. This recommendation is made on the basis of the review of the information and commitments provided in the BNFL ISMP and SRD, as well as the supplementary information and commitments provided in response to review questions from the RU. The ISMP documents a program that commits to meet the DOE nuclear safety regulation 10 CFR 835, "Occupational Radiation Protection."

3.2 Conformance to Top-Level Safety Standards and Principles

3.2.1 Radiological and Nuclear Safety Objectives

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003[9] also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in *Top Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006.[10] Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 3.3.1.

Review Methodology

The ISMP was evaluated for programmatic conformance to the following attribute: the adequacy of the program documented in the ISMP guidance to conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. The radiological and nuclear standards in DOE/RL-96-0006 include human dose standards to which all facility activities of the Contractor involving radiological and nuclear hazards must comply. These standards are consistent with radiological exposure limits embodied by DOE and U.S. Nuclear Regulatory Commission (NRC) regulations as well as the perspectives of the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP). This evaluation was conducted through a review of the material presented in the ISMP and the resolution of questions developed in the review process.

Evaluation

Section 3.0, "Conformance with Laws and Regulations" of the ISMP provides a description of the methods used by the TWRS-P project to conform to top-level safety standards and principles. Section 4.1.1,

9. DOE/RL-96-0003, Section 4.1.2, item 11c, p. 12.

10. *Top Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, February 1996.

"Development of the Safety Requirements Document," of the ISMP provides additional information supporting the adequacy of the TWRS-P project, and addresses and incorporates top-level safety standards and principles in the submittal. An evaluation of programmatic conformance to each of the top-level safety standards and principles included in the Radiological and Nuclear Safety Standards and Objectives has been performed. The standards and objectives include "Individual" (Section 4.2.1.1), "General Safety Objectives" (Section 4.2.1.2), "Radiation Protection" (Section 4.2.1.3), and "Technical Safety Objectives" (Section 4.2.1.4). The ISMP provides adequate statements indicating programmatic conformance to each of these standards and objectives.

Conclusions

The reviewers recommend approval of this contract requirement with respect to programmatic conformance to each of the top-level safety standards and principles addressed by the Radiological and Nuclear Safety Standards and Objectives. The BNFL ISMP documents a program that conforms to the Individual, General Safety Objectives, Radiation Protection, and Technical Safety Objectives as described in the following sections.

3.2.1.1 Individual

Requirement

DOE/RL-96-0003 requires that the Contractor's ISMP complies with DOE nuclear safety regulations, in conformance with the DOE-stipulated top-level safety standards and principles, and with the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. The top-level radiological, nuclear, and process safety standards for an individual include those for workers, co-located workers, and the public for normal operation and credible accident conditions as listed in Table 1 in DOE/RL-96-0006.[11] Pursuant to DOE/RL-96-0003 and in order to approve the ISMP, the RO must make a determination that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006.

The Contractor's ISMP is required to conform to three types of top-level standards specified by DOE in Table 1 of DOE/RL-96-0006. The first type, applicable to workers and co-located workers, is a radiation dose standard (in units of rem/y or rem/event) that addresses external and internal whole body, partial body, and organ exposures. The second type, applicable to workers and co-located workers, is termed an ALARA Design Limit in units of rem/y or rem/event. This type of standard is consistent with ALARA design objectives used to evaluate engineering features under normal operations as defined in 10 CFR 835, "Occupational Radiation Protection." The design objective establishes an exposure level value, in units of mrem per hour, to control the potential exposure of a radiological worker. In general terms, the facility shall be designed to maintain exposures to radiological workers at 20 percent of the applicable standards and as far below this average as is reasonably achievable. For anticipated events, the design standard is not a dose limit but rather the specification of a process to optimize selection of safeguards during the design phase. The ALARA design standard specifies the event consequence (as a radiation exposure value) above which the documented ALARA design engineering program must be applied to evaluate potential safeguards affecting the event sequence. From a design perspective, this value represents a threshold level for the consequence of a normal operation or an accident above which an ALARA evaluation would be performed to determine whether a potential engineering feature would be optimal given economic and

11. DOE/RL-96-0006, Section 2.1, Table 1, "Dose Standards Above Normal Background", p. 2.

societal considerations. If a potential engineering feature were determined to be cost-effective and feasible, it would be incorporated in the facility design. The third type of standard, applicable to the public, is a radiation dose standard as a total (internal and external) effective dose equivalent, or effective dose equivalent to the thyroid, in units of rem/year or rem/event from a specific pathway or source.

DOE/RL-96-0006, Table 1, specifies four event probability ranges addressing normal operation and credible accident conditions as follows: normal events, anticipated events, unlikely events, and extremely unlikely events. Normal events are typical of normal facility operations. They are expected to occur regularly in the course of facility operations; the associated probability of occurrence during the lifetime of the facility is one per year. A general guideline for this event probability is that normal modes of facility systems operation should provide adequate protection of health and safety. Anticipated events are characterized as minor incidents and upsets of moderate frequency that may occur once or more during the lifetime of the facility; the associated probability range is 1×10^{-2} to less than one per year. A general guideline for this event probability range is that the facility should be capable of returning to operation without extensive corrective action or repair. Unlikely events are characterized as more severe incidents that are not expected, but may occur, during the lifetime of the facility; the associated probability range is 1×10^{-4}/yr. to 1×10^{-2}/yr. A general guideline for this event probability range is that the facility should be capable of returning to operation following potentially extensive corrective action or repair, as necessary. Extremely unlikely events are characterized as events that are not expected to occur during the lifetime of the facility, but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material.; The associated probability range is 1×10^{-6}/yr. to 1×10^{-4}/yr. A general guideline for this event probability range is that facility damage may preclude a returning to operation. (For example, the probability of occurrence of 1×10^{-2}/yr. is equivalent to a probability of one occurrence in 100 years; 1×10^{-4}/yr.; one in 10,000 years; 1×10^{-6}/yr.; one in 1,000,000 years.)

DOE/RL-96-0006, Table 1, requires a contractor to derive standards for both the worker and the co-located worker at the accident probability ranges of unlikely events and extremely unlikely events. A footnote to Table 1 for the four entries in the "To be derived" column states that specific limits are to be derived and proposed by the Contractor. Examples of such derived limits and implementation approaches are described in *Methods for the Assessment of Worker Safety Under Radiological Accident Conditions at Department of Energy Nuclear Facilities*.[12] It is also stated in the footnote to Table 1 that the specific limits will be finalized as part of the standards identification and approval activities to be performed early in Part A of the program.

Review Methodology

The ISMP was evaluated for programmatic conformance to top-level radiological, nuclear, and process safety standards and principles for the individual contained in DOE/RL-96-0006. The information provided by BNFL was assessed against the approval criterion: the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in Table 1 of DOE/RL-96-0006.

The radiological and nuclear standards are presented in Table 1 of DOE/RL-96-0006. They include the human dose standards to which all facility activities of the Contractor involving radiological and nuclear hazards must comply, and ALARA design standards that ensure the identification and incorporation of cost-effective and feasible safeguards to prevent and mitigate radiological exposures. These standards are

12. *Methods for the Assessment of Worker Safety Under Radiological Accident Conditions at Department of Energy Nuclear Facilities*, EH-12-94-01, U.S. Department of Energy, Washington, D.C.

consistent with radiological exposure limits embodied by DOE and NRC regulations and the perspectives of ICRP and NCRP. This evaluation was conducted through a review of the BNFL *Radiological and Nuclear Exposure Standards for Facility and Co-located Workers*,[13] the BNFL ISMP, and the resolution of questions developed in the review process.

BNFL was required to provide a regulatory deliverable that addresses and incorporates the top-level safety standards and principles of Table 1 of DOE/RL-96-0006. The deliverable is contained in the *Radiation Exposure Standard for Workers Under Accident Conditions* (BNFL RESW), dated August 28, 1997. Revisions to the deliverable document were provided on December 8 and 17, 1997, as part of the review question and resolution process. Table A of the BNFL RESW corresponds to Table 1 of DOE/RL-96-0006. Table 1 ensures that the Contractor establishes a level of adequate radiological protection to be afforded by the facility. An evaluation of the adequacy of the Contractor submittal to meet this purpose is documented in the evaluation report of the BNFL RESW found in Appendix B of the BNFL SRD Evaluation Report.

Evaluation

Numerous sections of the ISMP document relevant information on programs that are to conform to the top-level radiological, nuclear, and process safety standards and principles in Table 1 of DOE/RL-96-0006. This includes the individual radiological dose and the ALARA design standards (e.g., Section 1.3.2, "Laws/Regulations/Top-Level Safety Requirements/Best Industry Practices"; Section 1.3.3, "Safety Requirements Document"; Section 1.3.5, "Facility Design/Development Activities and Safety Features Identification"; Section 1.3.6, "Accident Analysis"; Section 1.3.7, "Acceptable Level of Public Safety"; Section 1.3.8, "Acceptable Level of Worker Safety"; Section 2.3.3, "Radiation Protection Program"; and Section 3.9, "Radiation Protection Practices"). The programs described in these sections provide for the identification and incorporation of cost-effective and feasible safeguards to prevent and mitigate radiological exposures.

Section 1.3.3 states that the SRD defines the safety criteria and the design requirements (implementing codes and standards) necessary to protect workers and the public from radiological, nuclear, and process hazards and hazardous situations.

Section 1.3.4 states that the process hazards analysis (PHA) and the accident analysis identify the need for accident prevention and mitigation controls to satisfy the safety criteria documented in the SRD.

Sections 1.3.7 and 1.3.8 provide a program description for the conformance of the facility design with standards established in the BNFL RESW, Table A.

Section 2.3.3 describes the radiation protection program. This description ensures conformance with radiological dose and ALARA design standards under normal operations.

Section 3.9 describes a radiation protection program, which requires that radiation exposure, and environmental impact due to any release of radioactive material from the facility be kept ALARA and within prescribed limits during normal operation. This program consists of two main elements: radiation protection design and ALARA design.

13. *Radiological and Nuclear Exposure Standards for Facility and Co-located Workers Under Accident Conditions*, BNFL-5193-RES-01, Rev. 0, BNFL Inc., Richland, Washington, August 28, 1997.

BNFL's overall program for accident mitigation and selection of safeguards provides an adequate level of safety, and its proposed consequence limit is sufficiently low to ensure that radiation exposures to workers and co-located workers as a result of accidents would be ALARA. Therefore, the ISMP provides adequate statements of programmatic conformance to each of the standards specified in Table 1 of DOE/RL-96-0006.

Conclusions

The reviewers recommend approval of this contract requirement with respect to programmatic conformance with each of the top-level safety standards and principles for an individual specified in Table 1 of DOE/RL-96-0006. The BNFL ISMP documents programs that provide conformance to the standards for an individual.

3.2.1.2 General Safety Objectives

Requirement

DOE/RL-96-0003 requires that the Contractor's ISMP comply with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and with the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. The top-level radiological, nuclear, and process safety standards for General Safety Objectives limit the risk to workers, co-located workers, and the public for normal operation and credible accident conditions. Conformance with these objectives is established, in part, through standards required by Table 1 of DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must make a determination that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 3.1.

The General Safety Objectives comprise three standards: the Operations Risk Goal, the Accident Risk Goal, and the Worker Accident Risk Goal:

> The Operations Risk Goal states: "The risk, to the population (public and workers) in the area of the Contractor's facility, of cancer fatalities that might result from facility operation should not exceed one-tenth of one percent (0.1%) of the sum of cancer fatality risks to which members of the U.S. population generally are exposed." A referenced footnote states, "For evaluation purposes, individuals are assumed to be located within 10 miles of the controlled area."
>
> The Accident Risk Goal states: "The risk, to an average individual in the vicinity of the Contractor's facility, of prompt fatalities that might result from an accident should not exceed one-tenth of one percent (0.1%) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population generally are exposed." A referenced footnote states, "For evaluation purposes, individuals are assumed to be located within one mile of the controlled area."
>
> The Worker Accident Risk Goal states: "The risk, to workers in the vicinity of the Contractor's facility, of fatality from radiological exposure that might result from an accident should not be a significant contributor to the overall occupational risk of fatality to workers." A referenced footnote states, that "For evaluation purposes, workers are assumed to be located within the controlled area."

Review Methodology

The ISMP was evaluated for programmatic conformance to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. The information provided by BNFL was assessed to the following attribute: the adequacy of the programs documented in the ISMP to conform to the General Safety Objectives contained in DOE/RL-96-0006. Conformance to these objectives is established, in part, through the standards required by Table 1 of DOE/RL-96-0006. These standards include the radiological dose standards for workers, co-located workers, and the public during normal operation and credible accident conditions. These standards are consistent with radiological exposure limits embodied by DOE and NRC regulations and the perspectives of the ICRP and the NCRP. This evaluation was conducted through a review of the BNFL RESW and the resolution of questions developed in the review process.

BNFL was required to provide a regulatory deliverable that addresses and incorporates the top-level safety standards and principles of Table 1 of DOE/RL-96-0006. The deliverable is contained in the BNFL RESW. Subsequent revisions to this deliverable document were provided as part of the review question and resolution process. Table A of the BNFL RESW corresponds to Table 1 of DOE/RL-96-0006. The BNFL RESW addresses conformance to each of the General Safety Objectives. An evaluation of the adequacy of Contractor conformance is documented in Appendix B of the BNFL SRD Evaluation Report.

Evaluation

Numerous sections of the ISMP document relevant information on programs that conform to the General Safety Objectives of DOE/RL-96-0006 for risk to the workers, co-located workers, and the public under normal operations and credible accident conditions. These sections include Section 1.3.1, “Laws/Regulations/Top-Level Safety Requirements/Best Industry Practices”; Section 1.3.3, “Safety Requirements Document”; Section 1.3.5, “Facility Design/Development Activities and Safety Features Identification”; Section 1.3.6, “Accident Analysis”; Section 1.3.7, “Acceptable Level of Public Safety”; Section 1.3.8, “Acceptable Level of Worker Safety”; Section 2.3.3, “Radiation Protection Program”; and Section 3.9, “Radiation Protection Practices.” The programs described in these sections ensure limits to the risk to workers, co-located workers, and the public from normal operations and credible accident conditions.

Section 1.3.3 states that the SRD defines the Safety Criteria design requirements (implementing codes and standards) necessary to protect workers and the public from radiological, nuclear, and process hazards and hazardous situations.

Section 1.3.4 states that the PHA and the accident analysis identify the need for accident prevention and mitigation controls to satisfy the Safety Criteria documented in the SRD.

Sections 1.3.7 and 1.3.8 provide a program description for the conformance of the facility design with standards established in the BNFL RESW, Table A.

Section 2.3.3 describes the radiation protection program. This description ensures assures conformance with radiological dose and ALARA design standards under normal operations.

Section 3.9 describes a radiation protection program, which requires that radiation exposure, and environmental impact due to any release of radioactive material from the facility be kept ALARA and

within prescribed limits during normal operation. This program consists of two main elements: radiation protection design and ALARA design.

For the proposed BNFL facility, airborne effluents are likely to represent the primary pathway for radiation exposure to the public. Applicable regulations restrict the radiation exposure to the public from all airborne effluent sources at the Hanford site, which would include those from the proposed BNFL facility, to less than or equal to 10 mrem per year. For this reason, the risk to the public from the primary exposure pathway from the BNFL facility will be limited to some fraction of 10 mrem per year.

BNFL's overall program for accident mitigation and selection of safeguards provides an adequate level of safety and its proposed consequence limit is sufficiently low to ensure that radiation exposures to workers and co-located workers as a result of accidents would be ALARA. Therefore, the ISMP provides adequate statements of programmatic conformance to each of the General Safety Objectives required by DOE/RL-96-0006.

Conclusions

The reviewers recommend approval of this contract requirement with respect to programmatic conformance with each of the General Safety Objectives required by DOE/RL-96-0006. The BNFL ISMP documents programs that provide conformance to the standards limiting the risk to workers, co-located workers, and the public from normal operations and credible accident conditions.

3.2.1.3 Radiation Protection

Requirements

DOE/RL-96-0003 requires that the contractor's ISMP comply with all applicable laws and regulations, particularly the implementation plans required by the 10 CFR 830 rules. DOE/RL-96-0003 also states that the ISMP shall comply with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and with the SRD. Pursuant to DOE/RL-96-0003, the *Process For Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*,[14] applicable laws and regulations specifically include the DOE nuclear safety regulation 10 CFR 835, "Occupational Radiation Protection."

DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. The Radiation Protection Objective is to "[e]nsure that during normal operation radiation exposure within the facility and radiation exposure and environmental impact due to any release of radioactive material from the facility is kept as low as is reasonably achievable (ALARA) and within prescribed limits, and ensure mitigation of the extent of radiation exposure and environmental impact due to accidents."[15] Conformance with this objective is established, in part, through programmatic compliance with the requirements of 10 CFR 835, "Occupational Radiation Protection" and the standards required by Table 1 of DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must make a determination that the program documented in the ISMP complies with all applicable laws and regulations and conforms to

14. *Process For Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, DOE/RL-96-0003, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, February 1996, Section 2.0, p. 2.

15. DOE/RL-96-0006, Section 3.2, p. 4.

the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006.

Review Methodology

The ISMP was evaluated for programmatic conformance to top-level radiological, nuclear, and process safety standards and principles for the Radiation Protection Objective contained in DOE/RL-96-0006. The information provided by BNFL was assessed to the following attribute: the adequacy of the programs documented in the ISMP to conform to the Radiation Protection Objective contained in DOE/RL-96-0006. Conformance to these objectives is established, in part, through programmatic compliance with the requirements of 10 CFR 835, "Occupational Radiation Protection" and the standards required by Table 1 of DOE/RL-96-0006. These standards include the radiological dose standards for workers, co-located workers, and the public during normal operation and credible accident conditions. These standards are consistent with radiological exposure limits embodied by DOE and NRC regulations and the perspectives of the ICRP and the NCRP. This evaluation was conducted through a review of the BNFL RESW; and the resolution of questions developed in the review process.

BNFL was required to provide a regulatory deliverable that addresses and incorporates the top-level safety standards and principles of Table 1 of DOE/RL-96-0006. The deliverable is contained in the BNFL RESW. Subsequent revisions to the deliverable document were provided as part of the review question and resolution process. Table A of the BNFL RESW corresponds to Table 1 of DOE/RL-96-0006. The BNFL RESW addresses conformance to the Radiation Protection objective. An evaluation of the adequacy of Contractor conformance is documented in Appendix B of the BNFL SRD Evaluation Report.

Evaluation

Numerous sections of the ISMP document relevant information on programs that are to conform to the Radiation Protection Objective of DOE/RL-96-0006, which requires that radiation exposure within the facility, and radiation exposure and environmental impact due to any release of radioactive material from the facility, is kept ALARA and within prescribed limits during normal operation. It also is required to ensure mitigation of the extent of radiation exposure and environmental impact due to accidents. Programmatic compliance with 10 CFR 835 ensures radiation exposure within the facility is maintained ALARA and within prescribed limits during normal operation.

Section 2.3, "Compliance with 10 CFR 835, 'Occupational Radiation Protection,'" provides a description of a radiation protection program implementing the requirements of 10 CFR 835 including plans, schedules, and other measures for achieving compliance. The ISMP provides adequate statements of programmatic compliance with the nuclear safety requirements of 10 CFR 835.

Section 3.9, "Radiation Protection Practices," describes a radiation protection program, which requires that radiation exposure and environmental impact due to any release of radioactive material from the facility be kept ALARA and within prescribed limits during normal operation. This program consists of two main elements: radiation protection design and ALARA design.

Section 1.3.3, "Safety Requirements Document," states that the SRD defines the Safety Criteria and the design requirements (implementing codes and standards) necessary to protect workers and the public from radiological, nuclear, and process hazards and hazardous situations.

Section 1.3.5, "Facility Design/Development Activities and Safety Features Identification," states that the PHA and the accident analysis identify the need for accident prevention and mitigation controls to satisfy the Safety Criteria documented in the SRD.

Sections 1.3.7, "Acceptable Level of Public Safety," and 1.3.8, "Acceptable Level of Worker Safety," provide a program description for the conformance of the facility design with standards established in the BNFL RESW, Table A.

Section 2.3.3, "Radiation Protection Program," also describes a radiation protection program. This description ensures conformance with radiological dose and ALARA design standards under normal operations.

BNFL's overall program for accident mitigation and selection of safeguards provides an adequate level of safety and its proposed consequence limit is sufficiently low to ensure that radiation exposures to workers and co-located workers as a result of accidents would be ALARA. Therefore, the ISMP provides adequate statements of programmatic conformance to the Radiation Protection Objective required by DOE/RL-96-0006.

Conclusions

The reviewers recommend approval of this contract requirement with respect to programmatic conformance with the Radiation Protection Objective required by DOE/RL-96-0006. The BNFL ISMP documents programs that require radiation exposure within the facility, and radiation exposure and environmental impact due to any release of radioactive material from the facility, be kept ALARA and within prescribed limits during normal operation. This ensures mitigation of the extent of radiation exposure and environmental impact due to accidents.

3.2.1.4 Technical Safety Objectives

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 3.3.

The three top-level principles in DOE/RL-96-0006 relating to Technical Safety Objectives are:

1. Public Protection—Measures in the design and operation of the facility to protect the public against accident conditions should be evaluated against acceptable guidelines to demonstrate that they perform their intended purpose with high confidence.

2. Worker Protection—Measures in the design and operation of the facility to protect the workers against accident conditions should be evaluated using an acceptable approach to demonstrate that they perform their intended purpose with high confidence.

3. Accident Vulnerability Mitigation—Particular care should be taken to identify, evaluate, and prevent and/or mitigate any vulnerabilities to accidents that might, by themselves, result in a release of radioactive material that exceeds acceptable levels.

Review Methodology

The reviewers assessed the ISMP to determine if it describes how a process will ensure conformance with the Technical Safety Objectives top-level principles in DOE/RL-96-0006.

Evaluation

Numerous sections of the ISMP document relevant information on programs that are to conform to the Technical Safety Objectives of DOE/RL-96-0006, which requires public protection, worker protection, and accident vulnerability mitigation.

Section 1.3.4, "Process Hazard Analysis," expresses BNFL's commitment to using a systematic team-based approach to identify and analyze the significance of potentially hazardous situations associated with the operation and maintenance of the TWRS-P Facility." Specifically, the goals of PHA are to "...2) Identify features in the design or operation of the facility that could lead to accidents, 3) Assist designers in identifying the need for design features to eliminate or control hazards and hazardous situations."

Section 1.3.6, "Accident Analysis," expresses BNFL's commitment to performing accident analysis. "During the design phase, the set of potential accidents identified by the PHA is considered in the accident analysis to identify the need for prevention and mitigation controls required during operation or for deactivation to satisfy the Safety Criteria documented in the SRD."

Section 1.3.7, "Acceptable Levels of Public Safety," expresses BNFL's commitment to perform consequence analyses for each accident involving a radionuclide or chemical release. "For those accidents that involve a radionuclide release, the calculated exposures are compared to the radiological exposure standards in Table 1-2 [in the BNFL ISMP] to determine the need for accident prevention or mitigation features credited for public safety. For chemical release, the projected exposure is compared to the standards in the Emergency Response Planning Guide-2 (ERPG-2). If the radiological or chemical release exposure standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed."

Section 1.3.8, "Acceptable Level of Worker Safety," expresses BNFL's commitment to identify the need for engineered or administrative controls to prevent or limit exposure of workers to less than the exposure standards listed in Table 1-2 of the BNFL ISMP. "The evaluation of the availability and reliability of the SSCs include factors such as failure to start and failure to operate, as well as unavailability resulting from maintenance activities. Accident prevention and mitigation controls are added to the design as necessary to satisfy the worker accident risk goal."

Section 1.3.5, "Facility Design/Development Activities and Safety Features Identification," states: "In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls." Preference is also given to passive engineered features over active engineered features."

Section 3.7, "Proven Engineering Practices," expresses BNFL's commitment to incorporating proven technologies, (i.e., "they perform their intended function with high confidence,") into the design of TWRS privatization.

Sections 3.7.1, "Passive Features," and 3.7.2, "Active Features," describe examples of passive and active BNFL prevention and mitigation features.

Conclusion

The reviewers recommend approval of this contract requirement with respect to the Technical Safety Objectives. Sections 1.3.7, "Acceptable Levels of Public Safety," and 3.7, "Proven Engineering Practices" of the Contractor's ISMP commit BNFL to ensuring conformance to the Public Protection and Worker Protection top-level principles of DOE/RL-96-0006. Sections 1.3.4, "Process Hazard Analysis," and 1.3.6, "Accident Analysis," commit BNFL to ensuring conformance with the Accident Vulnerability Mitigation Top-Level Principle in DOE/RL-96-0006.

3.2.2 Radiological and Nuclear Safety Principles

3.2.2.1 Defense-in-Depth

Requirements

DOE/RL-96-0006, Section 4.1.1, requires that the Contractor apply defense in depth to the design and operation of its TWRS-P facility. Defense in Depth consists of the following six principles with which the Contractor is required to conform :

- Defense in Depth (Section 4.1.1.1): To compensate for potential human and mechanical failures, a defense-in-depth strategy should be applied to the facility commensurate with the hazards such that assured safety is vested in multiple, independent safety provisions, no one of which is to be relied upon excessively to protect the public, the workers, or the environment. This strategy should be applied to the design and operation of the facility.

- Prevention (Section 4.1.1.2): Principle emphasis should be placed on the primary means of achieving safety, which is the prevention of accidents, particularly any that could cause an unacceptable release.

- Control (Section 4.1.1.3): Normal operation, including anticipated operational occurrences, maintenance, and testing, should be controlled so that facility and system variables remain within their operating ranges and the frequency of demands placed on structures, systems, and components important to safety is small.

- Mitigation (Section 4.1.1.4): The facility should be designed to retain the radioactive material through a conservatively designed confinement system for the entire range of events considered in the design basis. The confinement system should protect the workplace and the environment.

- Automatic Systems (Section 4.1.1.5): Automatic systems should be provided that would place and maintain the facility in a safe state and limit the potential spread of radioactive materials when operating conditions exceed predetermined safety setpoints.

- Human Aspects (Section 4.1.16): The human aspects of defense in depth should include a design for human factors, a quality assurance program, administrative controls, internal safety

reviews, operating limits (Technical Safety Requirements), worker qualification and training, and the establishment of a safety/quality program.

Review Methodology

Review of the defense in depth discussion in the ISMP was performed using the attribute for defense in depth in RL/REG-97-07:

1. A program that defines multiple, independent safety provisions which are sufficient for identified hazards and that no one provision is relied upon excessively to protect the public, the workers or the environment; and

2. Describe how defense in depth features will be tailored into the design and operations in a manner commensurate with the identified hazards.

The reviewers evaluated the ISMP to determine if BNFL's approach to facility safety addressed Top-Level Principles 4.1.1.1 through 4.1.1.6.

ISMP information that the reviewers considered for this assessment was found in Section 3.1, "Defense in Depth," of the ISMP.

Evaluation

BNFL's intent to vest safety in multiple, independent safety provisions is described in Section 3.1, "Defense in Depth," of the ISMP. BNFL described defense in depth as multiple layers of protection to mitigate a hazardous situation. BNFL's selection for multiple layers of defense-in-depth will be passive engineered design features, active engineered design features and administrative controls, respectively. BNFL also notes that defense in depth will be a consideration in classifying SSCs (Section 1.3.10). Defense in depth is considered in procedure development (Sections 1.3.13 and 5.6.1) and is tied to protection systems (Section 3.7.2). Section 4.1, "Safety Management Processes," provides additional discussion of BNFL's defense in depth approach.

While the approach described is acceptable, BNFL did not acceptably describe its method (the manner) for implementing defense in depth. In Section 3.1 of the ISMP, BNFL stated defense-in-depth is applied (implemented) in the following manner:

- Conservative identification of the hazardous situation;

- Conservatism is applied in assessing design features for normal operations such that they also provide protection against hazardous situations;

- If the hazardous situation cannot be removed by using engineered features the potential consequence of the hazardous situation is conservatively assessed. This can be qualitative assessment (use of a binning matrix and judgment) or a quantitative frequency and consequence calculations if deemed appropriate;

- Operator training and use of procedures assures the capability to perform as the first line of defense (i.e., the operator responds appropriately to the development of a hazardous situation);

- The combination of engineered features and administrative controls provided depend on the overall severity class of the hazardous situation;

- If the potential for exceeding the worker or public radiological or chemical exposure standards exists, Design Class I or II engineered features are specified.

The above describes methods of establishing conservative safety margins, not a method for implementing defense-in-depth. Examples of defense-in-depth implementing criteria are:

- Criteria and methodology for determining the number of multiple layers necessary for protection.

- Criteria for determining the Design Classification of SSCs used to achieve defense in depth.

- Criteria for establishing acceptable risk associated with defense in depth features.

In several question responses and other correspondence, BNFL has provided additional information regarding their planned implementation of defense in depth. This new information is documented fully in the SRD Evaluation Report (RL/REG-98-01, Section 3.2.3.1.1) and is not repeated here. This information shows BNFL has proived an adequate subordinate standard for Top-Level Principle 4.1.1.1 (Defense in Depth) in Appendix 1A to the ISAR, but not for Top-Level Principles 4.1.1.2 through 4.1.1.6 (Prevention Control, Mitigation, Automatic Systems, and Human Aspects).

Conclusions

The BNFL broad commitment to apply defense in depth in their safety program is acceptable. However, SC 4.3-1 and SC 7.0-2 did not adequately incorporate Top-Level Principles 4.1.1.5 and 4.1.1.3, respectively, and subrodinate standards were not identifieid for any of the principles related to defense in depth except for SC 4.3-1 (see SRD Evaluation Report Section 3.2.3.1). Also, BNFL did not acceptably describe its method (the manner) for implementing defense in depth in the ISMP. Therefore, BNFL shall modify the ISMP to provide a description of their plans to implement defense in depth prior to initiating preliminary design.

3.2.2.2 Safety Responsibility

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensure compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the approved SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the overall safety responsibility principle required by DOE/RL-96-0006, Section 4.1.2.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall safety responsibility principle. The information provided by BNFL was assessed to the following attributes:

1. Verify that safety responsibility for the facility is established and well defined throughout the life of the facility;

2. Verify that commitments from relevant parties are established to provide data and services needed to fulfill safety commitments; and

3. Verify that processes to obtain, analyze, and implement lessons learned from relevant research, design, construction, modification, and operation of similar facilities are described.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

BNFL addresses the overall safety responsibility principle in Section 3.2, "Safety Responsibilities," of the ISMP. Various aspects of safety responsibility are addressed throughout the ISMP as follows.

Section 3.2, "Safety Responsibilities," describes the safety roles for the TWRS-P project during design, construction, and operation with reference to Figures 11-1 and 11-2. Tables 9-1 through 9-5 address the assignment of safety roles in relation to design, procurement, construction, testing, startup, operations, and deactivation.

Section 11.0, "Organization Roles, Responsibilities and Authorities," provides a description of the safety roles, responsibilities, and authorities.

Section 1.2, "Summary," states that the BNFL safety approach is based on the successful experience of the BNFL team with similar facilities. This theme is expanded in Section 3.2 with respect to the design and operational experience gained by BNFL at more than 30 nuclear and chemical facilities at Sellafield and other sites. Lessons learned at these other facilities were reportedly used as part of the preparatory work for TWRS-P facility hazard identification studies and incorporated into the TWRS-P facility design and plans for operation. The lessons-learned program is also the subject of Section 3.16.7, "Lessons Learned."

The reviewers evaluated whether the roles, responsibilities, and authorities for defining, implementing, and maintaining safety were adequately described in Section 3.2, Tables 9-1 through 9-5, and Section 11.0 of the BNFL ISMP. This was to determine if the overall principle of safety responsibility is adequately addressed in the standards and requirements identified and recommended by BNFL. The reviewers determined that, for the most part, the safety roles and responsibilities are clearly described. For example, the reviewers found that Tables 9-1 through 9-5 specifically identify safety-related responsibilities by functional area for the design, fabrication/construction, startup, operations, and deactivation phases of the TWRS-P facility. The reviewers also observed that the safety responsibilities identified in Section 11.0 for the design/construction and operations phases of the facility are generally well defined. However, the reviewers identified a concern regarding Section 11.0 with respect to (a) the safety roles and responsibilities of BNFL team members and subcontractors, and (b) the BNFL organization(s) responsible for managing subcontractor performance and for ensuring that subcontractors discharge their safety responsibilities in an appropriate manner (Review Question 109). BNFL responded to this concern with the following statements:

> "[S]afety expertise is integrated across the Project, BNFL has the sole responsibility for defining and implementing approved safety standards and communicating those safety standards as requirements for all team members and subcontractors who conduct work for the Project[;]"
>
> and

> "BNFL retains responsibility for oversight of team members and subcontractors performance and for overall project safety."

These responses, however, do not address the top-level safety principle of safety resonsilbiity (DOE/RL-96-0006, 4.1.2.1). This principle states:

> "Ultimate responsibility for the safety of the facility rests with the Contractor. In no way should this responsibliity be diluted by the separate activities and responsilbities of designers, suppliers, constructors, the Regulatory Unit, or independent oversight bodies."

BNFL must clearly indicate who has ultimate responsibility for (see also Section 3.2.3.1.3 of this report).

The reviewers examined Sections 1.2, 3.2, and 3.16.7 of the ISMP to determine the extent to which operating experience and the results of safety-related research relevant to safety were obtained, reviewed, and analyzed, and lessons learned implemented in the design, construction or modification, and operation of the TWRS-P facility. The reviewers found that operating experience, results of research results, and lessons learned appear to be incorporated into the TWRS-P facility design and plans for operation. However, it was not apparent to the reviewers from these sections whether BNFL intends to continue to obtain, evaluate, and incorporate lessons learned from other facilities into the TWRS-P facility during Part B activities (Review Question 137). BNFL committed to implementing a lessons-learned program in Part B that will require the review of internal and external events from similar facilities for the purpose of enhancing the safety of the TWRS-P facility.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. The reviewers identified two issues and BNFL provided adequate responses in both cases.

However, BNFL has not adequately addressed who has ultimate responsibility for safety. The reviewers concluded that the ISMP is acceptable for the safety responsibility portion of the contract requirement relating to conformance to the top-level safety standards and principles, provided BNFL addresses who has ultimate responsibility for safety.

3.2.2.3 Authorization Basis

Requirements

DOE/RL-96-0003 states that the Contractor's ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003 and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process standards and principles contained in DOE/RL-96-0006. This includes the authorization basis principle required by DOE/RL-96-0006, Section 4.1.3.

Review Methodology

The information provided by BNFL was assessed to the following attribute: to determine the compatibility of BNFL's ISMP with the authorization basis principle. This examination was conducted through review of the material presented in the BNFL SRD, Vol. II, and the ISMP.

Evaluation

The authorization basis principle DOE/RL-96-0006 identifies the requirements to establish, document, and submit material to the RU for evaluation and in support of authorization decisions and regulatory oversight. It further identifies requirements to maintain the authorization basis current in light of the design and available new information. It also identifies expected content of the authorization basis.

Section 3.3, "Licensing Basis," of the ISMP states that the licensing basis is similar to the authorization basis in that it is "the composite of information provided by BNFL on which the Regulatory Unit issues an operating authorization" and Section 3.3.1, "Content of the Licensing Basis," describes the content of the "licensing basis," which includes the following:

- Integrated Safety Management Plan
- Safety Requirements Document
- Safety Analysis Reports
- Technical Safety Requirements
- Quality Assurance Program
- Radiation Protection Program
- Emergency Plan
- Other Information.

The reviewers examined the consistency between BNFL's approach to changes in the authorization basis and the RU's position defined in the *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*, (RL/REG-97-13).[16] In a number of areas, the BNFL ISMP is incomplete or inconsistent with RL/REG-97-13. For example, it is not clear that BNFL's configuration management program ensures that changes are evaluated for their effect on the authorization basis. Also, the BNFL process for evaluating and documenting changes is unclear.

Conclusions

The reviewers determined that relative to the authorization basis principle, the Contractor's ISMP is not fully compliant with the authorization basis principle of DOE/RL-96-0006. The reviewers recommend approval of this portion of the contract requirement relating to the top-level safety standards and principles subject to the condition that BNFL revise Section 3.3 of its ISMP to clearly describe an authorization basis management process that conforms to the RU position described in RL/REG-97-13. This revision shall be completed prior to the start of Part B design activities.

3.2.2.4 Safety/Quality Culture

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP

16. *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*, RL/REG-97-13, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington, December 1997.

conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the overall safety/quality culture principle required by DOE/RL-96-0006, Section 4.1.4.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall safety/quality culture principle. The information provided by BNFL was assessed to the following attributes:

1. Verify that the ISMP contains provisions to establish an appropriate safety and quality culture that includes an emphasis on excellence in all activities;

2. Verify that a safety/quality program is established that governs BNFL's actions and interactions of all personnel and organizations engaged in activities related to the facility; and

3. Verify that BNFL has safety and quality responsibilities specifically identified in its operations.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

BNFL addresses the overall safety/quality culture principle in Section 3.4, "Safety/Quality Culture," of the ISMP. Section 3.4 outlines the policies and procedures employed to achieve a culture in which individuals involved in safety-related activities accept responsibility for safety and quality through all phases of the TWRS-P project. Communication techniques, training, planning, assessments, and stop-work authority are among the provisions identified in Section 3.4 of the ISMP for achieving a strong safety and quality culture. Also, safety roles and responsibilities are identified within Tables 9-1 through 9-5, Section 11.0, and elsewhere in the ISMP.

The reviewers evaluated Section 3.4 of the ISMP to determine if it adequately reflects the importance of a strong safety and quality culture. The reviewers found that Section 3.4 presents a reasonable approach with particular emphasis on communicating safety/quality policies and expectations to BNFL team personnel. Also considered pertinent by the reviewers was the empowerment of TWRS-P facility employees. Section 3.4 describes how employees can stop the activity in which they are involved if the work procedures or process is not clear or the activity appears to be unsafe.

The reviewers examined Section 3.16.1, "Safety Committees," of the ISMP to assess the purpose and makeup of the Safety Committee. An issue was identified regarding the apparent exclusion of workers as members of this committee during the construction, operations, and deactivation phases of the facility (Review Question 89). BNFL responded to this concern by stating that worker participation in safety committees is one of the most important elements of the safety/quality culture and the heart of the Safety Improvement Program. BNFL also indicated that workers will be invited to participate in the TWRS-P Safety Committee meetings.

Another issue was also identified by the reviewers regarding Section 3.16.5, "Performance Monitoring," in that: (a) a member of the TWRS-P QA organization is not on the team that will conduct performance monitoring, and (b) the Quality Assurance Program is not one of the areas monitored (Review Question 138). BNFL responded by committing to change the ISMP to reflect the inclusion of

(1) a member of the TWRS-P QA organization on the team that will conduct performance monitoring, and (2) the Quality Assurance Program as one of the areas to be monitored.

The reviewers examined Section 11.0, "Organization Roles, Responsibilities and Authorities," of the ISMP to determine if safety and quality responsibilities are specifically identified. An issue was identified regarding Section 11.0 in that it does not address the roles and responsibilities of BNFL team members and subcontractors related to safety (Review Question 109). As described in Section 3.13 of this Evaluation Report, BNFL's response adequately clarified this issue.

During their evaluation of Figures 11-1 and 11-2 of the ISMP, the reviewers identified an issue regarding the reporting relationship of the TWRS-P project QA Manager shown in these figures compared to the reporting relationship reflected in the BNFL QAP (Review Question 163). BNFL responded by committing to revise Figure 11-1 in a manner that is compatible with the QAP. With respect to Figure 11-2, BNFL provided a satisfactory explanation to the reviewers for retaining the reporting relationship as depicted in the figure.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. Although the reviewers identified four issues, BNFL provided adequate responses in each case. The reviewers therefore concluded that the BNFL ISMP is acceptable for the safety/quality culture portion of the contract requirement relating to conformance to the top-level safety standards and principles.

3.2.2.5 Configuration Management

Requirements

DOE/RL-96-0003 requires that the contractor's ISMP ensures compliance with DOE nuclear safety regulations, in conformance with the DOE-stipulated top-level safety standards and principles, and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process standards and principles contained in DOE/RL-96-0006. This includes the overall configuration management principle required by DOE/RL-96-0006, Section 4.1.5.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall configuration management principle. The information provided by BNFL was assessed to the following attributes:

1. Verify that BNFL plans to evaluate all planned changes involving the technology of the process and the facility design and operation;

2. Determine if BNFL has established provisions for facility changes involving process chemicals, technology, equipment, and procedures;

3. Verify that the procedures which describe change management address the technical basis for proposed changes, impact of the changes on process safety, modification of the operating procedures, the schedule for proposed changes, and authorization for proposed changes;

4. Verify that formal configuration management will be applied to all facility activities during the program's lifetime to ensure that programmatic objectives, including safety, are fully achieved;

5. Verify that work will be performed and controlled according to pre-approved plans and procedures that clearly delineate responsibilities;

6. Verify that documented records will be retained;

7. Verify that BNFL personnel will become, and remain, familiar with the features and limitations of facility components, including appropriate input obtained from the design organization on pre-operational testing, operating procedures, and the planning and conduct of training; and

8. Verify that a system will be used to control and maintain accurate as-built drawings during the life of the facility.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

BNFL describes its Configuration Management (CM) program for nuclear, radiological, and process safety for the TWRS-P facility in Section 1.3.16, "Configuration Management," of the ISMP. The four basic steps of the CM program, (1) Identification, (2) Evaluation, (3) Approval, and (4) Implementation are defined in this section. Section 1.3.9, "Quality Assurance Program," indicates that administrative processes such as configuration management are subject to the requirements of the BNFL QAP. Section 1.3.14, "Startup Testing," states that the startup testing program documents the as-built configuration of the facility. The TWRS-P facility configuration management program is the subject of discussion in Section 5.3, "Configuration Management." This section summarizes the essential elements of the Management of Change procedures. The safety roles and responsibilities of the TWRS-P project Configuration Management group during the design and construction phase and the operations phases are discussed in Sections 11.1, "Design and Construction Phase," and 11.2, "Operations Phase," respectively.

The reviewers evaluated whether the elements of the BNFL CM program were adequately described in Section 1.3.16 of the ISMP. The elements of this CM program appeared to be logical, in general, although the reviewers raised a question regarding the following:

1. The identity of the organizations or positions responsible for performing each of the four basic configuration management steps,

2. The qualifications required for personnel performing each step, and

3. The safety-related requirements that would cause proposed changes to be rejected during the evaluation step (Review Question 176).

BNFL provided supplemental information that satisfactorily addressed these issues.

Section 5.3 of the ISMP was analyzed by the reviewers regarding the provisions for change management. The reviewers noted in Section 5.3 that procedures are developed to manage changes to process chemicals, technology, equipment and procedures, together with changes to facilities that affect a covered process. The reviewers also observed that Section 5.3 identifies nine considerations that are addressed to manage each change (e.g., the impact of the change on safety and health). In Section 2.1, "Statutory Compliance," of the ISMP, the reviewers observed that changes to the TWRS-P facility technical baseline configuration are reviewed and documented in accordance with procedures to ensure that a high level of protection is maintained for the workers, public, and environment. The reviewers also noted that a configuration management group is clearly shown in the organizational structure of Figures 11-1 and 11-2, as well as in the description of responsibilities in Sections 11.1 and 11.2 of the ISMP.

The reviewers assessed the adequacy of the measures established by BNFL regarding authorization for proposed changes. As part of this assessment, the reviewers evaluated Section 4.1.3, "Development of Safety Management Programs," of the ISMP and identified an issue regarding the extent to which the RU will be involved in the approval of proposed changes to the SRD (Review Question 85). BNFL responded by stating that DOE will be involved in approval of changes to the SRD.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. Although the reviewers identified two issues, BNFL provided adequate responses in both cases. The reviewers therefore concluded that the BNFL ISMP is acceptable for the configuration management portion of the contract requirement relating to conformance to the top-level safety standards and principles.

3.2.2.6 Quality Assurance

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the overall QA principle required by DOE/RL-96-0006, Section 4.1.6.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall QA principle. The information provided by BNFL was assessed to the following attributes:

1. Verify that sufficient detail is provided to conclude that the QA program is adequately integrated into BNFL's safety management programs;

2. Verify that QA and quality control are applied throughout all phases and to all activities associated with the facility as part of a comprehensive system to ensure, with a high level of confidence, that all items delivered and services and tasks performed meet required standards;

3. Verify that BNFL plans to use well-proven and established techniques and procedures supported by QA practices to provide high- quality equipment and achieve high- quality construction; and

4. Verify that BNFL plans to establish operational QA and control programs to assist in ensuring satisfactory performance in facility activities important to safety.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

BNFL addresses the overall QA principle in several places within the ISMP. Section 1.3.9, "Quality Assurance Program," indicates that application of the requirements of the QAP continues during design, procurement, construction, startup, testing, inspections, operations, maintenance, modifications, and deactivation of the facility. Section 3.5, "Quality Assurance Program (QAP)," discusses the TWRS-P project QAP in the context of its application to the various phases of the project beginning with the Process Hazards Analysis (PHA), SRD, and Hazard Analysis Report (HAR). Sections 3.3.1.5 and 3.5 of the BNFL ISMP discuss compliance with, "Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program," (DOE/RW-0333P) during TWRS-P project high-level waste production, storage and transportation.[17]

The reviewers evaluated Section 1.3.9 of the ISMP to assess the extent to which BNFL committed to apply appropriate QA and quality control (QC) assurances throughout all phases and to all activities associated with the TWRS-P facility. The reviewers found that Section 1.3.9 requires the QAP to be applied during design, procurement, construction, start-up, testing, inspections, operations, maintenance, modifications, and deactivation of the facility. It was also noted during review of Section 1.3.9 that BNFL's QA program is an important tool in achieving safe operation of the TWRS-P facility and the program is used to ensure that all aspects of the integrated safety approach have been implemented for the TWRS-P project. However, the existing BNFL QAP was developed primarily to support Part A of the TWRS-P Contract. Without reviewing BNFL's Part B QAP and QA implementation plan, it is not possible for the reviewers to determine the extent to which the BNFL QA program is appropriate for later phases of the contract. Thus, BNFL was requested to provide the schedule and milestones for submitting the Part B QAP and implementation plan to the RU (Review Question 76). BNFL responded by indicating that the BNFL Part B QAP and its implementation plan will be submitted to the RU 60 days before Part B contract award.

The reviewers noted that the wording of Section 3.3.1.5 and Section 3.5 of the ISMP appears to limit the application of DOE/RW-0333P to HLW production, storage, and transportation. BNFL was therefore requested to explain the extent to which DOE/RW-0333P will be applied to the design of HLW-affected activities (Review Question 73). BNFL responded by stating that DOE/RW-0333P will be applied to all activities associated with HLW services from design through production and acceptance.

The reviewers benefited from the BNFL QAP Evaluation Report (which documents the evaluation of the BNFL QAP by the RU) as a baseline in assessing the extent to which BNFL plans to use well-proven and established techniques and procedures supported by effective QA practices.

17. *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program (QARD)*, DOE/RW-0333P, Rev. 5, U.S. Department of Energy, Washington, D.C., 1995.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. Although the reviewers identified two questions, BNFL provided adequate responses in both cases. The reviewers therefore concluded that the BNFL ISMP is acceptable for the QA portion of the contract requirement relating to conformance to the top-level safety standards and principles.

3.2.2.7 Design, Construction and Pre-Operational Testing

3.2.2.7.1 Design

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles, and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 4.2.1.

The three top-level principles in DOE/RL-96-0006 relating to Design are as follows:

- Safety Design (Section 4.2.1.1): The facility should be designed for a set of events such as: normal operation, including anticipated operational occurrences, maintenance, and testing; external events; and postulated accidents.

- Risk Assessment (Section 4.2.1.2): Acceptable risk analyses should be applied during the design to delineate provisions for the prevention and mitigation, including emergency preparedness and response, of otherwise risk-dominant events.

- Safety Analysis (Section 4.2.1.3): A safety analysis should be carried out as required to evaluate the safety performance of the design and identify requirements for operations.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall design principle. The information provided by BNFL was assessed to the following attributes:

1. Describe the facility design process (and that the design process provides assurance that the facility is designed for the set of events that includes normal operations, anticipated operational occurrences, and postulated accidents including external events); and

2. Incorporate appropriate methodologies for risk assessment and safety analysis for normal operations, anticipated operational occurrences, and postulated accidents, including external events.

Evaluation

BNFL's process of design for normal operation, anticipated operational occurrences, and accident conditions is described in Section 3.6, "Facility Design for Postulated Events," of the ISMP. Various aspects of facility design for postulated events are described throughout the ISMP, as follows:

Section 3.6.1, "Normal Operations," describes BNFL's design process, including the development of the overall process flowsheet by the technical group, and the examination of the design by the PHA group from a safety and operability perspective.

Section 3.6.2, "Anticipated Operational Occurrences," describes how BNFL builds features into the design to minimize the risk to personnel caused by anticipated operational occurrences that are not considered part of the normal process operation, to minimize the impact to the process operation, and to enable equipment to be maintained in a safe manner.

Section 3.6.3, "Accidents," describes how BNFL designs the TWRS-P facility to maintain confinement of radioactive materials to prevent significant release from the facility. Hazardous situations include both internal and external events; internal events are evaluated in the BNFL HAR, Section. 5.0, "Hazard Evaluation by Process Step," and external events are discussed in the BNFL HAR, Section. 2.1, "Site Description."

Section 1.3.6, "Accident Analysis," describes BNFL's approach to accident analysis, including methods that encompass factors such as the material at risk, and the rate and duration of the release of hazardous material, in the determination of the source terms. This section describes the process of separating accidents involving lower-risk from those of higher risk; grouping accidents on the basis of such considerations as location, phenomena involved, accident type, and the nature of the material at risk; and calculating the radionuclide or "cold" chemical releases from the facility.

Section 1.3.8, "Acceptable Level of Worker Safety," describes how BNFL bins potential accidents by a risk-based categorization of hazards and hazardous situations according to a frequency/consequence matrix, and how BNFL performs risk analyses using fault trees, event trees, and consequence analyses to determine risks to workers. From this process, preventive and mitigative engineered and administrative controls to be added to the design are identified. Table 1-2 of the BNFL ISMP shows the radiological exposure standards applied to the facility workers and co-located workers.

Section. 1.3.7, "Acceptable Level of Public Safety," describes how BNFL evaluates potential public exposures to releases of radionuclides and "cold" chemicals against the radiological and chemical exposure standards for the public (see Table 1-2 of the ISMP). For example, for chemical releases, the projected exposure is compared to the standards in Emergency Response Planning Guide-2 (ERPG-2). If the radiological or chemical release exposure standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles in relation to Design of DOE/RL-96-0006.

3.2.2.7.2 Proven Engineering Practices/Margins

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 4.2.2.

The five top-level principles in DOE/RL-96-0006 relating to Proven Engineering Practices/ Margins are as follows:

- Proven Engineering Practices (Section 4.2.2.1): Safety technologies incorporated into the facility design should have been proven by experience or testing, and they should be reflected in approved codes and standards. Significant new design features should be introduced only after thorough research and model or prototype testing at the component, system, or facility level, as appropriate.

- Common-Mode/Common-Cause Failure (Section 4.2.2.2): Design provisions should be included to limit the loss of safety functions due to damage to several structures, systems, or components important to safety resulting from a common-cause or common-mode failure.

- Safety System Design and Qualification (Section 4.2.2.3): Structures, systems, and components important to safety should be designed and qualified to function, as intended, in the environments associated with the events for which they are intended to respond. The effects of aging on normal and abnormal functioning should be considered in design and qualification.

- Codes and Standards (Section 4.2.2.4): Codes and standards for vessels and piping should be supplemented by additional measures (such as erosion/corrosion programs and piping in-service inspections) to mitigate conditions arising that could lead to an unacceptable release of radioactivity during the operational life of the facility.

- Criticality (Section 4.2.2.5): The facility should be designed and operated in a manner that prevents nuclear criticality.

Review Methodology

The reviewers assessed the ISMP to determine if it addresses the issue of how a process will ensure conformance with Top-Level Principle "Proven Engineering Practices/Margins." Specifically, the reviewers were looking for a description of the method by which the Contractor will identify and incorporate safety technologies into the facility design. The reviewers used the following criteria in their evaluation:

- The method for incorporating safety technologies into the design process ensures that the technologies are proven by experience or testing and that they are reflected in approved codes and standards;

- Whether the ISMP describes the research, modeling, or prototype testing that will occur in order to ensure that the technology can be relied upon for safety should the Contractor select novel design features;

- A discussion of prevention of common-cause or common-mode failures;

- A discussion of safety qualification;

- Inclusion of supplements to the codes and standards necessary for specific conditions, (e.g., corrosion testing and in-service piping inspections); and

- A description of the implementation of the nuclear criticality program.

Evaluation

Section 3.7, "Proven Engineering Practices," of the ISMP describes the Contractor's TWRS-P facility design approach for incorporating the use of proven technologies so that lessons learned from the use of existing technologies are incorporated into the operation of the facility. The manner in which new and novel uses of existing technologies and processes are examined through research and development are described throughout Section 3.7 of the ISMP, as follows.

Section. 3.7.1, "Passive Features," describes how TWRS-P processes are confined by at least two barriers (i.e., defense-in-depth), and how aspects of confinement design ensure that failure of one barrier does not lead to failure of the other (i.e., confinement is diverse). This is an example of design provision to limit the loss of safety functions caused by damage to several structures, systems, or components important to safety resulting from a common-cause or common-mode failure.

Section. 3.7.2, "Active Features," describes how ventilation systems, for example, are provided with redundant equipment to protect against single active failures.

Section. 3.11, "Safety System Design," describes BNFL's approach to the design of safety systems. Passive features rather than active features are employed when practicable. Potential faults are minimized by (1) process design features that moves the facility towards a safe state in response to failures, or (2) by incorporation of permanently available, passive features that render the facility safe following a failure. Conditions in which the safety systems are expected to operate are evaluated. Expected environmental conditions are incorporated into the specifications for the safety SSCs that must function to prevent hazardous situations or mitigate the consequences of accidents. SSCs are classified based on the basis of their importance to accident prevention and mitigation. Specifications for SSCs are commensurate with the importance of the functions that need to be performed.

However, Top-Level Standard 4.2.2.3, "Safety System Design and Qualification," prescribes the design approach towards SSCs important to safety. The contractual definition of important to safety in DOE/RL-96-0006 states that, "…as design matures and results from risk assessments identify vulnerabilities resulting from non-safety-related equipment, additional structures, systems, and components

should be considered within this definition [of important to safety]." BNFL describes SSCs important to safety using the Design Class I and II designation.

The ISMP states that Design Class I SSCs are designed so that after an initiating event, the systems are capable of performing their safety function assuming the failure of any single active component of the DC I SSCs (BNFL ISMP, Rev. 0, pg. 1-17). However, a similar requirement is not imposed upon DC II systems. Since the contractual definition of "important to safety" requires SSCs to be designed to limit risks, the artificial imposition of the single point failure criterion solely to DC I systems violates the logical approach to SSC design prescribed in the contract.

Section. 3.13, "Reliability, Availability, Maintainability, and Inspectability (RAMI)," states that in-cell components (primary circuit) are not designed to be maintained, because the design takes this into account by using all-welded pipework and enhanced (pre-operational) testing. Inspection of the primary circuit is performed indirectly via test coupons within the circuit to assess corrosion rates of the pipework, or directly through visual (closed- circuit television).

Section. 3.8, "Criticality Safety," states that BNFL establishes the need for criticality controls during the TWRS-P design phase by considering worst-case scenarios and applying conservative assumptions. Worst-case scenarios are modeled using validated computer codes to determine system reactivity and the degree of criticality control required. The ISMP states that the BNFL ISAR, Section 6.0, "Nuclear Criticality Safety," will provide "an analysis to show that specific controls for prevention of criticality are not required in TWRS-P." If any significant potential for criticality becomes apparent, appropriate controls will be implemented commensurate with the assessed potential."

Conclusions

BNFL must redefine the classification of SSCs so that the contractual definition of "important to safety" and the intent of integrated safety management are met. Subject to this condition, the reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles in relation to "Proven Engineering Practices/Margins" of DOE/RL-96-0006.

3.2.2.7.3 Radiation Protection

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD, as well as comply with all applicable laws and regulations, particularly the implementation plans required by the 10 CFR 830. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006.

Pursuant to DOE/RL-96-0003 applicable laws and regulations specifically include the DOE nuclear safety regulation 10 CFR 835, "Occupational Radiation Protection."[18] One radiological and nuclear safety principle for radiation protection states that "An acceptable system of radiation protection practices should

18. DOE/RL-96-0003, Section 2.0, p. 2.

be followed in the design, construction, and pre-operational testing phases of the facility for the protection of workers and the public." A second principle states that "An acceptable system of radiation protection practices should be followed in the operational phase for the protection of workers and the public." Conformance with these principles is established, in part, through programmatic compliance with the requirements of 10 CFR 835, "Occupational Radiation Protection" and the standards required by Table 1 of DOE/RL-96-0006.

Review Methodology

The reviewers evaluated the ISMP for programmatic conformance to the top-level radiological and nuclear safety principles for radiation protection. The information provided by BNFL was assessed to the following attribute: the adequacy of the programs documented in the ISMP to conform to the Radiation Protection Practices principles contained in DOE/RL-96-0006. Conformance with these principles is established, in part, through programmatic compliance with the requirements of 10 CFR 835, "Occupational Radiation Protection" and the standards required by Table 1 of DOE/RL-96-0006. Radiological dose standards for workers, co-located workers, and the public during normal operation and credible accident conditions are included. These standards are consistent with radiological exposure limits embodied by DOE and NRC regulations as well as the perspectives of the ICRP and the NCRP. This evaluation was conducted through a review of the material presented in the BNFL RESW, the ISMP, and the resolution of questions developed in the review process.

BNFL was required to provide a regulatory deliverable that addresses and incorporates the top-level safety standards and principles of Table 1 of DOE/RL-96-0006. The deliverable is contained in BNFL RESW. Subsequent revisions to this document were provided on as part of the review question and resolution process. Table A of the BNFL RESW corresponds to Table 1 of DOE/RL-96-0006. The BNFL RESW addresses conformance to dose standards for the public and the worker. An evaluation of the adequacy of the Contractor's conformance is documented in Appendix B to the BNFL SRD Evaluation Report.

Evaluation

Numerous sections of the ISMP document relevant information on programs that are to conform to the Radiation Protection Practices principle contained in DOE/RL-96-0006. This principle requires that an acceptable system of radiation protection practices be followed in the design, construction, pre-operational testing, and operational phases of the facility to protect workers and the public. Programmatic compliance with 10 CFR 835 results in conformance with radiation exposure within the facility being kept ALARA and within prescribed limits during normal operation.

Section 2.3, "Compliance with 10 CFR 835, 'Occupational Radiation Protection,'" of the ISMP provides a description of a radiation protection program implementing the requirements of 10 CFR 835 including plans, schedules, and other measures for achieving compliance with the requirements of 10 CFR 835. The ISMP provides adequate statements of programmatic compliance with the nuclear safety requirements of 10 CFR 835.

Section 3.9, "Radiation Protection Practices," provides a description of a radiation protection program, which requires that radiation exposure and environmental impact due to any release of radioactive material from the facility be kept ALARA and within prescribed limits during normal operation. This program consists of two main elements: radiation protection design and ALARA design.

Section 1.3.3, "Safety Requirements Document," states that the SRD defines the Safety Criteria as the design requirements (implementing codes and standards) necessary to protect workers and the public from radiological, nuclear, and process hazards and hazardous situations.

Section 1.3.5, "Facility Design/Development Activities and Safety Features Identification," states that the PHA and the accident analysis identify the need for accident prevention and mitigation controls to satisfy the Safety Criteria documented in the BNFL SRD.

Sections 1.3.7, "Acceptable Level of Public Safety," and 1.3.8, "Acceptable Level of Worker Safety," provide a program description for the conformance of the facility design with standards established in the BNFL RESW, Table A.

Section 2.3.3, "Radiation Protection Program," describes a radiation protection program. This description also ensures conformance with radiological dose and ALARA design standards under normal operations.

The Contractor's overall program for accident mitigation and selection of safeguards provides an adequate level of safety. The proposed consequence limit is sufficiently low to ensure that radiation exposures to workers and co-located workers as a result of accidents would be ALARA. Therefore, the ISMP provides adequate statements of programmatic conformance to the radiological and nuclear safety principles for Radiation Protection Practices required by DOE/RL-96-0006.

Conclusions

The reviewers recommend approval of this contract requirement with respect to programmatic conformance with the radiological and nuclear safety principles for Radiation Protection Practices required by DOE/RL-96-0006. The BNFL ISMP documents programs that require that an acceptable system of radiation protection practices should be followed in the design, construction, pre-operational testing, and operational phases of the facility for the protection of workers and the public.

3.2.2.7.4 Emergency Preparedness

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the emergency preparedness principle required by DOE/RL-96-0006, Section 4.2.4 and 4.3.3.

Review Methodology

The RU reviewers evaluated the ISMP for conformance of the programs to the top-level safety standards and principles for "emergency preparedness" in DOE/RL-96-0006, which is applicable during design, construction, and pre-operational testing of the facility. Additionally, the RU reviewers evaluated the ISMP programs for conformance to the four top-level safety standards and principles contained in DOE/RL-96-0006, Section 4.3.3 "Emergency Preparedness," which are applicable during operation of the facility.

The four emergency preparedness safety principles are as follows:

- Support Facilities (Section 4.2.4.1): The facility design should provide additional capability to place and maintain the facility in a safe state following an accident if the normal control areas are expected to become uninhabitable.

- Offsite Measures (Section 4.3.3.1): Hanford Site and offsite mitigation measures should be provided to substantially reduce the effects of an unacceptable accidental release of radioactive material.

- Accident Management Strategy (Section 4.3.3.2): The results of analyses of the facility's response to accidents with the potential for releases resulting in doses in excess exceeding the EPA and the Washington State emergency clean-up standards, beyond the facility control perimeter (security fence), should be used in preparing guidance on an accident management strategy.

- Establishment and Continued Exercise of Emergency Plans (Section 4.3.3.3): Emergency plans should be prepared before the startup of the facility and should be exercised periodically to ensure that protection measures can be implemented in the event of an accident that results in, or has the potential for, unacceptable releases of radioactive materials within and beyond the facility control perimeter. Emergency planning zones defined around the facility should allow for the use of a graded response.

The reviewers evaluated the ISMP for programmatic conformance to the top-level radiological and nuclear safety principles for emergency preparedness contained in DOE/RL-96-0006. The information provided by BNFL was assessed to the following attribute: the adequacy of the programs documented in the ISMP to conform to the emergency preparedness safety principles contained in DOE/RL-96-0006.

Evaluation

A comprehensive review of the emergency preparedness program radiological, nuclear, and process safety standards documented in ISMP was performed against the requirements in DOE/RL-96-0006.

Section 3.1 of the ISMP describes the Contractor's program for defense in depth. Defense in depth was applied by specifying that protection against hazards is achieved by a combination of engineered features and administrative controls to provide prevention and mitigation.

The ISMP specifies that protection against hazards is achieved by a combination of engineered hazards and administrative controls. One such engineered feature supplemented by administrative controls is the control room habitability provisions described in the BNFL SRD (see Safety Criterion 4.3-7). The Safety Criterion states that the control room or control area shall be designed to permit occupancy and actions to be taken to safely monitor the facility during normal operations, and to provide safe control of the facility for anticipated operational occurrences and accident conditions. If credit is taken for operator action to satisfy the public exposure standards of Safety Criteria 2.0-1 and/or 2.0-2, adequate radiation protection will be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body gamma and 30 rem beta skin for the duration of the accident. For occurrences and accidents involving chemical release, provisions shall be made such that the operator exposure does not exceed the worker exposure standards of Safety Criterion 2.0-2.

Safety Criterion 4.3-7 further states that consideration will also be given to accidents at nearby facilities if operator action is required to safely control the processes and bring the facility to a safe state. The need for an alternate system that would allow the processes to be placed in a safe state in the event the primary control area is uninhabitable will be evaluated.

The control habitability safety criterion addressed all the key items identified in the top-level principles found in DOE/RL-96-0006. As such, the Contractor's ISMP conforms to this top-level principle through the defense-in-depth approach to preventing and mitigating accidents.

Section 3.3.1.7 of the ISMP describes the proposed emergency plan and Section 3.10 describes the Emergency Preparedness Program. The BNFL program will be consistent with the *Hanford Emergency Response Plan* (DOE/RL-94-02), as required by the BNFL TWRS Privatization Contract.[19] As such, agreements will be established to enable the BNFL TWRS-P project to use existing Hanford Site response capabilities for emergency response to reduce the effects of accidental release of radioactive materials. Also, in accordance with Table S4-1 of the Contract, the BNFL Emergency Management Program will comply with the requirements of 40 CFR 68, "Chemical Accident Prevention Provisions"; 40 CFR 355, "Emergency Planning Notification"; and 29 CFR 1910.38, "Employee Emergency Plans and Fire Prevention Plans."

Table 3-1 of the BNFL ISMP provides the outline and content of the Emergency Response Plan. A training drill program and an emergency response exercise program are called for in the plan.

The ISMP programs discussed adequately address the provisions of Emergency Preparedness of DOE/RL-96-0006. As such, they conform to the respective emergency preparedness safety principles.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. The RU reviewers concluded that the programs contained in the BNFL ISMP conform to the emergency preparedness safety principles of DOE/RL-96-0006.

3.2.2.7.5 Inherent/Passive Safety Characteristics

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the top-level principle "Inherent/Passive Safety Characteristics," required by DOE/RL-96-0006, Section 4.2.5.

19. *Hanford Emergency Response Plan*, DOE/RL-94-02, U.S. Department of Energy, Richland, Washington, 1998.

Review Methodology

The reviewers evaluated BNFL's ISMP to determine if the ISMP describes how BNFL will conform with the overall Inherent/Passive Safety Characteristics principle. This principle states: "Design features that enhance the margins of safety through simplified, inherent, passive, or other highly reliable means to accomplish safety functions should be employed to the maximum extent practical." The reviewers evaluated the Contractor's conformance to the top-level safety standards and principles relating to Inherent/Passive Safety Characteristics to the following attributes:

1. Use highly reliable means to accomplish safety functions, including design features that enhance the margins of safety through simplified, inherent, passive, or other highly reliable means to accomplish safety functions; and

2. Prefer reliance upon engineered controls rather than reliance upon administrative controls, to accomplish safety functions.

Evaluation

Section 1.3.5, "Facility Design/Development Activities and Safety Features Identification," of the ISMP includes BNFL's commitment to use highly reliable means to accomplish safety functions. Section 1.3.5 states: "In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls. Preference is also give to passive engineered features over active engineered features. Reliance on human intervention would be used only when reliance on other means of eliminating or mitigating the hazardous situation cannot not be used." (The reviewers noted a significant error—the double negative "cannot not"—in this sentence in the BNFL ISMP. The ISMP must be revised to ensure a clear statement of the Contractor's intent.) The significance of this statement is that the Contractor agreed to methodically select hazard controls from an established hierarchy of potential controls, with administrative controls employed only as a last resort when engineered controls are impractical. Similarly, BNFL agreed to accomplish safety functions with passive engineered controls (which are generally more reliable than active devices), unless passive controls are impractical, or would be ineffective, in which case active engineered controls will be selected. BNFL's commitments in Section 1.3.5 adequately reflect both of the Review Methodology attributes listed above.

The reviewers examined the ISMP for further evidence of BNFL's commitment to a design process in conformance with top level principle "Safety Margin Enhancement." Section 3.7, "Proven Engineering Practices," of the ISMP describes how the Contractor intends to incorporate proven technologies so that lessons learned from the use of the technology is incorporated into the operation of the facility. Examples of passive and active engineered features are provided in Sections 3.7.1, "Passive Features," and 3.7.2, "Active Features" of the ISMP. In Section 3.7.2, BNFL commits to designing for "fail safe," based on understanding and categorizing failure modes. Section 3.7.2 states: "Preference is given in the facility design to components failing in their safe position on loss of motive power. During the design process, the failure modes of safety features are determined and specified. Simple and proven items of equipment (e.g., valves and pumps) are used, the (required) failure modes of which are well understood and categorized." BNFL has thus provided further evidence of its commitment to design the TWRS-P facility giving preference to simple, reliable means of hazards control, and giving preference to controls whose failure modes: (1) are understood, and (2) can be specified by the designers.

The BNFL SRD, Vol. II, contains the Contractor's proposed set of standards. BNFL Safety Criterion 4.1-2 is a proposed standard for general design, and includes the requirement: "Items and

processes shall be designed using sound engineering/scientific principles and appropriate standards. Design features that use simplified, inherently safe, passive, other highly reliable means to accomplish the specified safety function should be employed to the maximum extent practical." Safety Criterion 4.1-2 supports BNFL's commitment to design the TWRS-P facility using simplified, inherent, passive, or other highly reliable means to accomplish safety functions.

The RU reviewers determined that the ISMP adequately describes, for this stage of design, the Contractor's process for meeting the requirements for Inherent/Passive Safety Characteristics.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level principle "Safety Margin Enhancement" and also "Inherent/Passive Safety Characteristics," based on the commitments and information in the Contractor's ISMP. As required by contract, the ISMP specifies how BNFL will provide a program that governs the Contractor's actions and interactions of all personnel and organizations engaged in activities related to the facility, and emphasizes excellence in all activities involving design using simplified, inherent, passive, or other highly reliable means to accomplish safety functions.

3.2.2.7.6 Human Factors

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, Section 4.2.6.

There are three top-level principles in DOE/RL-96-0006 relating to Human Factors. These three principles are as follows:

- Human Error (Section 4.2.6.1): The possibility of human error in facility operations should be taken into account in the design by facilitating correct decisions and inhibiting wrong decisions by operators, and by providing means for detecting and correcting or compensating for error.

- Instrumentation and Control Design (Section 4.2.6.2): Sufficient instrumentation and control capability should be provided so that operators can diagnose facility conditions, place and maintain the facility in a safe state, and mitigate accidents under normal operating and postulated accident conditions. If necessary, measures should be provided to protect the operator during performance of these functions.

- Safety Status (Section 4.2.6.3): Parameters to be monitored in the control room should be selected and their displays to be arranged to ensure that operators have clear and unambiguous indications of the status of facility conditions important to safety. This is especially important for the purpose of identifying and diagnosing the actuation and operation of a system or components important to safety.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall Human Factors principle. The information provided by BNFL was assessed to the following attribute: to determine if the ISMP contains adequate provisions to ensure that human factors, including those listed below, are properly incorporated in the design and operations of the facility.

- Measures to mitigate the possibility of human error;
- Systems design to facilitate correct decisions by operators and inhibit wrong decisions and/or compensate for human errors;
- Measures to detect and correct and/or compensate for human errors;
- Provisions of instrumentation and control capability sufficient to allow operators to diagnose faulty conditions, to place and maintain the facility in a safe state, and to mitigate accidents;
- Parameters to be monitored in the control room and their placement to ensure clear and unambiguous indications of facility status.

Evaluation

Section. 3.12, "Human Factors," of the ISMP describes BNFL's TWRS-P facility design approach for human factors. The possibility of human error in facility operations is evaluated by task analyses conducted on operations involving personnel and that are required to maintain the safety functions of the facility.

The analyses provide an assessment of the feasibility of proposed tasks and an input to the design of interfaces in accordance with human capabilities. Adequate instrumentation in the control room and at local control stations is important (and provided) to allow operators to detect and correct abnormal conditions. The design of the TWRS-P facility is such that the facility is "user-friendly" to minimize omission and commission errors and to ensure that the operator is in the best possible position to respond to those situations in which human response is beneficial or required. Attention is given to the placement of instruments and controls in the control room to ensure that clear and unambiguous indications of facility status are provided to the operators. Section 3.11, "Safety System Design," of the ISMP BNFL describes BNFL's approach to the design of safety systems, including provision of process design features that moves the facility towards a safe state in response to failures, or by incorporating permanently available, passive features that render the facility safe following a failure.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. The reviewers concluded that BNFL's ISMP conforms to the top-level principles of Section 4.2.6 "Human Factors" of DOE/RL-96-0006.

3.2.2.7.7 Reliability, Availability, Maintainability, Inspectability

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the Reliability, Availability, Maintainability, and Inspectability (RAMI) required by DOE/RL-96-0006, Section 4.2.7.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall RAMI principle in DOE/RL-96-0006.

- Reliability (Section 4.2.7.1): Reliability targets should be assigned to structures, systems, and components or functions important to safety. The targets should be consistent with the roles of the structures, systems, and components or functions in different accident conditions. Provisions should be made for appropriate testing and inspection of structures, system, and components for which reliability targets have been set.

- Availability, Maintainability, and Inspectability (Section 4.2.7.2): Structures, systems, and components important to safety should be designated, designed, and constructed for appropriate inspection, testing, and maintenance throughout their operating lives to verify their continued acceptability for service with an adequate safety margin.

Review guidance for the evaluation of RAMI requires the assessing if the ISMP includes adequate provisions for a RAMI program that:

1. Assigns reliability targets to safety-related structures, systems, and components.

2. Designates, designs, and constructs safety-related structures, systems, and components for appropriate inspection, testing, and maintenance throughout their operating lives to verify their continued acceptability for service with an adequate safety margin.

This examination was conducted through a review of the material presented in the ISMP.

Evaluation

Section 3.13, "RAMI" of the ISMP provides clear definitions of each component of RAMI, including how that component relates to the intended design process. BNFL's intention in applying RAMI is demonstrated by an example relating to the cooling water supply system for the cesium concentrate storage vessel.

BNFL commits that, during the design phase, the TWRS-P facility and processes will be evaluated for RAMI. The use of validated modeling techniques is cited as the method for determining reliability and availability. Maintenance and inspection needs will be based on facility and process reliability requirements.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles of RAMI.

3.2.2.7.8 Pre-Operational Testing

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, including the Pre-Operational Testing required by DOE/RL-96-0006, Section 4.2.8.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall Pre-Operational Testing principles in DOE/RL-96-0006.

- Testing Program (Section 4.2.8.1): Pre-operational testing program should be established and followed to demonstrate that the entire facility, especially items important to safety, have been constructed and function according to the design intent, and to ensure that weaknesses are detected and corrected.

- Operational System and Functional Testing Procedures Validation (Section 4.2.8.2): Procedure for normal facility and system operation and for functional tests to be performed during the operational phase should be validated as part of the pre-operational testing program.

- Safety System Data (Section 4.2.8.3): During pre-operational testing, detailed diagnostic data should be collected on systems and components important to safety and the initial operating parameters of the systems and components should be recorded.

- Design Operating Characteristics (Section 4.2.8.4): During the pre-operational testing program, the as-built operating characteristics of process systems and systems and components important to safety should be determined and documented. Operating points should be adjusted to conform to values in the design basis. Training procedures and limiting conditions for operation should be modified to accurately reflect the operating characteristics of the systems and components as built.

Review guidance for the evaluation of Pre-Operational Testing requires assessing the BFNL ISMP to ensure that it contains provisions for Pre-Operational Testing. This includes ensuring that adequate time and resources are planned for cold- and hot-testing phases prior to initial production. The review must also ensure that the testing demonstrates adequate performance of safety-related structures, systems, and components.

This examination was conducted through a review of the material presented in the ISMP.

Evaluation

BNFL commitments to Pre-Operational Testing are extensively defined in the SRD. Several sections of the SRD, as noted below and as documented further in the SRD Evaluation Report, speak specifically to the top-level safety standards and principles.

The BNFL SRD, Vol. II, Section 6.0, "Startup," Safety Criterion 6.0-1 states: "A pre-operational testing program shall be established and followed to demonstrate that Design Class I and Design Class II structures, systems and components have been properly constructed and can perform their specified safety function. The program shall provide for the detection, tracking and correction of deficiencies." Safety Criterion 6.0-2 states: "Procedures for normal facility and system operation and for functional tests to be performed during the operating phase shall be validated as part of the pre-operational testing program." Safety Criterion 6.0-3 states "During pre-operational testing, detailed diagnostic data should be collected on systems and components designated as Design Class I and Design Class II and the initial operating parameters of the systems and components should be recorded." Safety Criterion 6.0-4 states "During the pre-operational testing program, the as-built operating characteristics of process systems and systems and components designated as Design Class I and Design Class II shall be determined and documented. Operating points should be adjusted to conform to values in the design basis. Training procedures and limiting conditions for operation should be modified, if necessary, to accurately reflect the operating characteristics of the systems and components as built."

Section 1.3.14, "Startup Testing," of the BFNL ISMP discusses at a high level how BNFL intends to implement these criteria, consistent with the design and testing philosophy applied to operational facilities in the United Kingdom. BNFL commits to a program that confirms the readiness of the facility for safe operation, including providing assurance that safety functions are performed correctly.

Section 3.14, "Startup Testing and Operation," of the ISMP commits to four levels of system performance demonstrations:

1. Process systems using water (cold test)
2. Mechanical handling systems (cold test)
3. Facility operation using simulated feeds (cold test)
4. Facility operation using active materials (hot test).

Section 5.6.4, "Startup Review," of the ISMP specifically commits to a program where the ability of all Design Class I and II structures, systems and components to perform their specified safety functions is tested during startup. The completeness and adequacy of procedures is also confirmed.

Conclusions

The reviewers recommend conditional approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles of Pre-Operational Testing. This approval is conditional on BNFL providing the content of the startup plan in ISAR Section 3.10, "Initial Testing and Startup Safety Review," as committed to in its ISMP.

3.2.2.8 Operation

3.2.2.8.1 Conduct of Operations

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, including Conduct of Operations required by DOE/RL-96-0006, Section 4.3.1.

Review Methodology

The reviewers evaluated the ISMP for conformance to overall Conduct of Operations principles. Although there are no RL/REG-97-07 review attributes associated with Conduct of Operations, there are extensive top-level principles in DOE/RL-96-0006 to consider in the evaluation, as follows:

- Organizational Structure (Section 4.3.1.1): The Contractor should exert full responsibility for the safe operation of the facility through a strong, unambiguous organizational structure.

- Normal Operations (Section 4.3.1.2): Operations should be conducted in accordance with approved operational safety requirements and in strict accordance with administrative and procedure controls.

- Emergency Operating Procedures (Section 4.3.1.3): To provide a basis for suitable operator response to accident conditions, emergency operating procedures should be established, documented, and approved.

- Readiness (Section 4.3.1.4): The facility manager should ensure that all elements for safe facility operation are in place including an adequate number of qualified and experienced workers. Minimum requirements also should be set for the availability of staff and equipment.

- Internal Surveillance and Audits (Section 4.3.1.5): Internal safety review procedures should be used by the Contractor to provide a continuing surveillance and audit of facility operational safety and to support the facility manager overall safety responsibility.

- Operations within the Authorization Basis (Section 4.3.1.6): Operations should be conducted in accordance with approved Technical Safety Requirements (TSRs). Limiting conditions of operation, limiting control settings, and safety limits should be established as necessary to ensure operation within the authorization basis.

- Access to Technical Safety Support (Section 4.3.1.7): Throughout the life of the facility, the Contractor should have access to engineering and technical support personnel, who are competent in all disciplines important to safety.

- Operational Events (Section 4.3.1.8): Facility management should institute measures to ensure that events relevant to safety are detected and evaluated, and that necessary corrective measures are taken promptly and information on them is disseminated. Operational event reports should be prepared and submitted to the Director of the Regulatory Unit. The facility management should have access to operational safety experience.

This examination was conducted through a review of the material presented in the ISMP.

Evaluation

An extensive evaluation of Conduct of Operations, including the relation between the BNFL descriptions in its SRD and the ISMP, is provided in the BNFL SRD Evaluation Report, and is not repeated here. Section 1.3.15, "Operations," of the BNFL ISMP commits to implementing principles for achieving excellence in operation of the TWRS-P facility though a Conduct of Operations program. The ISMP outlines the significant attributes of this program.

The ISMP demonstrates that BNFL has embedded Conduct of Operations principles in its safety approach. For example, it is a consideration in Section 3.16.5, "Performance Monitoring." It is also a recognized key to the Safety Management Program described in Sections 4.1.2, et. seq. and 4.1.3. Finally, BNFL commits in Section 4.2.3.2 of its ISMP to revise the ISMP to "…give greater attention to the conduct of operations…" as the project nears operation. BNFL also notes that the Final Safety Analysis Report (FSAR) "…places emphasis on conduct of operations."

Conclusions

The reviewers recommend conditional approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles of Conduct of Operations. This approval is conditional on BNFL providing the content of the startup plan in ISAR Section 3.0, "Conduct of Operations," as committed to in the ISMP.

3.2.2.8.2 Training and Qualification

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes those of Training and Qualifications required by of DOE/RL-96-0006, Section 4.3.4.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall Training and Qualification principles, which are:

- Personnel Training (Section 4.3.4.1): Personnel engaged in activities bearing on facility safety should be trained and qualified to perform their duties.

- Training Programs (Section 4.3.4.2): Programs should be established for continual training of operations and maintenance personnel to enable them to perform their duties safely and efficiently.

- Conditions Beyond Design Basis (Section 4.3.4.3): Operating staff should be trained and retrained in the procedures to follow if conditions exceed the design basis of the facility.

Review guidance for the evaluation of the Training and Qualification Program described in the ISMP requires the assessing of information provided by BNFL to the following attributes:

1. Personnel engaged in safety-related activities will be trained and qualified to perform their duties.

2. Operators are trained and retrained in the procedures for conditions that exceed the design basis of the facility.

3. The identification of the qualifications of internal safety oversight personnel.

The review was conducted considering material presented in the ISMP, and the resolution of questions developed during the review.

Evaluation

The SRD reviewers found that subordinate standards were identified, and that the subordinate standards conformed to the Top-Level Principles for Training and Qualifications. The BNFL SRD Attachment E, "Compliance with Applicable Laws and Contract Requirements," cites Section 7.2, "Training and Procedures," and specifically, Safety Criteria 7.2-1 and 7.2-4, as the subordinate standards for the Training and Qualifications principles. The reviewers also identified Safety Criterion 7.2-2 as an applicable subordinate standard.

Within its ISMP, BNFL commits to ensuring that personnel involved with the project have sufficient knowledge to safely fulfill the roles and responsibilities of their assigned tasks (Section 1.3.12). The planned Training and Qualification program is generally outlined in Section 3.15. Operator training and qualification requirements are noted in Section 4.2.2 and the level of training is tied to responsibility for safety and emergency response. The planned operator training program is briefly described in Section 5.6.3. Furthermore, BNFL commits in the supplemental response to Review Question 157 to cite ISMP Sections 1.3.12, "Training," 3.15, "Training and Qualifications," 4.2.2, "Training and Procedures," and 5.6.3, "Development of the Operator Training Program," as implementing codes and standards.

Conclusions

The reviewers recommend conditional approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles of Conduct of Operations. This approval is conditional on BNFL providing a description of the Training Plan in ISAR Section 3.0, "Conduct of Operations," as committed to in its ISMP.

3.2.2.8.3 Operational Testing, Inspection, and Maintenance

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes Operational Testing, Inspection and Maintenance required by DOE/RL-96-0006, Section 4.3.5.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall Operational Testing, Inspection and Maintenance principle. This principle states: "Structures, systems, and components important to safety should be the subject of appropriate, regular preventative maintenance, inspection, and testing and servicing when needed, to ensure that they remain capable of meeting their design requirements throughout the life of the facility. Such activities should be carried out in accordance with written procedures supported by quality assurance measures."[20]

Evaluation

Operational Testing, Inspection, and Maintenance is clearly addressed in elements of the BNFL SRD, notably Section 7.6, "Conduct of Maintenance." However, only the general philosophy of the process is discussed in the BNFL ISMP. This is appropriate for the current stage of the project.

Section 5.6.5, "Mechanical Integrity" of the ISMP establishes a BNFL commitment to conduct inspections and tests to ensure the integrity of process equipment is maintained. BNFL commits in Section 1.3.10, "Classification of Structures, Systems, and Components," that the highest levels of preventative maintenance will be applied to Design Class I SSCs.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level principle of Operational Testing, Inspection, and Maintenance.

3.2.2.8.4 Security

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP

20. DOE/RL-96-0006, Section 4.3.5.1

conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. This includes the Security principle required by DOE/RL-96-0006, Section 4.3.6.

Review Methodology

The reviewers evaluated the ISMP for conformance to the overall Security principle that states: "Adequate provisions for facility security and physical protection of structures, systems, and components important to safety should be provided."

Evaluation

The TWRS Privatization Contract[21] mandates that BNFL comply with "applicable regulations, DOE Orders, and DOE-provided top-level safeguards and security requirements stipulated in the *Top-Level Safeguards and Security Requirements for TWRS Privatization* (DOE/RL-96-0002[22])." The DOE contract with BNFL also incorporates many of the standard DOE Acquisition Regulations (DEAR) clauses on safeguards and security, including DEAR 952.204-2, DEAR 952.204-70, and DEAR 952.204-74.[23] Thus, the BNFL safeguards and security program will be overseen by DOE in the same manner as other DOE contractor facilities. Therefore, compliance with the Security principle is largely prescribed by applicable regulations, and DOE Orders, as well as DOE/RL-96-0002, to which BNFL is bound by contract. Furthermore, the oversight of the safeguards and security program by the DOE RL and Headquarters Offices provides an acceptable level of assurance that BNFL will establish and maintain an effective program facility security and physical protection of SSCs.

Section 7.3, "Safeguards and Security Interface" of the ISMP notes that "any conflicts that arise between considerations for safeguards and security and radiological, nuclear, and process safety will be resolved by discussions among BNFL, DOE-RL and the Regulatory Unit." Table 9-1, "Key Safety-Related Activities – Design Phase," of the ISMP recognizes the need to identify and incorporate requirements for security.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level principle of Security.

3.2.2.9 Internal Safety Oversight

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP ensures compliance with DOE nuclear safety regulations in conformance with the DOE-stipulated top-level safety standards and principles and the SRD. DOE/RL-96-0003 also states that the ISMP shall conform to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006. Pursuant to DOE/RL-96-0003, and in order to approve the ISMP, the RO must determine that the program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in

21. *TWRS Privatization* Contract No. DE-AC06-96RL13308, Part I, Section C Standard 5, Paragraph B, pg. C-27.

22. *Top-Level Safeguards and Security Requirements for TWRS Privatization*, DOE/RL-96-0002, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Management, Richland, Washington, February 1996.

23. Ibid., Part II, Section I, pg. I-1.

DOE/RL-96-0006. This includes the internal safety oversight principle required by DOE/RL-96-0006, Section 4.4.

Review Methodology

The ISMP was evaluated for conformance to the overall Internal Safety Oversight principle. The information provided by BNFL was assessed to the following attributes:

1. Verify that the ISMP establishes a framework for the safety review organizations that are responsible for ensuring the safety of the facility;

2. Verify that the separation between the responsibilities of the safety review organizations and those of the other organizations remains clear so that the safety review organizations retain their independence as safety authorities;

3. Verify that internal safety oversight will be conducted by qualified personnel to ensure that the safety standards are consistently met; and

4. Verify that all facility modifications that could affect safety will be assessed by BNFL for an "unreviewed safety question."

This examination was conducted through review of the material presented in ISMP and the resolution of questions developed during the review.

Evaluation

Section 3.16, "Internal Safety Oversight," of the ISMP provides a description of the TWRS-P project oversight activities to ensure safety of the workers and the public and to preclude environmental degradation. These activities include the internal safety oversight functions, administrative functions, skills of staff, safety committees, safety improvement program, incident investigations, unreviewed safety questions (USQs), performance monitoring, performance indicators, lessons learned, and feedback and trending.

The reviewers compared the description of the internal safety oversight program provided in Section 3.16 with the elements required by DOE/RL-96-0006. In general, the reviewers found that Section 3.16 contained a sufficient level of detail regarding the internal safety oversight measures required in this area. For example, BNFL established an adequate framework for its safety review organizations with sufficient separation and independence between these organizations and the activities being reviewed. The reviewers identified one issue regarding the timeframe for sending identified USQs to the RO (Review Question 90). The BNFL response provided adequate clarification in terms of BNFL proceeding at its own risk until a positive determination of an USQ is received from the RU.

Conclusions

The reviewers recommend approval of this portion of the contract requirement relating to conformance to the top-level safety standards and principles. Although the reviewers identified one issue regarding USQs, BNFL's response was adequate to clarify the issue in an acceptable manner. The reviewers therefore concluded that the BNFL ISMP is acceptable for the internal safety oversight portion of the contract requirement relating to conformance to the top-level safety standards and principles.

3.2.3 General Process Safety Principles

Requirements

DOE/RL-96-0003 states that the approval of the Contractor's proposed ISMP will be issued upon determination by the RO that: "…2) The program documented in the ISMP conforms to the top-level radiological, nuclear, and process standards and principles contained in DOE/RL-96-0006."[24] This section of the ISMP Evaluation Report draws upon the top-level principles related to Process Safety.

3.2.3.1 Overall Principles

3.2.3.1.1 Process Safety Management

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Process Safety Management" in DOE/RL-96-0006, Section 5.1.1. This principle states "[t]he Contractor should use a comprehensive process safety management program to eliminate or reduce the incidence, or mitigate the consequences of accidental hazardous chemical releases, process fires, and process explosions. This program should address management practices, technologies, and procedures."

Evaluation

Section 5.0 "Process Safety Management" of the ISMP states "[t]he chapter focuses on the BNFL management systems that ensure the TWRS-P Facility operates safely. The PSM is integrated with similar management systems for radiological and nuclear safety." The management systems detailed in Section 5.0 are based on all of the process safety management elements in OSHA's Process Safety Management Standard 29 CFR 1910.119 (except for Trade Secrets and Employee Involvement), and on the twelve top-level principles listed in DOE/RL-96-0006.

Conclusion

Section 5.0 "Process Safety Management" conforms to the top-level principles of Section 5.2 "Process Safety Management Program" of DOE/RL-96-0006.

3.2.3.1.2 Process Safety Objectives

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Process Safety Objectives" in DOE/RL-96-0006, Section 5.1.2. This principle states: "Process safety management should confirm that the facility is properly designed, the integrity of the design is maintained, and the facility is operated according to the safe manner intended."

24. DOE/RL-96-0006, Section 5.0, pp. 15-17.

Evaluation

Section 5.0, "Process Safety Management" of the ISMP does not express the objectives of process safety management as stated in DOE/RL-96-0006. However, BNFL's Safety Criterion 1.0-1 in the SRD, Vol. II, includes the statement that "Radiological and process safety management shall confirm that the facility is properly designed, the integrity of the design is maintained, and the facility is operated according to the safe manner intended."

Conclusion

The objectives of BNFL's Process Safety Management program, as stated in Safety Criterion 1.0-1 conform with Top-Level Principle 5.1.2 "Process Safety Objective." Therefore, the reviewers recommend approval of this section. Although the ISMP does not properly address the objectives of Process Safety Management, the reviewers approve this section based on the review of the BNFL SRD.

3.2.3.1.3 Process Safety Responsibility

Review Methodology

The reviewers assessed the BNFL ISMP to determine if the ISMP: (1) establishes the Contractor's assumption of primary responsibility for the facility; and (2) describes processes to obtain, analyze, and implement lessons learned from relevant research, design, operation, construction, modification, and operation of similar facilities.

Evaluation

Section 3.2 "Safety Responsibilities" states that "[t]he responsibility for safety of the TWRS-P Project rests with the Project Manager during design and construction and with the Plant Manager during operation....Safety roles are assigned by these managers to cover design, procurement, construction, testing, startup, operations, and deactivation. The roles are assigned to functional areas. By these assignments, facility safety becomes a facility-wide responsibility with safety responsibilities identified for each functional area." However, Section 11.2 "Operations Phase" states that "the General Manager's safety responsibilities during facility Operation and Deactivation are the same as those identified in Section 11.1, "Design and Construction Phase." Section 11.1, "Design and Construction Phase," states that "[t]he General Manager's responsibilities include: 1) Overall responsibility for safety..." Section 6.1.2, "Lines of Authority and Responsibility," states "[c]lear and unambiguous lines of authority are established throughout the TWRS-P Project through its design, construction, operation, and deactivation phases. The flowdown of ES&H responsibility and accountability starts with the Project Manager during construction and the Plant Manager during operation..."

None of the proposed BNFL Safety Criteria in the BNFL SRD implement the Process Safety Responsibility top-level principle, which requires that the Contractor (i.e., BNFL Inc.) unequivocally accept ultimate responsibility for process safety.

Conclusion

The BNFL ISMP states that both the General Manager and the Plant Manager are ultimately responsible for safety. Nowhere in the ISMP is the ultimate responsibility of BNFL for safety in TWRS privatization acknowledged. BNFL shall revise the ISMP to either 1) indicate that BNFL accepts ultimate responsibility

for safety, or 2) clarify that the General Manager's ultimate responsibility for safety is equivalent to the Contractor's responsibility.

3.2.3.2 Process Safety Management Program

3.2.3.2.1 Process Safety Information

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Process Safety Information" in DOE/RL-96-0006, Section 5.2.1. This principle states: "The Contractor should develop and maintain certain important information about the process. This information is intended to provide a foundation for identifying and understanding the process hazards. The process safety information includes, but is not limited to, a summary of material data, a description of each process and its operation, and equipment design data."

The information should confirm that the equipment is appropriate for the operation, that its integrity is maintained, and that it meets appropriate codes and standards.

Evaluation

Section 5.1 "Process Safety Information" of the ISMP commits BNFL to implement a process safety management program requiring the compilation of process safety information for highly hazardous chemicals to enable TWRS-P facility employees to identify and understand the hazards posed by the chemicals. (BNFL, in its response to Review Question 14, has agreed to revise Safety Criterion 3.1-4 [and any other Safety Criteria, including Safety Criterion 3.1-2] to clarify that analyses are not restricted to only "highly hazardous chemicals" as defined by OSHA, but to consider all process chemicals considered to pose a hazard.) Section 5.1 commits BNFL to compile information pertaining to the technology of the process, including process flow diagrams, process chemistry, maximum intended inventories, safe upper and lower limits for process parameters such as temperatures, pressures, flowrates, and compositions. Section 5.1 commits BNFL to assemble information pertaining to the installed equipment, including materials of construction, relief system components and the design basis for the relief system, design codes and standards employed, and safety systems. The information will be "assembled as the design evolves." The ISMP does not present the information necessary to confirm that "the process safety equipment is appropriate for the process operation" as stated in the Review Methodology above; that confirmation can only be established from an engineering review of the completed design and the corresponding hazard and accident analyses. Section 5.1 states that Section 1.3.17 [Ed note: actually Section 1.3.16] of the ISMP provides a summary of the TWRS-P configuration management program, and that additional details of this program will be provided in the ISAR Section 3.1, "Configuration Management."

Conclusion

The RU reviewers determined that the process and commitments in the Section 5.1 "Process Safety Information," of ISMP, in Section 5.1 Process Safety Information, conforms to Top-Level Principle 5.2.1 "Process Safety Information."

3.2.3.2.2 Process Hazard Analysis

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Process Hazard Analysis" in DOE/RL-96-0006, Section 5.2.2. This principle states: "The Contractor should perform a process hazards analysis using acceptable industry practices. The process hazards analysis should be appropriate for the complexity of the process and the hazard. The Contractor should consider the effects of engineering and administrative controls, human factors, facility siting, and previous incidents in the hazard analysis. The Contractor should document the results of the hazards analysis including process hazards and possible safety and health effects. The Contractor should submit the results of the hazards analysis to the Director of the Regulatory Unit for evaluation and in support of authorization decisions and regulatory oversight."

One of the purposes of the hazard analysis is to evaluate the adequacy of the design and operating procedures. The Contractor should establish a system to address the findings in order to ensure that the equipment and procedures provide an adequate degree of protection against accidents.

The Contractor should review and update the hazard analysis periodically to ensure that the process hazards analysis is consistent with the current process.

Evaluation

Section 5.5, "Process Hazards Analysis," of the ISMP commits BNFL to implement a process safety management program ensuring that process hazards analyses (PHAs) are performed using acceptable industry practices. Section 5.5 commits BNFL to a program ensuring that the:

1. PHA technique (BNFL HAR Section 3.3, "Hazard Evaluation Methodology") is tailored (BNFL HAR Section 3.2, "Selection of a Hazard Evaluation Methodology") to the information available and to the complexity of the TWRS-P processes,

2. Chosen PHA techniques address the hazards of the process by systematically evaluating potential deviations from design intent caused by the failure of engineered or administrative controls; and

3. PHA process considers human factors (BNFL ISMP Section 3.12, "Human Factors"), facility siting (BNFL HAR Section 2.1, "Site Description"), and previous incidents (BNFL HAR Section 4.4, "Comparison to Similar Facilities").

BNFL also commits to documenting the PHA consistent with the examples ("industry standards") of documentation given in *AIChE's Guidelines for Hazards Evaluation Procedures*,[25] and to consider consequences in the PHA, including a qualitative evaluation of the possible effects on the health and safety of facility workers. Section 5.5 makes no specific commitment to submit the results of the hazards analysis to the RO for evaluation and in support of authorization decisions and regulatory oversight, although submittal is apparently shown in Table 4-2, Part 4-7 and in Figure 9-1, pg. 1 of 3.

25. *AIChE Guidelines for Hazards Evaluation Procedures*, Center for Chemical Process Safety, American Institute of Chemical Engineers, New York, New York, 1992.

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.5 "Process Hazards Analysis," conforms to Top-Level Principle 5.2.2 "Process Hazards Analysis."

3.2.3.2.3 Operating Procedures

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Operating Procedures" in DOE/RL-96-0006, Section 5.2.3. This principle states "[t]he Contractor should develop and implement written operating procedures that provide clear instruction for safely conducting activities consistent with the process safety information. The procedures should address at least the following elements: steps for each operating phase of the process, operating limits, safety and health considerations, and safety systems and their functions."

Evaluation

Section 5.6.1, "Procedure Development," of the ISMP states that "Operating procedures provide clear instructions for safely operating the TWRS-P Facility during startup, normal operations, temporary operations, emergency operations, normal shutdown, and process startup following a turnaround or emergency shutdown....The term 'operating procedures' covers the entire range of procedures important for safe and efficient facility operations, in addition to those that detail routine facility operations."

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.1 "Procedure Development," conforms to Top-Level Principle, 5.2.3 "Operating Procedures."

3.2.3.2.4 Training

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP provides for a training and qualification plan as defined in DOE/RL-96-0006, Section 5.2.4. The training and qualification plan should contain provisions for:

1. Personnel engaged in safety-related activities will be trained and qualified to perform their duties;

2. Operators are trained and retrained in the procedures for conditions that exceed the design basis of the facility; and

3. Continual training of operations and maintenance personnel.

Evaluation

Section 5.6.3 "Development of the Operator Training Program" of the ISMP states "[t]he operator training program is developed and implemented in accordance with SRD Volume II, Sec. 7.2, Training and Procedures." The ISMP also states that "ISAR Section 3.4, 'Training and Qualification,' will further

address the training policy and describe the level of training required of facility workers to efficiently and safely perform their intended duties."

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.3 "Development of the Operator Training Program," conforms to Top-Level Principle 5.2.4 "Training."

3.2.3.2.5 Subcontractors

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle in DOE/RL-96-0006, Section 5.2.5. The principle states "[t]he Contractor may engage a subcontractor to perform maintenance, renovations, or specialty work on, or adjacent to, the process. The Contractor should inform the subcontractor of potential hazards related to the subcontractor's work and take appropriate measures to ensure the subcontractors provide their workers with appropriate procedures and training necessary for performing their jobs safely."

Evaluation

Section 5.2 "Control of Subcontractors" of the ISMP commits BNFL to implement a process safety management program ensuring that all subcontractors work as safely as the BNFL employees. Section 5.2 lists BNFL's responsibilities, including

1. Informing the subcontractors of known fire, explosion, or toxic hazards relating to the subcontractor's work and the process,

2. Explaining the emergency plan to the subcontractor,

3. Developing and implementing safe work practices to control the presence, entrance and exit of subcontractor employees,

4. Evaluating the performance of subcontractors in fulfilling their obligations, and

5. Maintaining an illness and injury log relating to the subcontractor work in the process areas.

Subcontractor responsibilities are listed and include, (1) ensuring that subcontractor employees are trained in the work practices necessary to safely perform their assignments, and, (2) documenting that each subcontractor employee has received and understood the training required to work safely at the TWRS-P facility.

Conclusion

The RU reviewers determined that the process and commitments contained in the Contractor's ISMP, in Section 5.2 "Control of Subcontractors," conforms to Top-level Principle 5.2.5 "Subcontractors."

3.2.3.2.6 Pre-startup Safety Review

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Pre-startup Safety Review in DOE/RL-96-0006, Section 5.2.6. This principle states: "The Contractor should perform a pre-startup safety review for the facility. Pre-startup reviews also should be performed prior to restarting the process after significant modifications have been made to the facility. The pre-startup review should confirm that prior to the introduction of hazardous materials that construction and equipment is in accordance with design specifications; safety operating, maintenance, and emergency procedures are in place; an adequate process hazards evaluation has been performed and the recommendations resolved; and training of employees has been completed. The results of this review should be submitted to the Director of the Regulatory Unit for evaluation and in support of authorization decisions and regulatory oversight."

Evaluation

Section 5.6.4 "Startup Review," of the ISMP states "[p]rior to operation, startup tests of the facility systems and personnel are performed in accordance with the Safety Criteria of SRD Volume II, Section 6.0, 'Startup.'"

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP Section 5.6.4 "Startup Review" conforms to Top-level Principle 5.2.6 "Pre-startup Safety Review."

3.2.3.2.7 Mechanical Integrity

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Mechanical Integrity" in DOE/RL-96-0006, Section 5.2.7. This principle states: "The Contractor should implement a mechanical integrity program that includes written procedures, training for maintenance activities, inspection and performance testing of process equipment, and quality assurance measures. The program should include measures to correct deficiencies in equipment that are outside acceptable limits."

> Note: A Mechanical integrity program is a major and necessary element in a process safety management program because of its importance in ensuring equipment integrity, eliminating potential ignition sources, and for determining that equipment is designed, installed, and operating properly.

Evaluation

Section 5.6.5 "Mechanical Integrity" in the ISMP states "[p]rocedures are established to maintain the integrity of process equipment, i.e., 'measures to correct deficiencies in equipment that are outside acceptable limits'; employees involved in maintaining the integrity of process equipment are trained through the TWRS-P Project training program; inspection and test results are documented; and the TWRS-P Project QAP includes procedures to ensure that equipment, as fabricated, is fit for service."

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.5 "Mechanical Integrity," conforms to Top-level Principle 5.2.7 "Mechanical Integrity."

3.2.3.2.8 Hot Work Control

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Hot Work Control" in DOE/RL-96-0006, Section 5.2.8. This principle states: "The Contractor should control hot work operations performed in or near the process or facility in order to ensure appropriate safety precautions, including fire prevention and protection, are taken prior to the work."

Evaluation

Section 5.6.6 "Hot Work Operations," of the ISMP states "[h]ot work operations are reviewed and conducted in accordance with SRD Safety Criterion 4.5-19 which governs administrative controls to minimize fire hazards."

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.6 "Hot Work Operations," conforms to Top-level Principle 5.2.8 "Hot Work Control."

3.2.3.2.9 Management of Change

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Management of Change" in DOE/RL-96-0006, Section 5.2.9. This principle states: "The Contractor should evaluate all planned changes involving the technology of the process and the facility design and operation in order to ensure that the impact on safety is analyzed and acceptable and to determine the need for modifications to operating procedures. The Contractor should establish and implement written procedures to manage changes to process chemicals, technology, equipment, and procedures; and changes to facilities. These procedures should address the technical basis for the proposed changes, impact of the changes on process safety, modifications of the operating procedures, the schedule for proposed changes, and authorization for proposed changes."

Evaluation

Section 5.3 "Configuration Management," of the ISMP commits BNFL to implement a process safety management program ensuring that the TWRS-P facility establishes and maintains consistency among design requirements, physical configuration, and facility documentation to the technical baseline throughout the operating and deactivation phases. The ISMP commits BNFL to a program ensuring that procedures are developed to manage changes to process chemicals, technology, equipment, and operating and maintenance procedures. The management of change procedures is required to consider:

1. The need to perform an unreviewed safety question (USQ) evaluation,
2. The technical basis for the proposed change,
3. The impact of the change on safety and health,
4. Modifications to operating procedures,
5. Schedule for completion of the changes ("activity"), and
6. The authorization requirements for the proposed changes.

Additional considerations include the retraining of employees who are affected by the change before restart of the process, and any changes in the process safety information. Section 1.3.16 "Configuration Management," provides a summary of the TWRS-P facility configuration management program. The ISMP states that additional detail on this program will be provided in the BNFL ISAR Section 3.1, "Configuration Management."

Conclusion

The RU reviewers determined that the process and commitments contained in the Contractor's ISMP, Section 5.3 "Configuration Management," conforms to Top-level Principle 5.2.9 "Management of Change."

3.2.3.2.10 Incident Investigation

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Incident Investigation" in DOE/RL-96-0006, Section 5.2.10. This principle states: "The Contractor should investigate each incident which results in, or could reasonably have resulted in, a major accident. The investigation should be conducted promptly and appropriate corrective measures should be recommended and implemented. The results of the investigation should be submitted to the RO for evaluation and in support of regulatory oversight."

Evaluation

Section 5.6.7 "Investigation of Incidents," of the ISMP states "[f]or incidents that have the potential to result in a major accident or a release of hazardous or radioactive material [sic], an investigation is conducted with the Safety Criteria of SRD Volume II, Section 7.7 'Reporting and Incident Investigation.'"

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.7 "Investigation of Incidents" conforms to Top-level Principle 5.2.10 "Incident Investigation."

3.2.3.2.11 Emergency Planning and Response

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP contains adequate provisions to ensure that an Emergency Preparedness Plan is provided and includes:

1. Anticipated emergency response interfaces with other co-located facilities at the Hanford Site and with local authorities

2. Response capabilities that will be provided by the Contractor

3. Training

4. Emergency exercises

5. Additional capability to place and maintain the facility in a safe state following an accident if the normal control areas are expected to become uninhabitable

6. Anticipated emergencies to be considered in emergency preparedness.

Evaluation

Section 5.6.8 "Emergency Action Plan," in the ISMP states "[f]or accidents that result in the need to take additional actions to protect the workers, the public, and the environment from accidental releases of hazardous or radiological material, an emergency response program is provided in accordance with the Safety Criteria of SRD Volume II, Section 7.8, 'Emergency Preparedness.' Emergency preparedness is addressed in ISMP Section 3.10, "Emergency Preparedness." The ISMP commits that BNFL will outline its plan in ISAR Section 9.0, "Emergency Management" and will describe how the plan complies with the requirements of 29 CFR 1910.119 [Ed. Note: actually, 1910.38], "Employee Emergency Plans and Fire Protection [Ed. Note: actually, Prevention Plans]," 40 CFR 68, "Chemical Accident Prevention Provisions," 40 CFR 355, "Emergency Planning and Notification," DOE/RL-94-02, and DOE/RL-96-0006.

Conclusion

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.6.8 "Emergency Action Plan" commit BNFL to an Emergency Preparedness Plan with the attributes listed in the Review Methodology for Emergency Planning and Response.

3.2.3.2.12 Compliance Audits

Review Methodology

The reviewers assessed the ISMP to determine if the ISMP describes how a process will ensure conformance with the top-level principle "Compliance Audits" in DOE/RL-96-0006, Section 5.2.12. This principle states: "The Contractor should conduct a compliance audit periodically to certify that the procedures and practices developed under the process safety management program are adequate and are being followed. The frequency of compliance audits is based on the applicable standards and the nature of the process hazards. The Contractor should promptly determine and document an appropriate response to each finding of the compliance audit. The results of the audits should be available to the RO in support of regulatory oversight."

Evaluation

Section 5.4 "Compliance Audits," of the ISMP commits BNFL to implement a process safety management program ensuring that periodic audits are performed to evaluate compliance with the elements of PSM. BNFL commits to developing reports of the audit findings in which corrective actions and their schedule for completion are provided. The ISMP states that "additional detail on this program will be provided in ISAR, Section 3.6, 'Audits and Assessments."

Conclusions

The RU reviewers determined that the process and commitments contained in the ISMP, Section 5.4 "Compliance Audits," conform to Top-level Principle 5.2.12 "Compliance Audits."

3.3 Standards-Based, Tailored, Safety Management Processes

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP "[s]pecify the standards-based management processes to be used by the Contractor to ensure that radiological, nuclear, and process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained." DOE/RL-96-0003 also requires that the ISMP "[d]escribe the Contractor's approach for tailoring its radiological, nuclear, and process safety deliverables and actions commensurate with the nature and level of hazards associated with its waste processing activities."[26] Pursuant to DOE/RL-96-0003 and in order to approve the ISMP, the RO must make a determination that the "selected safety management processes documented in the ISMP are standards based and are appropriately tailored to the hazards associated with the Contractor's proposed facility, its operation, and its deactivation."[27]

Review Methodology

Evaluation of the standards-based, tailored safety management processes assessed the information provided by BNFL in relation to the following attributes:

1. The adequacy of the safety management process described, in terms of (1) ensuring that the standards and requirements of the SRD will be implemented and maintained; (2) addressing the safety-related programmatic activities and safety management requirements of the Contract; and (3) being standards-based."

2. The adequacy of the methods for tailoring safety management processes, in terms of (1) the appropriateness of the tailoring of the safety management processes described in the ISMP; (2) the comprehensiveness of the description of, and the appropriateness of the methods employed for, tailoring safety management processes; and (3) the appropriateness of the methods employed for revising the tailoring of safety management processes as the nature of the activities changes, additional information relating to the hazards becomes available, or the waste treatment process changes."

This evaluation was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

The detailed evaluations, recommendations and conclusions, and more detailed discussions of the review considerations for each of these attributes are documented in the following sections. The overall recommendation for this evaluation criterion is presented after the discussions of the individual attributes.

26. DOE/RL-96-0003, Section 4.1.2, paragraph 11(g), p. 12.

27. Ibid., Section 3.3.1, Item 3 (ISMP), pg. 5.

3.3.1 Standards Based Safety Management Processes

Review Methodology

Evaluation of the standards-based, tailored safety management processes assessed the information provided by BNFL in relation to the following attribute:

1. The evaluation of whether the management processes in the ISMP were standards based assessed the information provided by BNFL in relation to the adequacy of the safety management processes, in terms of (1) ensuring that the standards and requirements of the SRD will be implemented and maintained; (2) addressing the safety-related programmatic activities and safety management requirements of the Contract; and (3) being standards-based.

Evaluation

Section 4, "Standards-Based Management," of the ISMP specifies the standards-based management processes proposed by BNFL to ensure that radiological, nuclear, and process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained. Section 4.1, "Safety Management Processes," describes the safety management processes, including:

Section 4.1.1, "Development of Safety Management Processes," which describes the means by which they are developed;

Section 4.1.2, "Identification of Safety Management Program Drivers," which describes BNFL's organization into programs , and the linkage between safety management programs and the standards;

Section 4.1.3, "Development of Safety Management Programs," which describes the means by which the safety management programs are implemented; and

Section 4.1.4, "Maintenance of Safety Management Programs, "which describes the means by which the safety management programs are maintained.

The reviewers examined the linkages between the safety management programs, described in Sections 4.1.2.1 through 4.1.2.6 of the BNFL ISMP and the standards and requirements defined in the BNFL SRD, Vol. II. This examination allowed the reviewers to assess the adequacy of the safety management processes in ensuring that the standards and requirements of the SRD will be implemented and maintained. This examination demonstrated that safety management programs were clearly linked to the implementation and maintenance of all of the SRD standards and requirements except those in the BNFL SRD, Vol. II, Chapters 2 and 9. In particular, the standards in the BNFL SRD, Vol. II, Chapters 1 and 3 are implemented and maintained through the "Nuclear and Process Safety Program" (ISMP, Section 4.1.2.1). The standards in the BNFL SRD, Vol. II, Section 4 are implemented and maintained through the "Engineering and Design Programs" (ISMP, Section 4.1.2.2). The standards in the BNFL SRD, Vol. II, Section 5 are implemented and maintained through the "Radiation Protection Program" (ISMP, Section 4.1.2.3). The standards in the BNFL SRD, Vol. II, Section 6 are implemented and maintained through the "Startup Program" (ISMP, Section 4.1.2.4). The standards in the BNFL SRD, Vol. II, Section 7 are implemented and maintained through the "Management and Operations Programs" (ISMP, Section 4.1.2.5). And, the standards in the BNFL SRD, Vol. II, Section 8 are implemented and maintained through the "Deactivation and Decommissioning Program" (ISMP, Section 4.1.2.6). Further examination indicated that the standards in the BNFL SRD, Vol. II, Section 2 will be implemented and

maintained through the engineering and design program and the RPP. It also indicated that the standards in the SRD, Volume II, Section 9 establish requirements for safety-related documentation and submittals that will be implemented and maintained through various combinations of the safety management programs described in the ISMP. Thus, the review established that safety management programs had been identified to implement and maintain all of the standards and requirements identified in the BNFL SRD, Vol. II.

The next step in the assessment of the adequacy of the safety management processes is the evaluation of the effectiveness of the identified safety management processes. This effectiveness evaluation was difficult to perform at the current stage of the BNFL TWRS-P project. With the exception of the initial QA program, described in the BNFL QAP, the safety management programs are in their formative stages and will not be sufficiently developed and documented until the appropriate stage of Part B activities. The reviewers assessed the adequacy of the safety management processes by evaluating the methods BNFL proposes to employ to develop the safety management processes (ISMP, Section 4.1.1) and the safety management programs (ISMP, Section 4.1.3) and to maintain the safety management programs (ISMP, Section 4.1.4).

In these discussions, BNFL commits to:

1. Continual integration of hazards identification and SRD (i.e., standards) development, design development, and accident analysis throughout the facility life cycle;

2. Linkage of safety management process implementing procedures to applicable SRD Safety Criteria (i.e., standards);

3. Documentation of how and why administrative controls credited for public and worker safety were identified;

4. Identification of administrative controls in the appropriate SRD safety criteria; and

5. Adoption of “best industry practices,” where appropriate.

This assessment concluded that the safety management process and program development and maintenance methods described can be used to develop and maintain safety management processes that will ensure that the standards and requirements of the SRD will be implemented and maintained.

The review of the effectiveness of the safety management processes also addressed the extent to which the SRD and ISMP commitments were imposed upon subcontractors. In performing this evaluation, the reviewers examined the discussion of the measures for control of subcontractors in Section 5.2, “Control of Subcontractors,” of the ISMP. Section 5.2 was found not to be explicit with regard to the applicability of SRD and ISMP commitments to subcontractors. BNFL addressed this issue (Review Questions 79, 107, 108, and 110) by stating that the SRD and ISMP commitments are binding on subcontractors to the extent that the subcontractor work scope includes the activities covered by the SRD or ISMP commitments. Thus, BNFL has committed to apply the safety management process and programs to subcontractors, as appropriate, to ensure that the standards and requirements of the SRD will be implemented and maintained by subcontractors.

The review of the adequacy of the safety management processes in addressing the safety-related programmatic activities and safety management requirements of the Contract relied heavily on a review of the adequacy of the standards. If the SRD standards set comprehensively addresses the safety-related programmatic activities and safety management requirements of the Contract, and the safety management processes are effective in implementing and maintaining the SRD standards, then the safety management

processes will effectively address the safety-related programmatic activities and safety management requirements of the Contract.

An issue was identified by the reviewers. The ISMP did not provide a commitment to establish a nuclear criticality safety program. BNFL responded to this issue (Review Questions 23 - 25, 70, and 71) with the following commitments:

1. Establish and maintain the controls needed to ensure that material specifications for any proposed feed to the facility are fully compatible with the process and are within the fissile material content bounds of the criticality assessment described in Section 3.8 of the ISMP;

2. Continue to perform nuclear criticality safety assessments when and where appropriate (as described in the response); and

3. Maintain appropriate access to trained nuclear criticality experts.

With this addition, the reviewers found that the safety management processes address the safety-related programmatic activities and safety management requirements of the Contract.

The reviewers examined the standards that formed the bases for the safety management programs to determine whether the safety management processes were standards based. The emphasis for this review was the administrative standards in the SRD, Vol. II, Section 7 and the related documentation and submittal standards in Section 9, which more directly govern the safety management programs. These standards were examined in the context of the DOE directives (considered in our review, but not imposed on the contractor) that define effective safety management programs, including:

DOE Order 151.1, “Comprehensive Emergency Management System,”

DOE Order 232.1A, “Occurrence Reporting and Processing of Operations Information,”

DOE Order 420.1, “Facility Safety,”

DOE Order 4330.4B, “Maintenance Management Program,”

DOE Order 5480.19, “Conduct Of Operations Requirements for DOE Facilities,”

DOE Order 5480.20A, “Personnel Selection, Qualification, and Training Requirements For DOE Nuclear Facilities,”

DOE Order 5480.21, “Unreviewed Safety Questions,”

DOE Order 5480.22, “Technical Safety Requirements,” and

DOE Order 5480.23, “Nuclear Safety Analysis Reports.”

The reviewers found that the administrative standards contained the appropriate elements of the corresponding DOE directives with two exceptions. First, the criticality safety program requirements of DOE Order 420.1 were not appropriately addressed. This issue was addressed satisfactorily by the commitments noted above. Second, the administrative standards also failed to define the term “reportable occurrence,” as discussed in DOE Order 232.1A and DOE Manual 232.1-1A, “Occurrence Reporting and

Processing of Operations Information." This issue was resolved by BNFL (Review Question 168): (1) providing a definition for "reportable occurrence," (2) committing to provide a threshold for occurrence reporting in a procedure to be developed during Part B, and (3) committing to provide specific criteria for incident reporting in a preliminary safety analysis report (PSAR) and final safety analysis report (FSAR).

The review of the administrative standards and the standards for safety-related documentation and submittals in BNFL SRD, Vol. II, Chapters 7 and 9, respectively, indicated the BNFL licensee- controlled requirements, operating limits analogous to technical safety requirements, but oriented toward worker protection, were not addressed in the standards. BNFL resolved this issue (Review Questions 94 and 142) by agreeing to add a Safety Criterion (i.e., standard) addressing licensee-controlled requirements.

As part of the determination of whether the safety management processes were standards-based, the reviewers also examined the standards-related criteria for the definition and development of safety management programs described in Section 4.1.2 of the ISMP. These criteria were found to be consistent with a process for the development of standards-based safety management programs.

Conclusions

The reviewers recommend approval of the portion of the contractual requirement related to standards-based safety management processes. As required by the Contract, the BNFL ISMP specifies the standards-based management processes to be used to ensure that radiological, nuclear, and process safety is adequately implemented, and maintained. The reviewers made the following conclusions in support of the recommendation for approval.

1. BNFL has identified safety management programs to implement and maintain all of the standards and requirements identified in Volume II of the SRD.

2. With the exception of the initial QA program, which has been approved by the RU, the safety management programs are in their formative stages and will not be sufficiently developed and documented for an effectiveness evaluation until the appropriate stage of the Part B activities. However, the safety management process and program development and maintenance methods committed to in the ISMP can be used to develop and maintain safety management processes that will be effective in ensuring that the standards and requirements of the SRD will be implemented and maintained.

3. BNFL has committed to applying the safety management process and programs described in the ISMP to subcontractors, as appropriate, to ensure that the standards and requirements of the SRD will be implemented and maintained by subcontractors.

4. The administrative standards in Chapters 7 and 9 of Volume II of the SRD contain the appropriate elements of the DOE Directives that define effective safety management programs.

5. The criteria for the definition and development of safety management programs committed to in the ISMP are consistent with a process for the development of standards-based safety management programs.

3.3.2 Tailoring of Safety Management Processes

Review Methodology

"The evaluation of the tailoring of safety management processes assessed the information provided by BNFL in relation to the adequacy of the methods for tailoring safety management processes, in terms of: 1) the appropriateness of the tailoring of the safety management processes described in the ISMP; 2) the comprehensiveness of the description of, and the appropriateness of the methods employed for, tailoring safety management processes; and 3) the appropriateness of the methods employed for revising the tailoring of safety management processes as the nature of the activities changes, additional information relating to the hazards becomes available, or the waste treatment process changes."[28]

Evaluation

Section 4.2, "Tailoring Safety Management Processes," of the ISMP describes the manner in which safety management processes are tailored, including:

- Section 4.2.1, "Engineered Features," which describes the tailoring of the safety management processes (e.g., design, construction, maintenance, and QA requirements) for engineered features;
- Section 4.2.2, "Training and Procedures," which describes the tailoring of training and procedures; and
- Section 4.2.3, "Tailoring of Safety Related Documentation," which describes the tailoring of safety-related documentation, including safety-related deliverables.

The tailoring of the safety management processes for engineered features is also described in the ISMP, Sections 1.3.10 and 1.3.11. The change process for safety management programs and safety-related deliverables is discussed in the ISMP, Sections 1.3.16, "Configuration Management," 3.3.2, "Control of the Licensing Basis," 3.3.3, "Changes to Safety Documentation," 4.1.4, "Maintenance of Safety Management Programs," and 5.3, "Configuration Management."

To assess the appropriateness of the tailoring of the safety management processes and safety-related deliverables described in the ISMP, the reviewers examined the description of the tailoring associated with engineered features, tailoring of training and procedures, and the tailoring of safety-related documentation, including safety-related deliverables. These tailoring process descriptions were examined in the context of the draft SPAT-13, *Tailoring For Integrated Safety Management Applications*.[29] The descriptions of the methods for tailoring safety management processes were consistent with the guidance in the draft SPAT-13. The reviewers found the tailoring of these safety management processes and the tailoring of safety-related deliverables to be generally reasonable and appropriate. However, the reviewers identified three interrelated issues related to the specifics of the tailoring of the safety management processes associated with engineered features. BNFL resolved these three issues by better defining the tailoring criteria and process (Review Questions 80, 105, 111-114, and 133-136) in more detail; explaining the

28. RL/REG-97-07, op. cit., Section 6.3, Paragraph c, Attribute 2, p. 12.

29. *Tailoring For Integrated Safety Management Applications*, SPAT-13, U.S. Department of Energy, Washington, D.C., June 1997.

technical basis for the tailoring approach (Review Question 170); and modifying the specific tailoring approach to comply with the DOE QA regulation (Review Questions 115-117, and 143).

To assess the adequacy of the methods employed for tailoring safety management processes and deliverables, the reviewers evaluated the general description of this process in Section 4.2 of the ISMP. As a result of this evaluation, the reviewers identified two issues by which BNFL proposed to tailor the safety management processes mandated by standards to which it had committed in its SRD, Vol. II. The first of these issues was clarification of the meaning of "a BNFL commitment to meet a standard." BNFL resolved this issue (Review Questions 48 and 93) by defining in detail what it means for BNFL to commit to a standard. The second issue concerned the manner in which BNFL intended to tailor the nuclear power plant standards for use in the design, construction, and operations of the TWRS-P facility. BNFL resolved this issue (Review Question 171) by providing a more detailed description of the process to be employed to tailor such standards that supplemented the general description of the process in Section 4.2 of the ISMP. The reviewers found that the discussion in the ISMP, supplemented by the information provided by BNFL to resolve these two issues, presents a reasonable and logical approach to the tailoring of safety management processes and safety-related deliverables to the nature and level of hazards, including process hazards.

The reviewers assessed the appropriateness of the methods employed for revising the tailoring of safety management processes and safety-related deliverables. This was accomplished by evaluating the description of the method for modifying safety management programs in the ISMP Sections 1.3.16, "Configuration Management"; 3.3.2, "Control of the Licensing Basis"; 3.3.3, "Changes to Safety Documentation"; 4.1.4, "Maintenance of Safety Management Programs"; and 5.3, "Configuration Management." The reviewers also noted that the discussion of the tailoring process in Section 4.2 of the ISMP is not limited to the development of the initial standards, safety management programs and processes, and safety-related deliverables. Therefore, the commitments made in Section 4.2 of the ISMP are also applicable to revisions to the tailoring of safety management processes and safety-related deliverables.

The reviewers identified three issues during their evaluation of the appropriateness of the methods employed for revising the tailoring of safety management processes. The first issue was the relationship between the BNFL change process for standards, upon which the safety management processes and programs are based, and the DOE stipulated process in DOE/RL-096-0004.[30] BNFL resolved this issue (Review Question 81) by committing to include, through the configuration management program, the essential elements of DOE/RL-96-0003 in its process for modifying standards as (1) additional information relating to the design or hazards becomes available, (2) the nature of the activities changes, or (3) the waste treatment process changes. The second issue was the definition of the circumstances under which RU review and approval were required for changes to standards, or to safety management process or program commitments, made in the ISMP. BNFL resolved this issue (Review Questions 81, 169, and 177), specifically, by committing that no proposed change to the ISMP or to the standards in Volume II of the SRD that, after approval of the SAP and prior to issuance of the construction authorization, could be interpreted as a decrease in commitment to worker or public safety would be implemented without the review and approval by the RU. The third issue was the need for additional detail in the description of the configuration management process. BNFL resolved this issue (Review Question 176) by providing additional information about the (1) organizations responsible for various configuration management activities, (2) qualifications required for individuals performing configuration management functions, and (3) criteria for acceptance or rejection of proposed changes.

30. DOE/RL-96-0003, Sections 3 and 4, pp. 3 - 6.

The reviewers found that the discussion in the ISMP, supplemented by the information provided by BNFL to resolve these three issues, presents a reasonable and logical approach for revising the ISMP to address tailoring of safety management processes and safety-related deliverables. Specifically, it is necessary to revise and tailor safety management processes and safety-related deliverables as the nature of the activities changes, additional information relating to the hazards becomes available, or the waste treatment process changes.

Conclusions

The reviewers recommend approval of the portion of the contractual requirement related to tailoring of safety management processes. As required by the Contract, the BNFL ISMP specifies the standards-based management processes to be used to ensure that radiological, nuclear, and process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained. Also, as required by the Contract, the ISMP describes BNFL's approach for tailoring its radiological, nuclear, and process safety deliverables and actions commensurate with the nature and level of hazards associated with its waste processing activities.

The reviewers made the following conclusions in support of the recommendation for approval:

1. The tailoring of the safety management processes and safety-related deliverables, as described by BNFL in the ISMP and supplemented in the responses to the RU's questions is reasonable and appropriate.

2. The ISMP, supplemented by the responses to the RU's questions, presents a reasonable and logical approach for revising the tailoring of safety management processes and safety-related deliverables as the nature of the activities changes, additional information relating to the hazards becomes available, or the waste treatment process changes.

Overall Recommendation

The reviewers recommend approval of the portion of the contractual requirement related to standards-based, tailored, safety management processes. As required by the Contract, the BNFL ISMP specifies the standards-based management processes to be used by the Contractor to ensure that radiological, nuclear, and process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained. As required by the Contract, the ISMP also describes BNFL's approach for tailoring its radiological, nuclear, and process safety deliverables and actions commensurate with the nature and level of hazards associated with its waste processing activities.

3.4 Management of Process Hazards

Requirements

DOE/RL-96-0003 states that "[t]he approval of the Contractor's proposed ISMP will be issued upon determination by the Director of the Regulatory Unit that:....4) The selected safety management processes documented in the ISMP properly and adequately address management of process hazards; and 5) The program documented in the ISMP contains appropriate features of integrated safety management

(i.e., integration among safety, design, and operations interests; integration over the life cycle of the activities; and integration into work planning and performance)."[31]

3.4.1 Process Safety Information

Review Methodology

The reviewers assessed the ISMP to the following attribute, "The ISMP addresses the development and maintenance of information that provide a foundation for identifying and understanding the process hazards. The ISMP should provide a description of process safety information that includes the following:

- A summary of material data
- A description of each process and its operation
- Equipment design data.

The ISMP should provide the information necessary to confirm that (1) the process safety equipment is appropriate for the process operation, (2) the equipment's integrity is maintained, and (3) the equipment meets codes and standards."

Evaluation

Section 5.0, "Process Safety Management," of the ISMP notes that the TWRS-P facility will be a "covered process" as defined by 29 CFR 1910.119 (OSHA's Process Safety Management ([PSM]) Standard). The TWRS-P facility will be a covered process because the process design involves storing up to 32 Metric Ton (MT) of liquid anhydrous ammonia, a "highly hazardous chemical," listed in Appendix A of the PSM Standard. Section 5.0 of the ISMP further notes that "a program that satisfies the OSHA PSM standard also satisfies the Top-Level Principles" in DOE/RL-96-0006.

Section 5.1, "Process Safety Information," of the ISMP commits BNFL to implement a process safety management program requiring the compilation of process safety information for highly hazardous chemicals. This will enable TWRS-P facility employees to identify and understand the hazards posed by the chemicals. In response to Review Question 14, BNFL has agreed to revise Safety Criterion 3.1-4 (and any other Safety Criteria, including Safety Criterion 3.1-2) to clarify that analyses are not restricted to only "highly hazardous chemicals" as defined by OSHA, but to address all process chemicals considered to pose a hazard. Section 5.1 of the ISMP commits BNFL to compile information pertaining to the technology of the process, including process flow diagrams, process chemistry, maximum intended inventories, and safe upper and lower limits for process parameters, such as temperatures, pressures, flowrates, and compositions. Section 5.1 commits BNFL to compile information pertaining to the installed equipment, including materials of construction, relief system components and the design basis for the relief system, design codes and standards employed, and safety systems. The information will be "assembled as the design evolves." Information necessary to confirm that "the process safety equipment is appropriate for the process operation" as stated above; and that confirmation can only be established from an engineering review of the completed design and the corresponding hazard and accident analyses, is not presented in the ISMP. The ISMP states that Section 1.3.17 of the ISMP provides a summary of the TWRS-P configuration management program, and that additional details of this program will be provided in the ISAR, Section 3.1, "Configuration Management." [Ed. Note: The statement is actually in Section 1.3.16 of the BNFL ISMP.] Thus, this section of the ISMP conforms to Top-Level Principle 5.2.1, "Process

31. DOE/RL-96-0003, Section 3.3.1, item 4, p. 5.

Safety Information," and acceptably addresses the development and maintenance of information that provides a foundation for identifying and understanding the process hazards.

3.4.2 Control of Subcontractors

Review Methodology

The reviewers assessed the ISMP to the following attribute, "The ISMP provides for the control of subcontractors including provisions for informing subcontractors of potential hazards related to the subcontractor's work and ensuring that subcontractors provide their workers with the appropriate procedures and training necessary for performing their jobs safely."

Evaluation

Section 5.2, "Control of Subcontractors," of the ISMP commits BNFL to implement a process safety management program ensuring that all subcontractors work as safely as the BNFL employees. As documented in Section 5.2, "BNFL's responsibilities include the following:

1. Informing the subcontractors of known fire, explosion, or toxic hazards relating to the subcontractor's work and the process

2. Explaining the emergency plan to the subcontractor

3. Developing and implementing safe work practices to control the presence, entrance and exit of subcontractor employees

4. Evaluating the performance of subcontractors in fulfilling their obligations [sic]

5. Maintaining an illness and injury log relating to the subcontractor work in the process areas.

Subcontractor responsibilities are also listed in Section 5.2 of the ISMP and include: (1) ensuring that subcontractor employees are trained in the work practices necessary to safely perform their assignments, and (2) documenting that each subcontractor employee has received and understands the training required to work safely at the TWRS-P facility. Thus, Section 5.2 of the ISMP conforms to Top-level Principle 5.2.5, "Subcontractors." Section 5.2 acceptably provides for the control of subcontractor employees, and for ensuring that subcontractors provide their workers with appropriate training necessary for performing their jobs safely.

3.4.3 Change (Configuration) Management

Review Methodology

The reviewers assessed the ISMP to the following attribute: "The reviewers should verify that the Contractor has evaluated all planned changes involving the technology of the process and the facility design and operation. The reviewers should determine if the Contractor has established provisions for facility changes involving process chemicals, technology, equipment, and procedures. The procedures which describe change management should address the technical basis for the proposed changes, impact of the changes on process safety, modification of the operating procedures, the schedule for proposed changes, and authorization for proposed changes."

Evaluation

Section 5.3, "Configuration Management," of the ISMP commits BNFL to implement a process safety management program ensuring that the TWRS-P facility establishes and maintains consistency among design requirements, physical configuration, and facility documentation to the technical baseline throughout the operating and deactivation phases. The ISMP commits BNFL to a program ensuring that procedures are developed to manage changes to process chemicals, technology, equipment, and operating and maintenance procedures. The management of change procedures is required to consider "1) The need to perform an unreviewed safety question (USQ) evaluation[,] 2) The technical basis for the proposed change[,] 3) The impact of the change on safety and health[,] 4) Modifications to operating procedures[,] 5) Schedule for completion of the activity[, and] 6) The authorization requirements for the proposed changes." Additional considerations include the retraining of employees who are affected by the change before restart of the process, and any changes in the process safety information. Section 1.3.16, "Configuration Management," of the ISMP provides a summary of the TWRS-P facility configuration management program. The ISMP states that additional detail on this program will be provided in ISAR Section 3.1, "Configuration Management," of the ISAR. Thus, Section 5.3 of the ISMP conforms to top-level principle 5.2.9, "Management of Change," and acceptably provides for facility changes involving process chemicals, technology, equipment, and procedures.

3.4.4 Compliance Audits

Review Methodology

The reviewers assessed the ISMP to the following attribute, "The ISMP contains commitments to periodically conduct audits to certify that the procedures and practices developed under the process safety management program are adhered to and are adequate, as well as to determine and document appropriate responses to each audit finding."

Evaluation

Section 5.4, "Compliance Audits," of the ISMP commits BNFL to implement a process safety management program ensuring that periodic audits are performed to evaluate compliance with the elements of PSM. This entails developing reports of the audit findings in which corrective actions and their schedule for completion are provided. The ISMP states that "additional detail on this program will be provided in ISAR Section 3.6, "Audits and Assessments." Thus, Section 5.4 of the ISMP conforms to Top-Level Principle 5.2.12, "Compliance Audits," and provides for periodic audits to determine compliance with procedures and practices developed under the process safety management program.

3.4.5 Process Hazards Analysis

Review Methodology

The reviewers assessed the ISMP to the following attribute: "The ISMP adheres to acceptable industry practices to perform hazards analysis. The hazards analysis process should provide for performing and documenting hazards analysis that address the following elements:

1. The selected hazards analysis process is tailored.

2. The hazards analysis process considers the effects of engineering and administrative controls, human factors, facility siting, and previous incidents in the hazard analysis.

3. The hazards analysis process requires documentation of the results of the hazards analysis including process hazards and possible safety and health effects.

4. The hazards analysis process requires submitting the results of the hazards analysis to the Regulatory Official for evaluation and in support of authorization decisions and regulatory oversight."

Evaluation

Section 5.5, "Process Hazards Analysis," of the ISMP commits BNFL to implement a process safety management program ensuring that PHAs are performed using acceptable industry practices. Section 5.5 commits BNFL to a program that ensures the following:

1. The PHA technique (BNFL HAR Section 3.3, "Hazard Evaluation Methodology") is tailored (BNFL HAR Section 3.2, "Selection of a Hazard Evaluation Methodology") to the information available and to the complexity of the TWRS-P processes;

2. The chosen PHA techniques address the hazards associated with the process by systematically evaluating potential deviations from design intent caused by the failure of engineered or administrative controls; and

3. The PHA process considers human factors (ISMP, Section 3.12, "Human Factors"), facility siting (BNFL HAR Section 2.1, "Site Description"), and previous incidents (BNFL HAR, Section 4.4, "Comparison to Similar Facilities").

BNFL commits to documenting the PHA consistent with the examples ("industry standards") documented in *AIChE's Guidelines for Hazards Evaluation Procedures*, and to consider consequences in the PHA. Consequences include qualitative evaluation of the possible effects on the health and safety of facility workers. Section 5.5 of the ISMP makes no commitment on behalf of BNFL to submit the results of the hazards analysis to the RO for evaluation and in support of authorization decisions and regulatory oversight. However, it should be noted that the BNFL SRD, Vol. II, Section 9, Safety Criterion 9.1-7 commits BNFL to submitting the hazards analysis to the RU for approval as part of the SAR. Furthermore, Safety Criteria 9.1-3 and 9.1-4 commit BNFL to maintaining current the SAR, which includes the hazards analysis, and to submitting the revisions to the RU. Thus, this portion of the ISMP is acceptable even without a specific commitment regarding submittal of the PHA to the RU. Therefore, Section 5.5 of the ISMP conforms to top-level principle 5.2.2, "Process Hazards Analysis," and provides for performing PHA to acceptable industry standards.

3.4.6 Conformance to Other Top-Level Safety Standards and Principles

Review Methodology

The reviewers assessed the ISMP to the following:

"The Contractor has addressed the following principles or has at least provided a placeholder for update when the ISMP is reviewed again at Authorization of Construction and Operation.

1. The ISMP addresses the development of operating procedures to provide clear instructions. The procedures should address the following elements: operating phase of the process, operating limits, safety and health considerations, and safety systems and their functions.

2. The ISMP contains a commitment to review and update the hazard analysis periodically.

3. The ISMP contains a commitment to develop and implement an operator training program that includes the following elements: an overview of the facility processes and operating procedures; the specific safety and health hazards, operating limits, emergency operations, and safety work practices; and refresher training.

4. The ISMP contains a commitment to perform a Pre-startup Review of the facility.

5. The ISMP contains a commitment to implement a mechanical integrity program that includes: 1) written procedures, 2) training for maintenance activities, 3) inspection and performance testing of process equipment, 4) quality assurance measures, and 5) measures to correct deficiencies in equipment that are outside acceptable limits.

6. The ISMP contains a commitment to implement a process to control hot work operations performed in or near the process or facility.

7. The ISMP contains a commitment to investigate incidents.

8. The ISMP contains a commitment to address an emergency action plan."

Evaluation

Section 5.6, "Conformance to Other Top-level Safety Standards and Principles," of the ISMP commits BNFL to implement a process safety management program that will ensure the following:

Section 5.6.1, "Procedure Development"—"Operating procedures provide clear instructions for safely operating the TWRS-P Facility during startup, normal operations, temporary operations, emergency operations, normal shutdown, and process startup following a turnaround or emergency shutdown."

Section 5.6.2, "Updating of the Hazards Analysis Report"—"At least every five years after the receipt of hazardous material at the TWRS-P Facility, the PHA and HAR are updated and revalidated by a qualified team."

Section 5.6.3, "Development of the Operator Training Program"—"The operator training program is developed and implemented in accordance with SRD Volume II, Section 7.2, 'Training and Procedures.'" The ISMP also states that "ISAR Section 3.4, 'Training and Qualification,' will further address the training policy and describe the level of training required of facility workers to efficiently and safely perform their intended duties."

Section 5.6.4, "Startup Review"—"Prior to operation, startup tests of the facility systems and personnel are performed in accordance with the Safety Criteria of SRD Volume II, Section 6.0, 'Startup.'"

Section 5.6.5, "Mechanical Integrity"—"Procedures are established to maintain the integrity of process equipment." These include "measures to correct deficiencies in equipment that are outside acceptable limits." Employees involved in maintaining the integrity of process equipment are trained through the TWRS-P project training program. "Inspection and test results are documented….The TWRS-P Project QAP includes procedures to ensure that equipment, as fabricated, is suitable for the process application for which it will be used."

Section 5.6.6, "Hot Work Operations"—"Hot work operations are reviewed and conducted in accordance with SRD Safety Criterion 4.5-19 which governs administrative controls to minimize fire hazards."

Section 5.6.7, "Investigations of Incidents"—"For incidents that have the potential to result in a major accident or a release of hazardous or radioactive material [sic], an investigation is conducted with the Safety Criteria of SRD Volume II, Section 7.7 'Reporting and Incident Investigation.'"

Section 5.6.8, "Emergency Action Plan"—"For accidents that result in the need to take additional actions to protect the workers, the public, and the environment from accidental releases of hazardous or radiological material, an emergency response program is provided in accordance with the Safety Criteria of SRD Volume II, Section 7.8, 'Emergency Preparedness.'"

Thus, Section 5.6 of the ISMP conforms to Top-Level Principles 5.2.3, "Operating Procedures"; 5.2.2, "Process Hazard Analysis"; 5.2.4, "Training"; 5.2.6, "Pre-startup Safety Review"; 5.2.7, "Mechanical Integrity"; 5.2.8, "Hot Work Control"; 5.2.10, "Incident Investigations"; and 5.2.11, "Emergency Planning and Response." Section 5.6 of the ISMP also addresses these principles or has at least provided a placeholder for updating them when the ISMP is reviewed at Authorization of Construction and Operation.

Conclusions

The RU review team recommends approval of the portion of the contractual requirement related to the management of process hazards. As required by the Contract, the BNFL ISMP specifies the standards-based management processes to be used by the Contractor to ensure process safety is adequately defined (i.e., tailored to the nature and level of hazards, including process hazards), implemented, and maintained. Also as required by the Contract, the ISMP documents safety management processes that properly and adequately address management of process hazards. The following conclusions support this recommendation:

Section 5.1, "Process Safety Information," conforms to Top-level Principle 5.2.1, "Process Safety Information," and acceptably addresses the development and maintenance of information that provide a foundation for identifying and understanding the process hazards.

Section 5.2, "Control of Subcontractors," conforms to Top-level Principle 5.2.5, "Subcontractors," and acceptably provides for the control of subcontractor employees, and for ensuring that subcontractors provide their workers with appropriate training necessary for performing their jobs safely.

Section 5.3, "Configuration Management," conforms to Top-level Principle 5.2.9, "Management of Change," and acceptably provides for facility changes involving process chemicals, technology, equipment, and procedures.

Section 5.4, "Compliance Audits," conforms to Top-level Principle 5.2.12, "Compliance Audits," and acceptably provides for periodically conducting audits to determine compliance with procedures and practices developed under the process safety management program.

Section 5.5, "Process Hazard Analysis," conforms to Top-level Principle 5.2.2, "Process Hazards Analysis," and provides for performing PHA to acceptable industry standards.

Section 5.6, "Conformance to Other Top-level Safety Standards and Principles of the ISMP," conforms to Top-Level Principles, as follows: 5.2.3, "Operating Procedures"; 5.2.2, "Process Hazard Analysis"; 5.2.4, "Training"; 5.2.6, "Pre-startup Safety Review'; 5.2.7, "Mechanical Integrity"; 5.2.8, "Hot Work Control";

5.2.10, "Incident Investigations'; and 5.2.11, "Emergency Planning and Response." Section 5.6 addresses these principles at the level of detail appropriate for this stage of the project.

3.5 Integrated Safety Management Features

Requirements

Pursuant to DOE/RL-96-0003 and in order to approve the ISMP, the RO must make a determination that "[t]he program documented in the ISMP contains appropriate features of integrated safety management (i.e., integration among safety, design, and operations interests; integration over the life-cycle of the activities; and integration into work planning and performance)."[32]

Review Methodology

The evaluation to determine whether the program documented in the ISMP contains the appropriate integrated safety management features was conducted in two parts. The first part of the evaluation addressed integration into work planning and performance. The second part of the evaluation addressed integration among safety, design, and operations interests and integration over the lifecycle of the activities.

The evaluation of integration into work planning and performance assessed the information provided by BNFL against the following attribute: the ISMP is consistent with the guiding principles and core safety management functions of integrated safety management. The guiding principles and core safety management functions of integrated safety management are defined below.

The guiding principles are philosophies, which embody integrated safety management, are: [33]

> "[Guiding Principle 1] Line management is responsible for the protection of the public, the workers, and the environment.
>
> [Guiding Principle 2] Clear, unambiguous lines of authority and responsibility for ensuring safety are established and maintained at all organizational levels.
>
> [Guiding Principle 3] Personnel possess the experience, knowledge, skills and abilities necessary to discharge their responsibilities.
>
> [Guiding Principle 4] Resources are effectively allocated to address safety, programmatic, and operational considerations. Protecting the public is a priority whenever activities are planned and performed.
>
> [Guiding Principle 5] Before work is performed, the associated hazards are evaluated and an agreed-upon set of standards and requirements are established which, if properly implemented, provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

32. DOE/RL-96-0003, Section 3.3.1, item 5, p. 5.

33. *Department of Energy Plan for the Development and Implementation of Integrated Safety Management (Implementation Plan for Board Recommendation 95-2),* 1996, p. 9.

> [Guiding Principle 6] Administrative and engineering controls to prevent and mitigate hazards are tailored to the work and associated hazards being performed.
>
> [Guiding Principle 7] The operational conditions and requirements are clearly established and agreed upon."

If the integrated safety management features are embodied in the Contractor's safety management processes and programs, then each guiding principle will be related to each aspect of the Contractor's work. It should be noted that all of the guiding principles were themselves evaluated as separate evaluation criteria in either the SRD or ISMP evaluations. Rather than repeat each guiding principle evaluation as it appears in the associated sections of the BNFL ISMP and SRD Evaluation Reports, Table 3.8-1 provides a cross-reference to the results of these evaluations.

Although these evaluations address each of the guiding principles, the reviewers also evaluated the ISMP programmatically to determine if there was additional evidence that the programs documented in the ISMP integrated safety into work planning and performance.

Table 3.8-1. Correlation Between Guiding Principles and Evaluation Reports Sections.

Guiding Principle (GP)	Evaluation Report Section
GP-1	SRD Evaluation Report Sects. 4.2.3.1.2 and 4.2.3.1.4
GP-2	SRD Evaluation Report Sects. 4.2.3.1.2, 4.2.3.1.4, and 4.2.3.4
GP-3	SRD Evaluation Report Sects. 4.2.3.3.4, 4.5
GP-4	SRD Evaluation Report Sects. 4.2.3.1.4
GP-5	SRD Evaluation Report Sects. 4.3 and 4.6
GP-6	SRD Evaluation Report Sect. 4.4 and ISMP Evaluation Report Sect. 4.3
GP-7	SRD Evaluation Report Sects. 4.2.3.3.1 through 4.2.3.3.6

The core safety management functions are embodied in the essential process steps of the contract-stipulated process in DOE/RL-96-0003.[34] The core safety management functions for integrated safety management is as follows:

> "[Core Function 1] Define the scope of work.
>
> [Core Function 2] Identify and analyze the hazards associated with the work.
>
> [Core Function 3] Develop and implement hazard controls.
>
> [Core Function 4] Perform the work within the controls.
>
> [Core Function 5] Provide feedback on the adequacy of the controls and continuous improvements in defining and planning the work."

34. DOE/RL-96-0003, Table 1, "Process to Develop Standards," p. 4.

Compliance to this process was contract stipulated and evaluated as part of the SRD review. The evaluation process and the results of this evaluation are documented in the BNFL SRD Evaluation Report (Section 4.4) and are not repeated here.

RL/REG-97-07 did not provide detailed attribute guidance for (1) integration into work planning and performance, and (2) integration among safety, design, and operations and integration over the life-cycle of the activities. Therefore, the review in these two areas was performed against the evaluation criterion itself, examining the philosophy and approach to integrated safety management presented by BNFL (see Sections 4.5.1 and 4.5.2). Both parts of this evaluation were conducted through review of the material presented in the ISMP and the resolution of the RU's questions developed during the review.

3.5.1 Integration into Work Planning and Performance

The integration into work planning and performance is the principal emphasis for the overall evaluation of the Contractor deliverables under Part A of the TWRS-P Contract. Although these evaluations address each of the guiding principles, the reviewers also evaluated the ISMP programmatically to determine if there was additional evidence that the programs documented in the ISMP integrated safety into work planning and performance.

Section 6, "Integrated Safety Management," of the ISMP describes how BNFL integrates safety management into work planning and performance. However, as would be expected, commitments relating to integrated safety management guiding principles and core safety management functions are found throughout the descriptions of safety management processes and programs in the BNFL ISMP and in the BNFL QAP.

To assess consistency with the guiding principles of integrated safety management (see Guiding Principle [GP] 1-7), the reviewers examined Section 6 and other parts of the ISMP in the context of draft DOE Guide 450.4-1, "Integrated Safety Management System Guide."[35] The results of this review are as follows.

The reviewers found that the commitments made in:

- Section 6.1.1, "Line Management Responsibility for ES&H," of the ISMP addressed and was consistent with GP-1 and the discussions of line management responsibility for safety in Section II.1 of the draft DOE guide.

- Section 6.1.2, "Lines of Authority and Responsibility," of the ISMP and the first paragraph of ISMP Section 3.2, "Safety Responsibilities," addressed and were consistent with GP-2 and the discussion of clear roles and responsibilities in Section II.2 of the draft DOE guide.

- Sections 1.3.12, "Training"; 3.15, "Training and Qualification"; 4.2.2, "Training and Procedures"; and 6.1.3, "Personnel Qualifications and Resources"; of the BNFL ISMP, and Section 2, "Personnel Training and Qualification" of the BNFL QAP addressed and were consistent with GP-3 and the discussions of competence commensurate with responsibilities in Section II.3 of the draft DOE guide.

35. DOE G 450.4-1, *"Integrated Safety Management System Guide,"* for use with DOE P 450.4, Safety Management System Policy, U.S. Department of Energy, Washington, D.C., draft for expedited review and comment, July 1997.

- Section 6.1, "Integration into Work Planning and Performance," and the last paragraph of Section 6.1.3, "Personnel Qualifications and Resources" of the BNFL ISMP addressed and were consistent with GP-4 and the discussions of balanced priorities in Sections II.4 and IV.2.1 of the draft DOE guide.

- Sections 3.4, "Safety/Quality Culture"; 6.1, "Integration into Work Planning and Performance," (items 3 and 7); and 6.1.4, "Hazard Assessment, Controls, and Operating Conditions," (items 1 - 4) of the ISMP addressed and were consistent with GP-5 and the discussions of identification of standards and requirements in Sections II.5 and IV.2.3 of the draft DOE guide.

- Sections 4.2, "Tailoring Safety Management Processes," and 4.2.2, "Training and Procedures," of the ISMP addressed and were consistent with GP-6 and the discussions of hazard controls tailored to work being performed in Sections II.6 and IV.2.3 of the draft DOE guide.

- Sections 3.4, "Safety/Quality Culture," and 6.1, "Integration into Work Planning and Performance," (item 7) of the ISMP addressed and were consistent with GP-7 and the discussion of operations authorization in Sections II.7 and IV.2.4 of the draft DOE guide.

Thus, the reviewers found within the ISMP commitments that addressed and were consistent with all seven of the GPs of integrated safety management.

To assess consistency with the core safety management functions (CSMF) of integrated safety management (CF-1-5 in the Review Methodology above), the reviewers examined Section 6 and other parts of the ISMP in the context of draft DOE Guide 450.4-1. The results of the review are as follows.

The reviewers found that the commitments made in:

- Sections 6.1, "Integration into Work Planning and Performance," (item 7), and 6.1.4, "Hazard Assessments, Controls, and Operating Conditions," (item 1) of the ISMP addressed and were consistent with CF-1 and the discussion of defining the work scope in Section IV.2.1 of the draft DOE guide.

- Sections 1.3.4, Process Hazards Analysis"; 4.1.1, "Development of Safety Management Processes," (item 1); 5.5, "Process Hazards Analysis"; 6.1, "Integration into Work Planning and Performance," (item 3); and 6.1.4 "Hazard Assessments, Controls, and Operating Conditions," (items 1 - 3) of the ISMP addressed and were consistent with CF-2 and the discussion of identifying and analyzing hazards in Section IV.2.2 of the draft DOE guide.

- Sections 3.4, "Safety Quality Culture";[36] 6.1, "Integration into Work Planning and Performance," (item 3); and 6.1.4, "Hazard Assessments, Controls, and Operating Conditions," (items 1 and 4) of the ISMP addressed and were consistent with CF-3 and the discussion of developing and implementing hazard controls in Section IV.2.3 of the draft DOE guide.

36. Particularly those in the second paragraph on page 3-9 of the ISMP.

- Sections 1.3.15, "Operations," (item 4); 3.4, "Safety/Quality Culture"; 6.1, "Integration into Work Planning and Performance" (items 6 and 7); and 6.1.2, "Lines of Authority and Responsibility," of the BNFL ISMP along with those in Section 5, "Work Processes," of the BNFL QAP addressed and were consistent with CF-4 and the discussion of performing work within controls in Section IV.2.4 of the draft DOE guide.

- Sections 1.3.17, "Incident Investigation"; 3.4, "Safety/Quality Culture"; 3.16, "Internal Safety Oversight"; 3.16.2, "Safety Improvement Program"; 3.16.3, "Incident Investigations"; 3.16.5, "Performance Monitoring"; 3.16.6, "Performance Indicators"; 3.16.8, "Feedback and Trending"; 5.4, "Compliance Audits"; 5.6.7, "Investigation of Incidents"; 6.1, "Integration into Work Planning and Performance," (items 2 and 11); and 6.1.4, "Hazard Assessments, Controls, and Operating Conditions" (items 5 and 6) of the ISMP along with those in Section 10, "Assessments," of the ISMP and those in Sections 3, "Quality Improvement"; 9, "Management Assessment'; and 10, "Independent Assessment," of the BNFL QAP addressed and were consistent with CF-5 and the discussion of providing feedback and continuous improvement in Section IV.2.5 of the draft DOE guide.

Thus, the reviewers found within the BNFL ISMP and QAP commitments that addressed and were consistent with all five of the CSMFs of integrated safety management.

In the course of the review, reviewers also examined those elements of the discussion of work practices in ISMP. Within the discussion of work practices in Section 6.1, "Integration Into Work Planning and Performance," of the ISMP, those elements that were not explicitly related to the GPs or the CSMFs of integrated safety management, such as items 1, 4, 5, 8, 12, and 13, were also examined. The reviewers found that the function of these items is to support the creation of a safe work environment and the type of safety/quality culture in which the GPs and CSMFs of integrated safety management can be effectively implemented.[37]

3.5.2 Integration Among Safety, Design, and Operations

In their review ISMP for the philosophy of "designing-in" safety and integration of safety in all aspects of TWRS-privatization, the reviewers examined the programs described in the ISMP and searched for evidence of this integration. The reviewers noted that this version of the ISMP focused mainly on the design activities of the Contractor. Therefore, the majority of the work addressed was design work, and the integration of safety into the planning and performance of this design work would lead naturally to the integration of safety into design. Thus, the evaluation of the integration of safety into the planning and performance of work also accomplished the majority of the evaluation of the integration of safety into design.

The remainder of the review focused on Section 3.11, "Safety Systems Design," of the ISMP, which provides a more specific discussion of BNFL's approach to the integration of safety into design. During this part of the review, the issue of whether there were standards-based safety management processes or programs with the specific role of ensuring a consistent, project-wide integrated approach to environmental, safety, and health protection (ES&H) for all activities was identified. BNFL resolved this issue (Review Question 110) by clarifying that the integration over of all activities was achieved by various aspects of the

37. For example, many of these management practices are recommended in the Lockheed Martin Energy Systems, Inc. K-25 Incident Lessons Learned Multimedia Presentation, Lockheed Martin Energy Systems, Oak Ridge, TN and Ann Rollins Communications, Inc., Knoxville, TN, 1997.

standards-based safety management processes and programs documented in the ISMP. The reviewers found that the commitments in Section 3.11, in combination with the commitments discussed previously in the evaluation of the integration of safety into work planning and performance, demonstrated appropriate integration of safety into design.

The ISMP description of operations was naturally limited at this stage of the TWRS-P project; therefore, the reviewers focused on the integration of safety into work planning and performance in assessing the integration of safety into operations. The reviewers found that the commitments discussed previously in the evaluation of the integration of safety into work planning and performance demonstrated a level of safety integration into operations appropriate for this stage in the TWRS-P project.

The review of safety integration throughout the lifecycle of the activities was necessarily limited by the focus of the ISMP on design and construction. Consequently, the reviewers were required to identify the issue of consistency of the focus of the ISMP on design and construction. BNFL was required to provide in its ISMP documentation of a safety management program that included integration throughout the lifecycle of the activities. BNFL resolved this issue (Review Question 95) by reaffirming its commitment to integrating its safety management program throughout the life of the TWRS-P program (i.e., design, construction, operation, and deactivation). The reviewers found that this commitment, in combination with the commitments discussed previously in the evaluation of the integration of safety into work planning and performance, demonstrated a level of safety integration throughout the lifecycle of the activities that was appropriate for this stage in the TWRS-P project.

Conclusions

The reviewers recommend approval of the portion of the contractual requirement that the program documented in the ISMP contains appropriate features of integrated safety management (i.e., integration among safety, design, and operations interests; integration throughout the lifecycle of the activities; and integration into work planning and performance). The reviewers' conclusions in support of the recommendation for approval are as follows:

- The ISMP contains commitments that address and are consistent with all seven of the GPs of integrated safety management.
- The ISMP contains commitments that address and are consistent with all five of the CSMFs of integrated safety management.
- The ISMP contains additional commitments that serve to support the creation of a safe work environment and the type of safety/quality culture in which the GPs and CSMFs of integrated safety management can be effectively implemented.
- The ISMP contains commitments relating to specific processes for integration of safety into design that, in combination with the commitments for integration of safety into work planning and performance, demonstrate appropriate integration of safety into design.
- The ISMP commitments for integration of safety into work planning and performance demonstrate a level of integration of safety into operations that is appropriate for this stage of the TWRS-P project.

- The BNFL response to RU Review Question 95, in combination with the commitments for integration of safety into work planning and performance, demonstrates a level of safety integration throughout the lifecycle of the activities that is appropriate for this stage of the TWRS-P project.

3.6 Regulatory Interfaces

Requirement

DOE/RL-96-0003 requires that the Contractor's ISMP "[d]efine the Contractor's interfaces with other regulatory regimes, such as environmental protection, occupational safety, and safeguards and security, and define the processes for resolving conflicting requirements at these interfaces and for ensuring safety adequacy at these interfaces (i.e., ensuring that safety "gaps" do not occur)." Pursuant to DOE/RL-96-0003, the RO must, in order to approve the ISMP, make a determination that "[t]he interfaces among regulatory regimes are appropriately addressed to ensure that adequate protection is fully achieved."[38]

Review Methodology

This section addresses the issue of interfaces among regulatory entities to ensure an adequate approach for resolving conflicts, without decreasing safety, is fully achieved. Evaluation of the regulatory interfaces included the assessment of the following attributes as defined in RL/REG-97-07:

1. Environmental Protection Interface—The ISMP explains the Contractor's interaction with the EPA, the Washington State Department of Ecology, the Washington State Department of Health, and the Benton County Clean Air Authority to anticipate and avoid safety problems arising from considerations other than radiological, nuclear, and safety regulation.

2. Occupational Health and Safety Interface—The ISMP explains the Contractor's interaction with the occupational, safety, and health regulators to anticipate and avoid safety problems arising from considerations other than radiological, nuclear, and safety regulation.

3. Safeguards and Security Interface—The ISMP explains the Contractor's interaction with the safeguards and security oversight organization to anticipate and avoid safety problems arising from considerations other than radiological, nuclear, and safety regulation.

4. Resolution of Conflicting Requirements and Standards—The ISMP has described the provisions to identify and resolve conflicts, while ensuring safe operation when potential conflicts arise between safety and compliance with other regulatory requirements (and among the other requirements)."

Evaluation

The evaluations for each of the attributes listed above were performed separately. They are documented under separate headings in the following sections.

38. DOE/RL-96-0006, Section 3.3.1, item 6, pg. 5.

3.6.1 Environmental Protection Interface

Section 7.1, "Environmental Protection Interface," of the ISMP states that the Environmental Protection Agency (EPA) has granted the Washington State Department of Ecology (Ecology) and the Washington Department of Health (WDOH) the authority to permit air emissions from the TWRS-P facility. Ecology is responsible for regulating criteria for pollutants and toxic air pollutants and for regulating the facility with respect to the *Resource and Conservation Recovery Act of 1976* (RCRA). The WDOH is responsible for regulating radioactive emissions. BNFL will identify all of its environmental permits and monitoring in its Environmental Plan. BNFL has developed a permitting plan to identify the tentative dates for major permitting activities and to document all of the permitting interfaces with other waste treatment, storage, and disposal interfaces. The plan provides for public involvement opportunities and has been jointly approved by DOE, Ecology, and the WDOH.

BNFL has also stated that it maintains communications with the regulatory agencies through meetings, and numerous discussions both in person and via telephone.

3.6.2 Occupational Safety and Health Administration (OSHA) Interface

Section 7.2, "Occupational Health and Safety Interface," of the ISMP notes that DOE is currently working on establishing a Memorandum of Understanding (MOU) with the OSHA. Section 7.2 of the ISMP also describes BNFL's commitment to have an OSHA-qualified Voluntary Protection Program (VPP) and to obtain STAR status during construction and operation. BNFL also has identified the Standard Industrial Code (SIC) to be SIC 4953, "Sanitary Services," during operation, and SIC 1629, "Heavy Construction, Not Elsewhere Classified," during construction.

BNFL has stated that it will comply with all applicable federal, state, and local safety and health regulations, including those of the Washington Industrial Safety and Health Administration (WISHA) and OSHA. Identification and mitigation of hazards will be performed using OSHA's process safety management requirements of 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals." Material Safety Data Sheets will be used for the identification of hazards as required by 29 CFR 1910.1200, "Hazard Communication."

3.6.3 Safeguards and Security Interface

Section 7.3, "Safeguards and Security," of the ISMP states that safeguards and security measures for Special Nuclear Material (SNM) appropriate for the TWRS-P facility will be developed with RL. Any conflict that arises between considerations for safeguards and security and radiological, nuclear, and process safety will be resolved by discussions among BNFL, RL Security, and the RU.

3.6.4 Resolution of Conflicting Requirements and Standards

In section 7.4, "Resolution of Conflicting Requirements and Standards," of the ISMP, BNFL has committed to maintain access to multiple regulatory resources to ensure that new and existing requirements are identified and any conflicts are resolved. These resources include:

- Federal Register (FR)
- Code of Federal Regulations (CFRs)
- State of Washington Administrative Code (WAC)
- The Bureau of National Affairs Inc. Environmental Reporter

- Working contacts with the EPA, the State of Washington, and other regulatory agencies
- Trade journals
- Corporate memberships on numerous regulatory committees.

BNFL has committed to resolve conflicts when they are identified. Furthermore, in Section 7.4 of the ISMP, BNFL has committed to use the more stringent regulation in cases where safety and environmental regulations conflict and an exemption is not granted.

With respect to the double-shell tank 241-AP-106, interface meetings were held among BNFL, DOE, and the Project Hanford Management Contractor to identify and resolve concerns. The interface responsibilities are recorded and agreed upon in interface control documentation. Changes to this documentation regarding new concerns or resolutions require the agreement of all parties involved in the interface agreement.

Conclusions

On the basis of the information provided in the BNFL ISMP and discussed above, the reviewers recommend approval of this contract requirement.

The process discussed in Section 7 of the ISMP should be sufficient to identify and provide a path for resolving conflicts relating to regulatory requirements in the SRD. As the design and construction process evolves and additional design documents are approved, these documents should be added to the conflict resolution process described in the ISMP.

3.7 Document Control and Maintenance

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP "[s]pecify the standards-based management processes to be used by the Contractor to ensure that radiological, nuclear, and process safety is adequately defined." Pursuant to DOE/RL-96-0003, the RO must, in order to approve the ISMP, make a determination that "[s]afety documentation processes delineated in the ISMP provide for appropriate document control and maintenance."[39]

Review Methodology

The reviewers assessed the ISMP to evaluate the document control and maintenance information provided by BNFL to the following attributes:

1. Determine if BNFL has established a document control and maintenance program;

2. Verify that documents developed under the safety management processes will be controlled under the BNFL QAP;

3. Verify that the document control and maintenance process is based on the BNFL QAP and QA implementation plan;

39. DOE/RL-96-0003, Section 3.3.1, item 7, p. 5.

4. Verify that the ISMP is included within the scope of documents subject to the document controls of the BNFL QAP; and

5. Verify that the integrated safety management processes described in the ISMP require that safety documentation to be subject to the document controls of the BNFL QAP.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

Section 8.0, "Document Control and Maintenance," of the ISMP identifies the procedures governing both the corporate BNFL policies and specific processes for document control. Also, Table 8-1, "Safety Management Records," in Section 8.0 provides a summary of the safety documents that are developed as part of the safety management process and controlled by the QAP.

The reviewers assessed the extent to which the safety documentation processes delineated in the ISMP provide for appropriate document control and maintenance. It should be noted that portions of this analysis were performed in combination with the reviews of compliance with 10 CFR 830.120 in Sections 3.1.4.2 of both this Evaluation Report and the SRD Evaluation Report. For example, as described in Section 3.1.4.2 of this Evaluation Report, Section 1.3.11, Table 1-4, "Application of Quality Assurance Program Requirements for QL-1, QL-2, and QL Structures, Systems, and Components," of the ISMP provides a matrix showing the extent to which BNFL applies specific QAP requirements to each of three quality levels (QLs). Table 1-4 shows that the QAP requirements for 10 CFR 830.120 QA Criterion 4 (Documents and Records) are fully applied to QL-1 and QL-2 structures, systems, and components (measures relating to document control and maintenance are addressed in large part in Criterion 4 of 10 CFR 830.120).

The BNFL QAP Evaluation Report documents the RU's evaluation of the BNFL QAP. The reviewers benefited from the QAP Evaluation Report with respect to several Review Methodology items listed above. For example, the reviewers were able to determine from the BNFL QAP and the BNFL QAP Evaluation Report that BNFL has established a document control and maintenance program. Also, the reviewers were able to verify that documents developed under the safety management processes will be controlled under the BNFL QAP.

The reviewers evaluated Section 3.3.3, "Licensing Basis," of the ISMP and determined that it does not provide a process for managing changes to the authorization basis, including control of the SRD and the ISMP during the period between Standards Approval and Construction Authorization (Review Question 81). BNFL's response was that after approval of the SA Package, and before issuance of the construction authorization, changes to safety documentation will be controlled by the TWRS-P project configuration management program. BNFL also indicated that the RU would be informed of proposed changes to the SRD and ISMP during this period.

As described in Review Question 169, the reviewers observed that the commitments regarding the process for document control and maintenance as documented in the SRD and the ISMP vary for different phases of operation. For example, Section 3.3.3.1 of the ISMP and Section 3.6 of the BNFL SRD appear to have different thresholds for informing the RU of proposed changes for major documents. BNFL's response adequately clarified its intentions in this area.

Conclusions

The reviewers recommend conditional approval of this contract requirement. As required by the Contract, the BNFL ISMP delineates safety documentation processes that provide for appropriate document control and maintenance. BNFL has committed to submit a revised QAP for RU review and approval before initiation of Part B activities. This revised QAP will be required to provide additional detail concerning the safety documentation processes that provide for appropriate document control and maintenance.

3.8 Scheduling of Safety-Related Activities

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP "[s]pecify the expected flow and schedule of the Contractors safety-related work and deliverables, including interactions with the Regulatory Unit." Pursuant to DOE/RL-96-0003, the RO must, in order to approve the ISMP, make a determination that "[s]cheduling of safety-related activities as described in the ISMP, including generation of regulatory submittals, is consistent with Figure 2…" of DOE/RL-96-0003.[40]

Review Methodology

The reviewers assessed the ISMP to evaluate the scheduling of safety-related activities, to the following attributes:

1. The adequacy of the schedule information provided for safety-related activities, including the identification of major milestones, the presentation of a time line timeline encompassing design, construction, operation, and deactivation, and the evidence presented supporting BNFL's ability to meet the schedule presented;

2. The adequacy of the schedule information for regulatory submittals and its consistency with the Figure 2 of DOE/RL-96-0003; and

3. The level of detail provided regarding the interdependencies among the safety-related deliverables, the safety-related activities, and the project milestones, particularly those related to design and construction.

This examination was conducted through review of the material presented in the ISMP and the resolution of questions developed during the review.

Evaluation

Section 9, "Scheduling of Safety-Related Activities," of the ISMP provides a sequencing of BNFL-planned events for the major milestone safety-related activities and deliverables for the design, fabrication and construction, startup, operation, and deactivation phases of the TWRS-P project in Figure 9-1, "Sequence of Safety Related Activities." The figure also illustrates the sequencing of interactions with the RU. Tables 9-1 through 9-5 of Section 9 described the key safety-related activities that BNFL has planned for the design, fabrication and construction, startup, operation, and deactivation phases of the TWRS-P project.

40. DOE/RL-96-0003, Section 3.3.1, item 8, p. 5.

To assess the adequacy of the schedule of safety-related activities, the reviewers compared the safety-related activities of Figure 9-1 and Tables 9-1 through 9-5 with the discussion of project activities and safety-related activities in the DOE G 430.1-1, "Cost Estimating Guide," and DOE Order 425.1, "Startup and Restart of Nuclear Facilities." The reviewers found that the figure and tables contained all the applicable safety activities identified for construction projects in DOE G 430.1-1 and all of those implied in paragraph 2.d of Attachment 1 to DOE Order 425.1. The figure and tables also provided a logical sequencing. However, BNFL provided only the sequencing of the events and not a schedule, as required by the Contract. BNFL responded to this issue (Review Question 97) by stating that the sequence provided in Figure 9-1 was drawn to scale and that a specific schedule would be provided with the ISAR. The reviewers compared the scale to the sequencing of the event and found the timing reasonable.

The reviewers compared Figure 9-1 in Section 9 of the ISMP to Figure 2 of DOE/RL-96-0003 to determine the adequacy of the schedule information for regulatory submittals. The reviewers found that the regulatory deliverables specified in DOE/RL-96-0003 had been incorporated in Figure 9-1. They also found that the duration of activities shown in Figure 9-1 (e.g., the periods between the notifications of intent to submit regulatory deliverables, such as the Construction Authorization Request Package and the Operations Authorization Request Package, and the actual submittal of these deliverables) were consistent with the reference schedules in Figures 5 and 6 of DOE/RL-96-0003.

The reviewers assessed the level of detail provided by BNFL regarding the interdependencies among the safety-related deliverables by comparing Figure 9-1 of BNFL ISMP and Figure 2 of DOE/RL-96-0003. These interrelationships were examined in the context of the project activities identified in DOE G 430.1-1 and implied in paragraph 2.d of Attachment 1 to DOE Order 425.1. This comparison demonstrated that Figure 9-1 is consistent with Figure 2 of DOE/RL-96-0003. It also demonstrated that Figure 9-1 illustrates a logical set of interdependencies and interrelationships for the key safety-related activities, including the development of regulatory submittals. For example, hazard assessment updates are performed at appropriate times to effect both the facility design and the development of the operating procedures.

Two issues were identified in this review. The first issue is that Figure 9-1 of the ISMP does not show a schedule for the deactivation authorization review. BNFL committed to provide the schedule for deactivation authorization review with the ISA submittal. The second issue (Review Question 99) is that Figure 9-1 showed a regulatory action, the issuance of a Limited Work Authorization (LWA), which was not included in Figure 2 of DOE/RL-96-0003. BNFL responded by identifying the bases for establishing a framework for the issuance of an LWA in a manner that was consistent with the regulatory process illustrated in Figure 2 of DOE/RL-96-0003.

Conclusions

The reviewers recommend conditional approval of this contract requirement. As required by the Contract, BNFL did not provide a schedule for these activities in its ISMP. However, the BNFL ISMP did provide an acceptable sequence and flow of safety-related work and deliverables that included the interactions with the RU. BNFL also committed to submit a schedule, including specific dates, for safety related activities, before starting Part B activities. Because the schedule will be available before Part B decision-making, and the sequence of safety-related activities and their interdependencies are acceptably described, the reviewers concluded that the BNFL ISMP is conditionally acceptable for this Contract requirement.

3.9 Self-Assessment Program

Requirements

DOE/RL-96-0003 requires that the Contractor's ISMP "[d]escribe the self-assessment functions to be employed by the Contractor ..." Pursuant to DOE/RL-96-0003, the RO must, in order to approve the ISMP, make a determination that "[s]elf assessment elements documented in the ISMP are appropriate."[41]

Review Methodology

The reviewers assessed the information provided by BNFL to evaluate its self-assessment program. The objectives of the evaluation were as follows:

1. Verify that BNFL's self-assessment process is part of or based on the BNFL QAP and QA implementation plan (i.e., with respect to Criterion 3, "Quality Improvement," and Criterion 10, "Independent Assessment," of 10 CFR 830.120); and

2. Confirm that the RU's QA review of the BNFL QAP adequately addressed self-assessment or, alternatively, if the RU's QA review did not adequately address self-assessment, evaluate BNFL's submittal against this criterion.

This examination was conducted through review of the material presented in the ISMP.

Evaluation

Section 10.0, "Assessments," of the ISMP identifies the activities that are evaluated through assessments during design, construction, operation, and deactivation. Section 10.0 also provides a summary of the more significant aspects involved with management assessments, independent assessments, and corrective action implementation and tracking. The BNFL SRD, Vol. II, Section 7.4 indicates that the maintenance program shall clearly define provisions for implementation of a self-assessment program.

Table 1-4 within Section 1.3.11 of the ISMP provides a matrix showing the extent to which BNFL applies specific QAP requirements to each of three QLs. The reviewers determined that: (1) Table 1-4 adequately reflects the QAP requirements for both 10 CFR 830.120 Criterion 3, "Quality Improvement," and Criterion 10, "Independent Assessment," and (2) the QAP requirements for Criteria 3 and 10 are fully applied to QL-1 and QL-2 structures, systems, and components.

The BNFL QAP Evaluation Report documents the evaluation of the BNFL QAP by the RU. The reviewers benefited from the BNFL QAP Evaluation Report with respect to confirming that this evaluation adequately addressed the appropriate elements of self-assessment.

Conclusions

The reviewers recommend conditional approval of this contract requirement. As required by the Contract, the BNFL ISMP describes the self-assessment functions to be employed by the Contractor and these self-assessment elements are appropriate. BNFL has committed to submitting a revised QAP for review and approval by the RU review and approval before the initiation of Part B activities. This revised QAP will

41. DOE/RL-96-0003, Section 3.3.1, item 9, p. 5.

be required to provide additional detail regarding the self-assessment programs to be employed during Part B activities.

3.10 Roles, Responsibilities, and Authorities

Requirements

DOE/RL-96-0003, Section 4.1.2, "Contractor Input" requires that the Contractor's ISMP "[i]dentify roles, responsibilities, and authorities for defining, implementing, and maintaining safety." Pursuant to DOE/RL-96-0003, the RO must, in order to approve the ISMP, make a determination that roles, responsibilities, and authorities for safety-related activities as described in the ISMP, are clear and appropriate.[42]

Review Methodology

During their evaluation of roles, responsibilities, and authorities, the reviewers assessed the information provided by BNFL using the following review guidance:[43]

> "The Contractor's safety definition, implementation, and maintenance roles, responsibilities and authorities should be part of or based upon the QAP and QA implementation plan. Note that safety definition, implementation, and maintenance roles, responsibilities, and authorities relates to Criterion I, "Quality Improvement," (10 CFR 830.120(c)(1)(l). The Contractor may have chosen to [integrate] the information to meet this approval criterion into its QAP. The reviewers should confirm that the RU's review adequately addresses these items. Alternatively, if the RU's QAP review did not adequately address these items, the reviewers should evaluate the Contractor's submittal against this criterion."

In addition, 10 CFR 830.120 (c) (1) (i), "Program," which is the DOE QA regulation governing programs, states, in part, that "[a] written QAP shall be developed, implemented, and maintained. The QAP shall describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work."

Evaluation

Section 11 "Organizational Roles, Responsibilities, and Authorities," of the ISMP contains the Contractor's organizational structure, functional responsibilities, and levels of authority for the design and construction and the operational phases of the project. Section 11 also contains two organizational charts, one for design and construction and one for operations.

Figure 11.1, "Design and Construction Organization," in Section 11 of the ISMP depicts the Design and Construction Organization. Environment, Safety and Health (ES&H) and QA functions are shown as direct reports to the Project Manager, with a dotted-line relationship to the Vice President ES&H and QA. This reporting relationship is significantly different than that shown in the BNFL QAP. In the QAP, QA is shown reporting directly to the BNFL, Inc., Corporate QA Manager, with a dotted-line relationship to the Project Manager.

42. DOE/RL-96-0003, Section 3.3.1, item 10, p. 5.

43. RL/REG-97-07, Section 6.10, p. 18.

This difference in organization charts was addressed by the RU reviewers (Review Question 77). BNFL responded by stating that the QA Manager's reporting relationships for the design and construction phase will be the same as those presented in the BNFL QAP. The response further stated that the reporting requirements for the operational phase will change to those specified in the ISMP organization chart for operations. A commitment was made to modify the ISMP organization chart for the design and construction phase to be consistent with the organization chart in the QAP.

The roles and responsibilities described in Sections 11.1, "Design and Construction Phase," and 11.2, "Operations Phase," of the ISMP provide six to eight one-line statements that provide general descriptions for the positions of General Manager, Project Manager, and Plant Manager. Additional broadly defined roles and responsibilities were identified in both sections. However, these roles and responsibilities were assigned to functional groups rather than to specific organizational positions. Authorities were not defined or clearly developed in either section, most likely due to the level of detail that is available at this point.

Conclusions

The reviewers recommend conditional approval of this contract requirement based on the development of the organizational structure, roles, and responsibilities. BNFL has committed to submit a revised QAP for review and approval by the RU before initiation of Part B activities. This revised QAP will be required to detail the roles, responsibilities, and authorities of the individuals responsible for the elements of the design process.

4.0 Recommendations

4.1 Recommendation for Approval

The RU has reviewed the BNFL ISMP and recommends that the RO approve the ISMP, subject to the conditions identified in Section 4.2 below. This recommendation is based upon the reviewers' conclusions concerning the ISMP that support the following determinations:

- The program documented in the ISMP complies with all applicable laws and regulations, as presented in Section 3.1 of this Evaluation Report;
- The program documented in the ISMP conforms to the top-level radiological, nuclear, and process safety standards and principles contained in DOE/RL-96-0006, as presented in Section 3.2 of this Evaluation Report;
- The selected safety management processes documented in the ISMP are standards- based and are appropriately tailored to the hazards associated with the Contractor's proposed facility, its operation, and its deactivation, as presented in Section 3.5 of this Evaluation Report;
- The selected safety management processes documented in the ISMP properly and adequately address management of process hazards, as presented in Section 3.4 of this Evaluation Report;
- The program documented in the ISMP contains appropriate features of integrated safety management (i.e., integration among safety, design, and operations interests; integration throughout the life cycle of the activities; and integration into work planning and performance), as presented in Section 3.8 of this Evaluation Report;

- The interfaces among regulatory regimes are appropriately addressed to ensure that adequate protection is fully achieved, as presented in Section 3.9 of this Evaluation Report;

- Safety documentation processes delineated in the ISMP provide for appropriate document control and maintenance, as presented in Section 3.10 of this Evaluation Report;

- Scheduling of the safety-related activities as described in the ISMP, including generation of regulatory submittals, is consistent with Figure 2 of DOE/RL-96-0003, as presented in Section 3.11 of this Evaluation Report;

- Self- assessment elements documented in the ISMP are appropriate, as presented in Section 3.12 of this Evaluation Report; and

- Safety definition, implementation, and maintenance roles, responsibilities, and authorities defined in the ISMP are clear and appropriate, as presented in Section 3.13 of this Evaluation Report.

- Pursuant to DOE/RL-96-0003, these determinations are necessary and sufficient for the approval of the BNFL ISMP.

4.2 Conditions of Approval

The review team identified deficiencies in BNFL's submittal with respect to the following approval criteria (DOE/RL-96-0003, Section 3.3.1, "Standards Approval"):

> "The selected safety management processes documented in the ISMP are standards based and are appropriately tailored to the hazards associated with the Contractor's proposed facility, its operation, and its deactivation; [and]
>
> The selected safety management processes documented in the ISMP properly and adequately address management of process hazards;"

These criteria were evaluated considering the full BNFL SA submittal and the Initial Safety Assessment (ISA). As noted in Section 3.5 of this document, the BNFL ISMP contains appropriate features of integrated safety management. However, in examining the ISA, which reflects execution of the process defined in the ISMP, the reviewers determined BNFL has not followed the rigorous process of identifying and characterizing hazards, developing control strategies, and documenting the set of standards and requirements necessary to ensure implementation of the control strategies specified in DOE/RL-96-0003.[44] BNFL's process is also not always consistent with the approach documented in their ISMP. This is particularly evident in BNFL's treatment of the hazards associated with criticality and hydrogen evolution.

BNFL's designation and use of Design Class (DC) I and II with respect to structures, systems and components (SSCs) is another example of inadequately following the integrated safety management process that tailors control strategies to risk.

Because these deficiencies deviate from the precepts of integrated safety management and the process as described in the Contract, they are significant and must be corrected. The result of these process

44. DOE/RL-96-0003, Revision 0.

deficiencies is a large number of open issues which limit the ability of the RU to establish the adequacy of the BNFL safety basis. These issues are documented in the *Initial Safety Evaluation Report*, RL/REG-98-09.[45] BNFL must take action prior to Part B to ensure their integrated safety management process is implemented as required by the Contract. This will ensure that future iterations of their hazards analysis process will identify all potential hazards. Additionally, BNFL must redefine the classification of SSCs so that the contractual definition of "important to safety" and the intent of integrated safety management are met.[46]

The review team identified the following additional conditions for approval. These actions are within the scope of Part A activities and must be completed prior to starting any preliminary design activities affected by the actions:

1. BNFL shall revise the submitted ISMP to incorporate modifications committed to by BNFL in its responses to the RU's questions during review of the SA Package.

2. BNFL shall revise Section 3.3 of the ISMP to clearly describe an authorization basis management process that conforms to the RU position described in RL/REG-97-13, *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*.[47] (Section 3.2.2.3 "Authorization Basis")

3. BNFL shall submit a revised Quality Assurance Plan (QAP) for RU review and approval. (Section 3.1.3, "10 CFR 830.120 Evaluation")

4. BNFL shall submit a schedule, including specific dates, for safety-related activities. (Section 3.8, "Scheduling of Safety Related Activities")

5. BNFL shall modify the ISMP to provide a description of their plans to implement defense in depth. (Section 3.2.2.1, "Defense-in-Depth"; see also DOE/RL-98-09)

6. BNFL shall revise the ISMP to either (1) indicate that BNFL Inc. accepts ultimate responsibility for safety, or (2) clarify that the General Manager's ultimate responsibility for safety is equivalent to the Contractor's responsibility. (Section 3.2.2.2, "Safety Responsibility" and Section 3.2.3.1.3, "Process Safety Responsibility")

45. DOE/RL-98-09, Revision 0.

46. BNFL letter W338-98-004, February 19, 1998, BNFL committed to change their design classification scheme. This must be incorporated in the ISMP.

47. RL/REG-97-13, Revision 2.

5.0 Acronyms

ALARA	as low as reasonably achievable
ATL	Assistant Team Leader
CFR	Code of Federal Regulations
CM	Configuration Management
CSMFs	core safety management functions
CST	crystalline silicotitanate
DEAR	DOE Acquisition Regulations
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
ERPG-2	Emergency Response Planning Guide-2
ES&H	Environment, Safety and Health
FR	Federal Register
FSAR	final safety analysis report
GP	guiding principle
HAR	Hazard Analysis Report
HLW	high-level waste
ICRP	International Commission on Radiological Protection
ISAR	Initial Safety Analysis Report
ISMP	Integrated Safety Management Plan
LAW	low-activity waste
LWA	Limited Work Authorization
MOU	Memorandum of Understanding
MT	metric ton

NCRP	National Council on Radiation Protection and Measurements
NRC	U.S. Nuclear Regulatory Commission
QL	quality levels
OSHA	Occupational Safety and Health Administration
PHA	Process Hazards Analysis
PSAR	preliminary safety analysis report
QAP	Quality Assurance Plan
QAP	quality assurance program
RAMI	Reliability, Availability, Maintainability, and Inspectability
RCRA	Resource and Conservation Recovery Act
RESW	Radiation Exposure Standard for Workers Under Accident Conditions
RL	U.S. Department of Energy, Richland Operations Office
RO	RU Regulatory Official
RPP	radiation protection program
RU	Regulatory Unit
SA	Standards Approval
SIC	Standard Industrial Code
SNM	special nuclear material
SRD	Safety Requirements Document
SSCs	structures, systems, and components
TSRs	Technical Safety Requirements
TWRS	Tank Waste Remediation System
TWRS-P	TWRS Privatization
USQs	unreviewed safety questions
VPP	Voluntary Protection Program
WAC	Washington Administrative Code

WDOH Washington Department of Health

WISHA Washington Industrial Safety and Health Administration

6.0 References

10 CFR 820, "Procedural Rules for DOE Nuclear Activities," *Code of Federal Regulations*, as amended.

10 CFR 830, "Nuclear Safety Management," *Code of Federal Regulations*, as amended.

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

29 CFR 1910, "Employee Emergency Plans and Fire Prevention Plans," *Code of Federal Regulations*, as amended.

40 CFR 68, "Chemical Accident Prevention Provisions," *Code of Federal Regulations*, as amended.

40 CFR 355, "Emergency Planning Notification," *Code of Federal Regulations*, as amended.

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DOE Order 5480.21, "Unreviewed Safety Questions," U.S. Department of Energy, Washington, D.C., December 24, 1991.

DOE Order 5480.22, "Technical Safety Requirements," Change 002, U.S. Department of Energy, Washington, D.C., January 23, 1996.

DOE Order 5480.23, "Nuclear Safety Analysis Reports," Change 001, U.S. Department of Energy, Washington, D.C., March 10, 1994.

DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors, DOE/RL-96-0003, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, February 1996.

DOE Regulatory Unit Evaluation Report of the BNFL, Inc. Safety Requirements Document, RL/REG-98-01, draft, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, February 1998.

DOE Regulatory Unit Initial Safety Evaluation Report of the BNFL Inc. Initial Safety Assessment, DOE/RL-98-09, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 1998.

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