RL/REG-98-18
Revision 0

REGULATORY UNIT POSITION ON RADIOLOGICAL SAFETY FOR HANFORD CO-LOCATED WORKERS

September 16, 1998

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

Richland Operations Office
PO Box 550
Richland, WA 99352

Approved by:_____

Date: _____

This page intentionally left blank

PREFACE

The Department of Energy's (DOE) Richland Operations Office (RL) issued a request for proposal in February 1996 for privatized processing of waste as part of the Hanford Tank Waste Remediation System (TWRS). Offerors were requested to submit proposals for the initial processing of the tank waste at the Hanford Site. Some of this radioactive waste has been stored in large underground storage tanks at the Site since 1944. Currently, approximately 54 million gallons of waste containing approximately 250,000 metric tons of processed chemicals and 215 million 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 intends to purchase waste processing services from a contractor-owned, contractor-operated facility through 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 commission its operation; e) operate the facility to process tank 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 process 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 process the tank waste. The Phase I effort consists of three parts: Part A, Part B-1, and Part B-2.

Part A is a twenty-month period to establish technical, operational, regulatory, and financial elements necessary for privatized waste processing services at fixed-unit prices. This includes 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 is for the Contractors to develop the Part-A deliverables and four months is for DOE to evaluate the deliverables and determine whether to authorize Contractors to perform Part B. Part A culminated in DOE's authorization on August 24, 1998, of BNFL Inc. to perform Part B.

Part B-1 is a twenty-four month period to a) further the waste processing system design introduced in Part A, b) revise the technical, operational, regulatory, and financial elements established in Part A, c) provide firm fixed-unit prices for the waste processing services, and d) achieve financial closure.

Part B-2 is a sixteen year period to complete design, construction, and permitting of the privatized facilities; provide waste processing services for representative tank wastes at firm fixed-unit prices; and deactivate the facilities. During Part B-2, approximately 10% to 13% of the total Hanford tank wastes will be processed.

Phase II will be a full-scale production effort. The objectives of Phase II are to implement the lessons learned from Phase I and to process all remaining tank waste into forms suitable for final disposal.

A key element of the TWRS Privatization Program is DOE's regulation of radiological, nuclear, and process safety through the establishment of a specifically defined regulatory approach and a specifically chartered, dedicated Regulatory Unit (RU) at RL. This regulation is authorized by DOE through the document entitled *Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors* (referred to as the Policy) and is 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 MOA details certain interactions among RL, the ASEH, and the ASEM as well as their respective roles and responsibilities for implementation of the regulatory approach.

The authority of the RU to regulate the TWRS Privatization Contractor is derived solely from the terms of the TWRS Privatization Contract. Its authority to regulate the Contractor on behalf of DOE is derived from the Policy. The characteristics and scope of this special regulatory approach (special in the sense that it is based on terms of a contract rather than formally promulgated regulations) are delineated in the MOA, the TWRS Privatization Contract, and the following four documents, which are incorporated into the Contract and are part of the MOA.

> *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
>
> *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, DOE/RL-96-0004

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 Contractor from any obligations to comply with such regulations or to be subject to the enforcement practices contained therein.

In the execution of the regulatory approach through its regulatory program, DOE expects the RU to 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 interacts 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-P Contractors are available to the public through the DOE/RL Public Reading Room at the Washington State University, Tri-Cities Campus, 100 Sprout Road, Richland, Washington.

This page intentionally left blank

TABLE OF CONTENTS

Exhibit

This page intentionally left blank

RADIOLOGICAL SAFETY FOR HANFORD CO-LOCATED WORKERS

1.0 PURPOSE

The purpose of this paper is to present the position of the Regulatory Unit (RU) that co-located workers (CLWs) are a subset of workers and should not be classified as members of the public. The paper presents the approach of the RU for regulating radiological safety for a CLW potentially affected by the Tank Waste Remediation Systems (TWRS) Privatization Program. This paper provides the position of the RU on specific issues and regulatory terms affecting standards for CLWs that have been raised or questioned during the regulatory process, including those raised by the U.S. Nuclear Regulatory Commission (NRC)[1,2,3]. To support the RU positions, this paper restates applicable radiological and nuclear standards for a CLW developed and approved by the RU and provides the basis for the RU position that these standards for a CLW are appropriate.

In developing this position paper, the RU explicitly decided to create a document whose scope would be limited to pre-existing information. This document is therefore an analytical paper, founded exclusively on authoritative sources. The document is intended to provide neither guidance to the Contractor on RU positions of acceptability of radiological design nor RU interpretations of previously existing requirements. The only judgmental content in this paper is to be found in the Conclusions section where the authors suggest a potential course of action for NRC consideration for the purpose of resolving this issue.

2.0 BACKGROUND

CLW is one of three classifications of individuals specified by the RU for regulating radiological safety. For the purpose of regulating TWRS Privatization (TWRS-P) activities, a CLW is an individual within the Hanford site, beyond the TWRS-P Contractor-controlled area, performing work for or in conjunction with U.S. Department of Energy (DOE) or utilizing other Hanford site facilities.[4] DOE's classification of some workers conducting other DOE activities on the Hanford site as CLWs results from the numerous, diverse, and often unrelated facilities and

[1] *Hanford Tank Waste Remediation System Privatization Co-Located Worker Standards,* SECY-98-038, U.S. Nuclear Regulatory Commission, Washington, D.C., March 4, 1998.
[2] Memorandum, John C. Hoyle, Secretary, to L. Joseph Callan, Executive Director for Operations, *Staff Requirements - SECY-98-038 - Hanford Tank Waste Remediation System Privatization Co-Located Worker Standards,* U.S. Nuclear Regulatory Commission, Washington, D.C., April 28, 1998.
[3] Letter, Carl J. Paperiello, Director, Office of Nuclear Material Safety and Safeguards to John Wagoner, Manager, Richland Operations Office, U.S. Department of Energy, *Co-Located Worker Standards for Accidents,* U.S. Nuclear Regulatory Commission, Washington, D.C., May 21, 1998.
[4] *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, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, July 1996.

activities involving radioactive materials located at a common site. The other classifications of individuals are TWRS-P Contractor facility workers (workers) and members of the general public (public).

A key element of the TWRS-P Program is the regulation of radiological, nuclear, and process safety through the establishment by the DOE of a specifically chartered, dedicated RU. The RU provides independent regulatory oversight of the TWRS-P contractors while structuring its regulatory process using principles consistent with those of NRC.[5] One of the reasons for consistency with the NRC is to facilitate a potential seamless transfer of regulatory responsibility to the NRC. A seamless transition is one with minimal impact on safety, cost, schedule, or production rate due to the transition of regulatory responsibility.

Differences in the DOE and NRC classifications of individuals for regulating radiological safety could create regulatory uncertainty and adversely affect a seamless transition. The NRC has commented on the use of CLW standards to support the identification of structures, systems, and components (SSCs) as important to safety.[6] NRC regulations do not specifically address a CLW. The NRC approach for using accident analyses to identify SSCs that are important to safety is to specify dose standards for a member of the public at or beyond the area controlled by the NRC licensee.[7] In contrast to the RU's position, the NRC has determined that the CLWs would be classified as members of the public under the applicable regulation 10 CFR Part 20, *Standards for Protection Against Radiation*, if the NRC were to assume regulatory jurisdiction over the TWRS-P Program.[8,9]

3.0 RU POSITION

The purpose of this section is to summarize the position of the RU that CLWs are a subset of workers and should not be classified as members of the public. The radiological standards that have been approved by the RU provide an adequate measure of radiological protection for a CLW.

The RU has evaluated[10] the TWRS-P Contractor's (BNFL Inc.'s) radiation dose standards for CLWs under normal events and accident conditions for conformance to DOE rule 10 CFR 835, *Occupational Radiation Protection*, and to DOE/RL-96-0006, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, including *Dose Standards Above Normal Background* and the *General Safety Objectives*. The RU has

[5] *Regulatory Plan*, RL/REG-97-10, Rev. 1, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, January 1998.
[6] SECY-98-038, March 1998.
[7] Ibid.
[8] Ibid.
[9] Title 10 Code of Federal Regulations Part 20, *Standards for Protection Against Radiation*, U.S. Nuclear Regulatory Commission, As Amended.
[10] Appendix B, *Evaluation Report of the BNFL Inc. Radiation Exposure Standards for Workers Under Accident Conditions*, of the *DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document*, RL/REG-98-01, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, March 1998.

concluded that BNFL Inc.'s approach to accident mitigation and selection of safeguards would provide adequate protection for the CLW.

The classification of an individual as a CLW is also found in a DOE safety analysis report[11] and a proposed standard.[12] In the DOE proposed standard for accident analysis, the CLW is defined as a worker in a fixed population outside the day-to-day process safety management controls of a given facility area. In practice, this fixed population is normally the workers at an independent facility area located some distance from the reference facility area.[13]

Although the CLW classification is not found in DOE rules, definitions for a general employee and a member of the public in the DOE rule 10 CFR 835, *Occupational Radiation Protection*, provide the basis for the RU position that CLWs are considered a subset of workers rather than as members of the public.[14] A general employee is an individual who is either a DOE or DOE contractor employee, an employee of a subcontractor to a DOE contractor, or a visitor who performs work for or in conjunction with DOE or utilizes DOE facilities.[15] As a worker at an independent facility area, a CLW is a general employee under that activity and may receive an occupational exposure. A member of the public means an individual who is not occupationally exposed to radiation or radioactive material.[16] An individual is not a "member of the public" during any period in which the individual receives occupational exposure.[17] A CLW should not be classified as a member of the public, because CLWs may receive occupational exposure under 10 CFR 835.

4.0 REGULATING RADIOLOGICAL STANDARDS FOR A TWRS-P CLW

This section describes the basis of the RU regulation of radiological, nuclear, and process safety, and key definitions for terms potentially affecting the regulation of radiological standards for CLWs. Through these rule-based definitions, it will be demonstrated that, for the normal operations case, the CLW is a class of worker and not a member of the public.

The framework for regulation of the TWRS Privatization Contractors is derived from the TWRS Privatization Contracts.[18] The authority of the RU to regulate the TWRS-P Contractors on behalf of DOE is derived from the *Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors* and the *Memorandum of Agreement for the Execution of*

[11] *Method for the Assessment of Worker Safety Under Radiological Accident Conditions at Department of Energy Nuclear Facilities,* EH-12-94-01, Vol. 2, *Appendixes* ,June 1994.
[12] DOE Standard *Definitions and Criteria for Accident Analysis,* DOE-DP-STD-3005-93 Proposed, U.S. Department of Energy, Defense Programs, Washington, D.C., March 5, 1993.
[13] Ibid.
[14] Title 10 Code of Federal Regulations Part 835, *Occupational Radiation Protection*, Final Rule, U.S. Department of Energy, December 1993.
[15] 10 CFR 835.2 Definitions, *General employee*, December 1993.
[16] 10 CFR 835.2 Definitions, *Member of the public*, December 1993.
[17] Ibid.
[18] *TWRS Privatization Request for Proposals*, DOE Contract No. DE-RP06-96RL13308, U.S. Department of Energy, Richland Operations Office, Richland, Washington, September 25, 1996.

Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors.[19,20] The RU regulates radiological, nuclear, and process safety of the Contractor. This regulation is based on compliance with the specific nuclear safety regulations defined under the 10 CFR 800 series of nuclear safety requirements and the regulatory program established in the following documents[21]:

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

- *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, DOE/RL-96-0004, U.S. Department of Energy, Richland, Washington, February 1996.

- *Concept of the DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, DOE-RL-96-0005, U.S. Department of Energy, Richland, Washington, February 1996;

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

The documents establishing the regulatory program and the DOE rules 10 CFR 835, *Occupational Radiation Protection*, and 10 CFR 830.120, *Quality Assurance*, contain definitions of regulatory terms. In many cases, these terms have a different meaning or interpretation in other documents, regulations or rules, particularly those promulgated by other agencies. For example, the term controlled area is defined differently in DOE/RL-96-0006, 10 CFR 835, and NRC rules.

4.1 THE 10 CFR 835 DEFINITIONS OF REGULATORY TERMS

The DOE rule 10 CFR 835 defines several regulatory terms that affect the classification of an individual as a CLW in the documents establishing the RU regulatory program including DOE/RL-96-0006.[22] These terms are *Occupational exposure*, *General employee*, *Radiological worker*, and *Member of the public*.

[19] *Policy for Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors*, DOE/RL-96-25, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, July 1996.
[20] *Memorandum of Agreement for the Execution of Radiological, Nuclear, and Process Safety Regulation of TWRS Privatization Contractors*, DOE/RL-96-26, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, July 1996.
[21] Section C, *Statement of Work*, Standard 4.c(2), p. C-22 of *TWRS Privatization Request for Proposals*, DOE Contract No. DE-RP06-96RL13308, U.S. Department of Energy, Richland Operations Office, Richland, Washington, September 25, 1996.
[22] 10 CFR 835.2 Definitions, December 1993.

Occupational exposure means an individual's exposure to ionizing radiation (external and internal) as a result of that individual's work assignment. Occupational exposure does not include planned special exposures[23], exposure received as a medical patient, background radiation, or voluntary participation in medical research programs.[24] It is important to note that the definition of occupational exposure does not specify the source of the exposure, but rather that the exposure is a result of the individual's work assignment. It is also important to note that a person need not necessarily be a radiological worker (defined below) to receive an occupational exposure. The individual's exposure on a work assignment is the sum of the dose received from any radioactive materials present in the facility where the work is performed as well as any dose received from radioactive materials or effluents from other nearby facilities. The DOE annual permissible occupational dose limit for a individual conducting a DOE activity is 5 rem total effective dose equivalent. The content of a DOE contractor's radiation protection program is required to include formal plans and measures for applying the as low as reasonably achievable (ALARA) process to occupational exposure.[25]

General employee means an individual who is a DOE or DOE-contractor employee, an employee of a subcontractor to a DOE contractor; or a visitor who performs work for or in conjunction with DOE or utilizes DOE facilities.[26] It is important to note that the individuals who are not general employees and who do not conduct work may be exposed to radiation and radioactive material during direct on-site access at a DOE site or facility. 10 CFR 835 has annual radiation dose limits for these individuals.[27] Any general employee may receive an occupational exposure. For example, the general employee who fills the soda machine at a DOE facility may be occupationally exposed. An example of a general employee in the category of a visitor utilizing DOE facilities is a Native American who may perform traditional ceremonies at Hanford. The DOE annual permissible occupational dose limit for an individual conducting a DOE activity is 5 rem total effective dose equivalent. While it is true that additional radiation protection provisions are required for individuals likely to be routinely occupationally exposed above 0.1 rem (100 mrem) per year total effective dose equivalent,[28] the limit of 5 rem applies to all general employees.

Radiological worker means a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (100 mrem) per year total effective dose equivalent.[29] 10 CFR 835 has requirements for provisions for radiological workers such as training, monitoring, and records.[30] It is important to note that a general employee may be a radiological worker if compliance to the additional requirements is achieved. For example, the general employee who performs maintenance activities at a DOE facility would be a radiological worker if the individual

[23] 10 CFR 835.204 Planned special exposures, December 1993.
[24] 10 CFR 835.2 Definitions, *Occupational exposure*, December 1993.
[25] 10 CFR 835.101(c) Radiation protection programs, December 1993.
[26] 10 CFR 835.2 Definitions, *General employee*, December 1993.
[27] 10 CFR 835.208 Limits for members of the public entering a controlled area, December 1993.
[28] 10 CFR 835.902 Radiological workers; §835.402 Individual monitoring; and, §835.702 Individual monitoring records, December 1993.
[29] 10 CFR 835.2 Definitions, *Radiological worker*, December 1993.
[30] 10 CFR 835.902, §835.402, and §835.702, respectively, December 1993.

is likely to be routinely occupationally exposed above 0.1 rem (100 mrem) per year total effective dose equivalent; assuming compliance with the provisions of the Contractor's ALARA program.

Member of the public means an individual who is not occupationally exposed to radiation or radioactive material. An individual is not a "member of the public" during any period in which the individual receives occupational exposure.[31] It is important to note that no individual is considered to be a member of the public during any period when he or she is receiving an occupational exposure.[32]

4.2 THE DOE/RL-96-0006 DEFINITIONS OF REGULATORY TERMS

The term CLW is defined in DOE/RL-96-0006 as an individual within the Hanford site, beyond the contractor-controlled area, performing work for or in conjunction with DOE or utilizing other Hanford site facilities. The classification of some workers as CLWs is a consequence of the numerous and diverse activities being performed at a common DOE site.

DOE/RL-96-0006 also defines the term controlled area, which is used in numerous top-level standards including the *General Safety Objectives*.[33] The controlled area is defined in DOE/RL-96-0006 as "The physical area enclosing the facility by a common perimeter (security fence). Access to this area can be controlled by the Contractor. The controlled area may include identified restricted areas." In DOE/RL-96-0006, a restricted area is defined as "An area identified by the Contractor to which access is limited for the purposes of protecting individuals against undue risk from exposure to radiation and radioactive materials. Only a radiation [radiological] worker is allowed into this area."

5.0 DOE OCCUPATIONAL DOSE LIMITS AND ACCIDENT DOSE STANDARDS

The TWRS-P Contractor's integrated standards-based safety management program is required to comply with 10 CFR 835 and to conform to the top-level standards of DOE/RL-96-0006.[34] The purpose of this section is to summarize the occupational dose limits in 10 CFR 835 applicable to CLWs and DOE's approach to regulating accident dose standards for CLWs. The applicability of 10 CFR 835 occupational dose limits to CLWs provides the basis for radiological standards for CLWs during normal events. The DOE approach to regulating accident dose standards for CLWs is referenced in DOE/RL-96-0006.

DOE has addressed radiological standards for CLWs prior to the TWRS-P regulatory activity. Definitions of general employee and member of the public in 10 CFR 835, provide the basis for the RU position that occupational dose limits for CLWs are the same as those for workers. There are workers conducting DOE activities at multiple, independent facilities on the same site

[31] 10 CFR 835.2 Definitions, *Member of the public*, December 1993.
[32] Ibid.
[33] DOE/RL-96-0006, Rev. 0, February 1996.
[34] DOE Contract No. DE-RP06-96RL13308, September 25, 1996.

throughout the DOE complex (e.g., Hanford site, Idaho National Engineering Laboratory site, Savannah River Plant site). Although these workers are typically working under the responsibility of different contractors, each individual is a general employee of DOE, a DOE contractor, or a subcontractor to a DOE contractor. For the purpose of regulating TWRS-P activities, a CLW is an individual within the Hanford site, beyond the TWRS-P Contractor-controlled area, performing work for or in conjunction with DOE or utilizing other Hanford site facilities.[35] The CLW is a general employee while performing work (i.e. a DOE activity) and may receive an occupational exposure.

Requirements for workers in 10 CFR 835 are applicable to CLWs within the Hanford site beyond the TWRS-P Contractor-controlled area because the rule states that a DOE activity is to be conducted in accordance with a radiation protection program (RPP) as approved by DOE.[36] Each requirement of 10 CFR 835 is to be addressed in an RPP. This includes the annual permissible occupational dose limit for a individual conducting a DOE activity of 5 rem total effective dose equivalent; other limits also apply including those for specific organs and parts of the body.[37] An RPP may limit the annual occupational exposure for an individual to less than 5 rem. Any general employee may receive an occupational exposure while conducting a DOE activity in accordance with the provisions of the applicable RPP. In fact, a worker may conduct activities under more than one RPP during the year provided their annual occupational exposure from all activities is below the 10 CFR 835 dose limits and in compliance with each RPP.

DOE has not established a universal accident dose standard value for CLWs to be used for the design of nuclear facilities. Rather, DOE has proposed a method to assess worker safety under accident conditions.[38] The RU referenced the proposed method in the top-level standards document, DOE/RL-96-0006. This method for assessing the adequacy of radiological design provisions and safety under accident conditions for DOE facilities classifies some individuals as a CLW.[39] DOE has reported on accident dose guidelines proposed by Contractors for radiological consequence versus accident frequency for workers, CLWs, and the public.[40] For radiological consequence assessment, Contractor-proposed accident dose standards for CLWs typically range between the value for workers at the reference facility and the value for members of the public.[41] Some DOE accident assessments do not distinguish CLWs from workers at the reference facility.[42] The impact of the accident dose value selected for the CLW on the facility design and selection of safety provisions under accident conditions depends on numerous factors. These include the proximity of the CLWs to the reference facility, the nature of the site and meteorological conditions, and the specifics of the accident, source term, and release.

[35] DOE/RL-96-0006, Rev. 0, February 1996.
[36] 10 CFR 835.101(a) Radiation protection programs, December 1993.
[37] 10 CFR 835 Subpart C - Standards for Internal and External Exposure, December 1993.
[38] *Method for the Assessment of Worker Safety under Radiological Accident Conditions at Department of Energy Nuclear Facilities*, EH-12-94-01, Volume 1, *Main Report*, June 1994.
[39] EH-12-94-01, Volume 1, June 1994.
[40] EH-12-94-01, Volume 2, June 1994.
[41] Ibid.
[42] EH-12-94-01, Volume 1, June 1994.

6.0 RADIOLOGICAL AND NUCLEAR SAFETY STANDARDS

The RU has evaluated and approved radiological standards for a CLW.[43] This evaluation considered the appropriateness of classifying some workers as CLWs, the definitions of regulatory terms potentially affecting the standards, the adequacy of CLW standards to achieve an appropriate level of worker protection, and the acceptable value for the risk of fatal cancer. The purpose of this section is to restate the radiological and nuclear safety standards for a CLW to be used in regulating TWRS-P activities.

The DOE regulatory approach for 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 level of safety[44] for its specific activities. The Contractor-recommended set of radiological, nuclear, and process safety standards are documented in its *Safety Requirements Document* (SRD).[45] The Contractor's standards based integrated safety management program is documented in its *Integrated Safety Management Plan* (ISMP).[46]

To manage the radiological and nuclear safety risks associated with the proposed TWRS-P facility, the DOE regulatory approach requires that the Contractor's set of recommended standards conform to the top-level standards and principles specified in DOE/RL-96-0006. These standards limit the risk to workers, CLWs, public, and the environment from the radiological consequences of normal operations and credible accident events. Most radiological standards were required by DOE, while some were derived by the Contractor and approved by the RU.

Top-level standards governing radiological and nuclear safety for a CLW are presented in DOE/RL-96-0006, Section 2.0, *Radiological and Nuclear Safety Standards*, and Section 3.0, *Radiological and Nuclear Safety Objectives*. The radiological and nuclear safety standards are specified in Section 2.1, Table 1, *Dose Standards Above Normal Background*. The Contractor (BNFL Inc.) is required to address and conform to these standards in the regulatory submittal, *Radiological Exposure Standard For Workers Under Accident Conditions* (RESW). The scope of the RESW addresses radiation dose standards during normal and credible accident conditions for conformance to Table 1 of DOE/RL-96-0006. The standards recommended by the Contractor in their RESW are also required to comply with all applicable laws and regulations and provide for an adequate level of safety. The standards are contained in the Contractor's SRD regulatory deliverable.[47]

DOE/RL-96-0006, Table 1, specifies four event probability ranges addressing normal operation and credible accident conditions. General guidelines and frequencies, listed for the four event probability ranges, are:

[43] Appendix B, RL/REG-98-01, Rev. 0, March 1998.
[44] The term *adequate safety* has a prescribed meaning within the TWRS-P Regulatory Unit Concept. This paper makes frequent use of the term *adequate level of safety* and *adequate radiological safety*. There is no intended connection between the terms used in this paper and the *adequate safety* term used in the Regulatory Unit lexicon.
[45] *Safety Requirements Document*, BNFL-5193-SRD-01, Volumes I and II, Rev. 1, BNFL Inc., Richland, Washington, June 1998.
[46] *Integrated Safety Management Plan*, BNFL-5193-ISP-01, Rev. 3, BNFL Inc., Richland, Washington, July 1998.
[47] BNFL-5193-SRD-01, Volumes I and II, Rev. 1, June 1998.

1. Normal events are typical of normal facility operations expected to occur regularly in the course of facility operations; the associated frequency of occurrence during the lifetime of the facility is 1 or more per year. As defined in Table 1, a general guideline for this event probability is that normal modes of operating the facility systems should provide adequate protection of health and safety.

2. 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 $1x10^{-2}$ to <1 per year. As defined in Table 1, 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.

3. 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 $1x10^{-4}$ to $1x10^{-2}$ per year. As defined in Table 1, 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.

4. 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 $1x10^{-6}$ to $1x10^{-4}$ per year. As defined in Table 1, a general guideline for this event probability range is that facility damage may preclude returning to operation. (Note that a probability of occurrence of $1x10^{-2}$ per year is equivalent to a frequency of one occurrence in 100 years; $1x10^{-4}$ per year equates to one in 10,000 years; $1x10^{-6}$ per year equates to one in 1,000,000 years; recurrence interval treatment.)

6.1 DOE-SPECIFIED CLW DOSE STANDARDS ABOVE NORMAL BACKGROUND

Top-level standards required by DOE for regulating radiation dose and ALARA[48] design for a CLW under normal and anticipated events are specified in DOE/RL-96-0006, Table 1. Two types of top-level standards are specified for a CLW. The first type is a radiation dose standard (in units of rem/y or rem/event) limiting internal dose from inhaled radionuclides and external dose from any direct radiation. The second type is termed an ALARA design limit in units of rem/y or rem/event.

The ALARA design limit standard complies with ALARA design objectives used to evaluate engineering features under normal operations required by 10 CFR 835.[49] The design objective establishes an exposure level value, in units of mrem per hour, to control the potential exposure of

[48] The ALARA principle in radiation protection is to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonably achievable, taking into account social, technical, economic, practical, and public policy considerations. ALARA is not a dose limit but a process which has the objective of attaining doses as far below applicable regulatory limits as is reasonable.
[49] 10 CFR 835 Subpart K - Design and Control, December 1993.

a radiological worker. In general terms, the facility is required to be designed to maintain 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 that has the objective of optimizing the selection of safety systems, structures, components, and administrative controls (safeguards) during the design phase. The ALARA design limit standard specifies the event consequence as a radiation dose 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 economical and societal considerations. If a potential engineering feature were determined to be cost-effective and feasible, it would be incorporated in the facility design.

Under normal events, the top-level standards specified by DOE for regulating radiation dose and ALARA design for a CLW are ≤5 rem/yr, and ≤1.0 rem/yr ALARA design limit; each standard has a footnote referencing 10 CFR 835.1002(b), *Facility Design and Modification*. Under anticipated events, two top-level standards for regulating radiation dose and ALARA design for a CLW are specified by DOE. One standard is ≤5 rem/event; the standard has a footnote referencing Proposed Rule 10 CFR 60, *Disposal of High-level Radioactive Waste in Geologic Repositories*; design basis events (60 FR 15180, Federal Register, 3/33/95). The second standard is ≤1.0 rem/event ALARA design limit; the standard has a footnote referencing 10 CFR 835.1002(b), *Facility Design and Modification.*

The DOE-required radiation dose standards for a CLW of ≤5 rem/yr under normal events in Table 1 of DOE/RL-96-0006 include all contributors to the annual occupational exposure of a CLW. That is, the regulatory annual occupational dose limit for a general employee, which includes a CLW, is 5 rem from all occupational exposures. The ≤5 rem/yr dose limit for a CLW in Table 1 does not authorize an additional 5 rem from the BNFL Inc., facility operations for a CLW at a nearby facility. This notation is required to ensure that these standards are in compliance with the requirements of 10 CFR 835.

6.2 CONTRACTOR-TAILORED CLW DOSE STANDARDS ABOVE NORMAL BACKGROUND

In their regulatory submittals, BNFL Inc., tailored the implementation of several of the top-level standards governing a CLW that were developed by DOE and presented in DOE/RL-96-0006, Table 1. Tailoring the implementation of the top-level standards included changing the event probability ranges specified in Table 1 and the ALARA design standards for a CLW. Standards for a CLW tailored by BNFL Inc., that were approved by DOE are presented in Revision 1 of Volume II, Table 2-1, *Radiological Exposure Standards Above Normal Background,* of their *Safety Requirements Document* regulatory submittal.[50] Table 2-1 provides the BNFL Inc.,

[50] BNFL-5193-SRD-01, Volumes I and II, Rev. 1, June 1998.

proposed standards corresponding to those required by Table 1 of DOE/RL-96-0006. For convenience, Table 2-1 is provided as an enclosure to this position paper. As documented, the RU has approved the tailored standards where BNFL Inc., provided adequate justification that the tailored standards conformed to the original DOE standard and were commensurate with an evaluation of the potential radiological, nuclear, and process hazards to provide for an adequate level of safety.[51]

BNFL Inc.'s Table 2-1 tailored the implementation of DOE-developed Table 1 top-level standards with respect to the probability ranges of normal and anticipated events. In Table 2-1, BNFL Inc., redefines the normal (and anticipated) event probability range such that minor incidents and upsets having an associated frequency greater than 10^{-1} per year have been included in the normal events range rather than in the anticipated events range. BNFL Inc., has redefined normal events as those typical of normal facility operations expected to occur regularly in the course of facility operations including routine and preventive maintenance activities. Considering the expected operating lifetime of the proposed facility of up to 40 years, this redefinition of the probability range of normal events is reasonable and likely will provide for a more conservative and appropriate application of dose standards than those specified by Table 1.

BNFL Inc.'s Table 2-1 also tailored the implementation of DOE-developed ALARA design limit standard for the redefined normal event probability range for a CLW. The top-level standard for the ALARA design limit listed in Table 1 of DOE/RL-96-0006 is ≤1.0 rem/y. Table 2-1 lists the same design limit, ≤1.0 rem/y, but qualifies it as "per 10 CFR 835 design objective and per 10 CFR 835.1002(b)," and adds a footnote stating: "In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and CLWs under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c)." The RU review of the tailored standard indicated that it is equivalent to the DOE-developed ALARA design limit standard because the design value is the same and the tailored standard addresses the control of both external and internal (from inhalation) radiation exposures.

BNFL Inc.'s Table 2-1 tailored the implementation of DOE-specified ALARA design limit standard for the redefined anticipated event probability range for a CLW. The top-level standard listed in Table 1 of DOE/RL-96-0006 is ≤1.0 rem/event. Table 2-1 lists 1.0 rem/event Design Action Threshold with a footnote stating that "When a calculated accident exposure exceeds this threshold, then…actions…taken…include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost-effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventive or mitigative features if they are not both cost-effective and feasible." During its review the RU noted that the term "less bounding" is to imply that the evaluation would be reassessed using less conservative, but realistic, values. The RU review concluded that the tailored standard conforms to the DOE-developed top-level standard; the tailored standards provide for an adequate level of safety and ensures that cost-

[51] *DOE Regulatory Unit Evaluation Report of the BNFL Inc. Safety Requirements Document*, RL/REG-98-01, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, March 1998.

effective safeguards affecting anticipated events are evaluated (and incorporated as appropriate) whenever the final calculated event consequence to a CLW is 1 rem or more.

6.3 CONTRACTOR-DERIVED CLW DOSE STANDARDS ABOVE NORMAL BACKGROUND

DOE did not specify top-level standards for regulating radiation dose and ALARA design for a CLW under unlikely and extremely unlikely events. However, DOE/RL-96-0006, Table 1, requires a contractor to derive standards for the CLW at the accident probability ranges of unlikely events and extremely unlikely events. A footnote to the four "To be derived" entries states that specific limits are to be derived and proposed by the Contractor and that examples of such derived limits and implementation approaches are described in the DOE/EH report *Methods for the Assessment of Worker Safety Under Radiological Accident Conditions at Department of Energy Nuclear Facilities*, EH-12-94-01, June 1994. The footnote also states 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.

To support their derived standards, BNFL Inc., designated the location of a CLW receptor in Table 2-1 as, "The most limiting location at or beyond the BNFL Inc., TWRS-P Controlled Area Boundary." The controlled area is defined in DOE/RL-96-0006 as, "The physical area enclosing the facility by a common perimeter (security fence). Access to this area can be controlled by the Contractor. The controlled area may include identified restricted areas." In DOE/RL-96-0006, a restricted area is defined as, "An area identified by the Contractor to which access is limited for the purposes of protecting individuals against undue risk from exposure to radiation and radioactive materials. Only a radiation [radiological] worker is allowed [unescorted access]into this area."

For Table 2-1, BNFL Inc., derived a ≤25 rem/event radiation dose standard for a CLW under the unlikely events and extremely unlikely events accident probability ranges. Each standard includes two footnotes stating that:

1. "In addition to meeting the listed worker and CLW dose standards for accidents, the Worker Accident Risk Goal is satisfied through the calculation of the risk from accidents with accident prevention and mitigation features added as necessary to meet the Goal," and
2. "In addition to meeting the listed dose standards for accidents, BNFL approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis, and to provide for sufficient design margin and operational flexibility."

While the dose value at the endpoint of 10^{-2} does not meet the 10^{-5} risk goal, on average, across the full probability range, the goal is met. It was upon this basis that the BNFL dose standard was accepted.

The 25 rem per event dose standard as a consequence of an accident is low enough to ensure that the risk to a CLW from the consequences of accidents would be acceptable. BNFL Inc.'s approach ensures that cost-effective safeguards affecting unlikely and extremely unlikely events are evaluated (and incorporated as appropriate) consistent with methods for optimization.

7.0 RADIOLOGICAL AND NUCLEAR SAFETY OBJECTIVES

The purpose of this section is to evaluate conformance of the CLW standards with three radiological and nuclear safety objectives that limit the radiological and nuclear safety risks and regulate radiation dose to a CLW. These objectives, specified in DOE/RL-96-0006, Section 3.0, *Radiological and Nuclear Safety Objectives*, are the *Operations Risk Goal*, the *Accident Risk Goal*, and the *Radiation Protection Objective*.[52] Conformance with these objectives has been used as a measure to determine that the CLW standards recommended by BNFL Inc., are appropriate.[53] The recommended standards are also required to comply with all applicable laws and regulations as part of the regulatory process in Part A.

7.1 BNFL INC., CONFORMANCE WITH THE OPERATIONS RISK GOAL

The *Operations Risk Goal* (DOE/RL-96-0006, Section 3.1.1) states that: "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 that "For evaluation purposes, individuals are assumed to be located within 10 miles of the controlled area."

The radiation dose and ALARA design standards proposed by BNFL Inc., for a CLW for normal operations conform to the Operations Risk Goal. The average annual dose to the CLWs from the Contractor's facility will likely be significantly less than the dose standards listed for normal operations. This is due to the designed margin of safety and the selection of standards incorporating the application of an ALARA program. Applicable regulations restrict the radiation exposure to ≤ 10 mrem per year at the site boundary from all Hanford airborne effluent sources, which would include those from the proposed BNFL Inc., facility. For this reason, the average annual dose from the BNFL Inc., facility due to airborne effluents will be limited to some fraction of the 10 mrem per year. Airborne effluents are likely to represent the primary pathway for radiation exposure to a CLW.

Conformance with the Operations Risk Goal was evaluated using available data on the annual and ten-year average cancer fatality risks to the U.S. population.[54] These data indicate that the ten-year cancer fatality average for the U.S. population is 173 cancer fatalities per 100,000 persons (1982-1992). In 1996, the annual cancer fatality average for the U.S. population was 210 cancer fatalities per 100,000 persons. These data approximate to 200 cancer fatalities per 100,000

[52] DOE/RL-96-0006, February 1996.
[53] Appendix B, RL/REG-98-01, Rev. 0, March 1998.
[54] *Cancer Facts & Figures - 1996*, American Cancer Society, 1996.

persons per year. Using these data, the corresponding one-tenth of one percent value specified in the goal was 0.2 cancer fatalities per 100,000 persons per year or a rate of 2×10^{-6} cancer fatalities per year. Using the risk factor of 4×10^{-4} fatal cancers per rem for exposures below 10 rem recommended by the BEIR V report[55] and adopted by both ICRP and NCRP, the 2×10^{-6} annual cancer fatality value equates to an annual exposure of about 5 mrem. The likely average annual exposure from the BNFL Inc., facility to CLWs during normal operations is consistent with this value.

Based on the RU evaluation of the risk to individuals assumed to be located within 10 miles of the controlled area, the BNFL Inc., standards set ensures that the risk to a CLWs in the area of the Contractor's facility, of cancer fatalities that might result from normal facility operation and credible accident doses, 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. Such assurance provides for conformance, in part, to the Operations Risk Goal and for an adequate level of safety during normal operations.

7.2 BNFL INC., CONFORMANCE WITH THE ACCIDENT RISK GOAL

The *Accident Risk Goal* (DOE/RL-96-0006, Section 3.1.2) states that: "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 that "For evaluation purposes, individuals are assumed to be located within one mile of the controlled area."

Conformance with the Accident Risk Goal limiting the risk of prompt fatalities was based on the BNFL Inc., radiation dose standards not exceeding 25 rem for any credible accident. Given that an acute radiation dose of approximately 100 rem carries almost no risk of prompt death,[56] it is reasonable to conclude that a worker radiation dose standard of 100 rem, or less, would satisfy the goal. BNFL Inc. has proposed dose standards that are not more than 25% of this value.

Based on the RU evaluation of the risk to individuals assumed to be located within one mile of the controlled area, the BNFL Inc., standards set assures that 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. Such assurance provides for an adequate level of safety controlling the risk of prompt fatality during credible accident conditions.

[55] *Health Effects of Exposure to Low Levels of Ionizing Radiation*, BEIR V, Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences, 1990.
[56] EH-12-94-01, Volume 2, June 1994.

7.3 BNFL INC., CONFORMANCE WITH THE RADIATION PROTECTION OBJECTIVE

The *Radiation Protection Objective* (DOE/RL-96-0006, Section 3.2) is to, "Ensure 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."

The radiation dose and ALARA design standards proposed by BNFL Inc., in Table 2-1 for a CLW conform to the Radiation Protection Objective. The selection of standards incorporating the application of an ALARA program to optimize exposures from facility operations is essential to conforming to this goal. The RU concluded that BNFL Inc.'s overall approach to accident mitigation and selection of safeguards would provide an adequate level of safety for a CLW if properly implemented. BNFL Inc.'s radiation dose standards for a CLW are sufficiently low to ensure that radiation exposure and environmental impact due to accidents would be mitigated. BNFL Inc.'s radiation dose standard is ≤25 rem for credible accidents in the unlikely and extremely unlikely event probability ranges. For these event probability ranges, BNFL Inc., has included an additional provision to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis, and to provide for sufficient design margin and operational flexibility. BNFL Inc.'s overall approach to accident mitigation and selection of safeguards would provide an adequate level of safety.

8.0 REGULATING TO ACCEPTABLE VALUE FOR THE RISK OF FATAL CANCER

To support the objective of regulating an adequate level of radiological safety, the RU has compared the risk values for fatal cancer from credible accidents at the proposed BNFL Inc., facility with those recommended by expert groups.[57] A risk value represented by about 2.5×10^{-5} fatal cancers per year is consistent with the recommendations of the International Commission on Radiological Protection (ICRP), which note that a fatal cancer risk in the range of 1×10^{-6} to 1×10^{-5} per year would likely be acceptable to individual members of the public. The RU has evaluated BNFL Inc., radiation dose standards under accident conditions for conformance to a risk value of 1×10^{-5} fatal cancers per year.[58] BNFL Inc., has recommended a CLW radiation dose standard of not greater than 25 rem for credible accidents in the unlikely (10^{-4} to 10^{-2} per year) and extremely unlikely (10^{-6} to 10^{-4} per year) event probability ranges. The risks represented by 25 rem in the unlikely and extremely unlikely event probability ranges are on average 2.5×10^{-5} and 2.5×10^{-7} fatal cancers per year, respectively. These calculations assume the BEIR V risk coefficient of 1×10^{-3} fatal cancers per rem applicable to an exposure at or above 10 rem[59]. These risk values satisfy the acceptable value cited by the ICRP.

[57] *Guidance for the Reviewer of TWRS Privatization Contractor Radiation Exposure Standards for Workers,* RL/REG-97-08, Rev. 0, U.S. Department of Energy, Richland Operations Office, Office of Radiological, Nuclear, and Process Safety Regulation, Richland, Washington, June 1997.
[58] Appendix B, RL/REG-98-01, Rev. 0, March 1998.
[59] BEIR V, 1990.

9.0 CONCLUSIONS

The CLW concept has been adopted by the RU for use on the TWRS-P project for two reasons. First, it was considered prudent to impose more restrictive standards on radiation exposures to workers who are remote from the facility then those who are actually employed at the facility. Second, the concept is particularly applicable to a larger site such as Hanford where many facilities may be in operation simultaneously. For such sites, adoption of the CLW concept has the effect of limiting the risk contribution of a single facility on the site population as a whole.

Despite the CLW standards for TWRS-P, the CLW concept is not universally applied within DOE. Where it is not applied, the equivalent to a CLW is treated as a worker and not as a member of the public. This treatment is common throughout all the DOE rules and most of the DOE Orders, excepting only those few where the CLW concept is treated explicitly. If the CLW were to be treated as a member of the public for TWRS-P, a serious and unexplainable anomaly would be introduced into the entire safety and regulatory fabric of the Agency.

This Position Paper asserts the RU position that the CLW is a subset of worker, and should not be considered to be a member of the public. The case for this position is made in several ways. In Section 4.0, the case is founded on rule-based definitions contained in 10 CFR 835. In Section 5.0, the case is founded upon the fact that all workers, including CLWs, will have their activities conducted in accordance with a DOE-approved radiation protection program. In Section 6.0, the case is founded upon the risk goals for assessment of worker safety under accident conditions contained in a prominent DOE-EH report. In Section 7.0, the case is founded on the operation and accident risk goals contained in the TWRS-P Contract. In Section 8.0, the case is founded upon BEIR V guidelines on acceptable incremental risk of acute and latent cancer.

This paper does not attempt to assert its position from the point of view of the NRC rules. NRC staff personnel are better equipped to interpret their rules than members of a DOE Regulatory Unit. An appropriate resolution of this issue with the NRC could probably best be achieved by a NRC study that begins with the assumption that the CLW is actually a class of worker. The study would then ask, “What changes in the DOE site procedures or practices would be necessary to support its positions within the NRC context?” Such an inquiry would probably include evaluation of the Hanford Emergency Planning system, the training program required to gain site access, the controls imposed on site access and related security measures and so forth. Such a course of action is likely to reveal areas in which the Hanford Site controls can be improved that will be of benefit to both the Hanford workers as well as the nearby members of the public.

This page intentionally left blank.

Exhibit 1: Table 2-1, Radiological Exposure Standards Above Normal Background

Description	Estimated Frequency of Occurrence f (yr -1)	General Guidelines	Worker	Co-located Worker	Public
Normal Events: Events that occur regularly in the course of facility operation (e.g., normal facility operations); including routine and preventive maintenance activities.	>0.1	Normal modes of operating facility systems should provide adequate protection of health and safety.	≤5 rem/yr ≤50 rem/yr any organ, skin, or extremity ≤15 rem/yr lens of eye ≤1.0 rem/yr ALARA design objective per 10CFR835.1002(b) (1)	≤5 rem/yr ≤1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b)(1)	≤10 mrem/yr (airborne pathway) ≤100 mrem/yr (all sources) ≤100 mrem/yr (public in the controlled area) ≤25 mrem/yr (radioactive waste)
Anticipated Events: Events of moderate frequency that may occur once or more during the life of a facility (e.g., minor incidents and upsets).	$10^{-2} < f \leq 10^{-1}$	The facility should be capable of returning to operation without extensive corrective action or repair.	≤5 rem/event (2,3) 1.0 rem/event design action threshold (4)	≤5 rem/event (2, 3) 1.0 rem/event design action threshold (4)	≤100 mrem/event (3)
Unlikely Events: Events that are not expected, but may occur during the lifetime of a facility (e.g., more severe incidents).	$10^{-4} < f \leq 10^{-2}$	The facility should be capable of returning to operation following potentially extensive corrective action or repair, as necessary.	≤25 rem/ event (2,3)	≤25 rem/event (2, 3)	≤5 rem/event (3)
Extremely Unlikely Events: Events that are not expected to occur during the life of the facility but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material.	$10^{-6} < f \leq 10^{-4}$	Facility damage may preclude returning to operation.	≤25 rem/ event (2,3)	≤25 rem/event (2,3)	≤25 rem/event ≤5 rem/event target (3) ≤300 rem/event to thyroid
Location of Receptor			Within the BNFL TWRS-P Controlled Area Boundary, including 241-AP-106	The most limiting location at or beyond the BNFL TWRS-P Controlled Area Boundary	The most limiting location along the near river bank/Hwy 240 /southern boundary

Notes

(1) In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and co-located workers under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c).

(2) In addition to meeting the listed worker and co-located worker exposure standards for accidents, the Worker Accident Risk Goal is satisfied through the calculation of the risk from accidents with accident prevention and mitigation features added as necessary to meet the Goal.

(3) In addition to meeting the listed exposure standards for accidents, BNFL's approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis, and to provide for sufficient design margin and operational flexibility.

(4) When a calculated accident exposure exceeds this threshold, then appropriate actions are taken. These include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost-effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventative or mitigative features if they are not both cost-effective and feasible.