



BNFL-TWP-SER-003, Rev. 2

TANK WASTE REMEDIATION SYSTEM PRIVATIZATION PROJECT

RADIATION PROTECTION PROGRAM FOR DESIGN

June 1, 1999

Prepared for:

U.S. Department of Energy
Richland Operations Office
Contract DE-AC06-RL13308

Prepared By:

BNFL Inc.
2940 George Washington Way
Richland, Washington 99352



TANK WASTE REMEDIATION SYSTEM PRIVATIZATION PROJECT

RADIATION PROTECTION PROGRAM FOR DESIGN

June 1, 1999

Technical Publications Services		
Technical Publications Specialist: Chad DeMeyer	Signature:	Date:
Originator		
Shielding and Dose Assessment Lead: David J. Pisarcik	Signature:	Date:
Checker		
Senior Staff Scientist (SAIC): James D. Jamison	Signature:	Date:
Approver		
Safety and Regulatory Programs Manager: Donald W. Edwards	Signature:	Date:
Operations Manager: (PSC Chairperson) Alan Dobson	Signature:	Date:
Accepted by:		
Project Manager: Dr. Christopher Burrows	Signature:	Date:

Prepared for:

U.S. Department of Energy
Richland Operations Office
Contract DE-AC06-96RL13308

Prepared By:

BNFL Inc.
2940 George Washington Way
Richland, Washington 99352



CONTENTS

ACRONYMS iv

1.0 INTRODUCTION 1

2.0 RPP DOCUMENT ORGANIZATION 1

3.0 PURPOSE 2

4.0 APPLICABILITY 2

5.0 BNFL COMPLIANCE WITH 10 CFR 835 REQUIREMENTS FOR TWRS-P DESIGN PHASE 2

5.1. MAINTENANCE OF THE RPP 3

5.2. AUDITS REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835 3

5.3. MANAGEMENT OF RECORDS REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835 4

5.4. TRAINING REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835 4

5.5. BNFL INC. APPLICATION OF ALARA TO THE TWRS-P FACILITY DESIGN 4

5.5.1. ALARA Policy/Management Commitment 5

5.5.2. Organization and Responsibilities 6

5.5.3. Administrative Control Levels 7

5.5.4. Radiological Performance Goals/Indicators 7

5.5.5. ALARA Training 7

5.5.6. Plans and Procedures 8

5.5.7. Internal Assessments/Audits 9

5.5.8. Optimization Methodology 9

5.5.9. ALARA Design Process 11

5.5.10. ALARA Design Criteria 12

5.5.11. ALARA Design Process Components 13

5.5.12. ALARA Documentation 16

5.5.13. Radiological Work/Experiment Planning 16

5.5.14. Records 16

6.0 Bibliography 16

APPENDIX

A BNFL INC. TANK WASTE REMEDIATION SYSTEM-PRIVATIZATION PROJECT COMPLIANCE WITH 10 CFR 835 REQUIREMENTS A-i



ACRONYMS

ALARA	as low as reasonably achievable
ASC	ALARA Subcommittee
CAMS	Corrective Action Management System
CBA	cost-benefit analysis
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
GET	General Employee Training
ISAR	Initial Safety Analysis Report
NRPB	National Radiation Protection Board
PPE	Personal Protection Equipment
PSC	Project Safety Committee
QA	quality assurance
QAP	Quality Assurance Program
RCP	Radiological Controls Program
RPP	Radiation Protection Program
TWRS-P	Tank Waste Remediation System-Privatization



1.0 INTRODUCTION

This document is the Radiation Protection Program (RPP) for the BNFL Inc. design activities for the Tank Waste Remediation System-Privatization (TWRS-P) Project located at the U.S. Department of Energy (DOE) Hanford Site. This RPP is used to achieve compliance with the requirements of 10 Code of Federal Regulations (CFR) 835, "Occupational Radiation Protection." As such, the RPP is a subset of the BNFL Inc. Radiological Controls Program (RCP). Pursuant to 10 CFR 835.101(a), the RPP must be submitted and approved by the U.S. Department of Energy, Richland Operations Office (DOE-RL) before commencement of the TWRS-P Facility design activities.

The RPP is developed and submitted for regulatory approval in stages corresponding to the status of the TWRS-P Project. This initial RPP submittal describes the plans and measures for achieving compliance with the requirements of 10 CFR 835 that are applicable to the TWRS-P Facility design phase. No radiological source term will exist to cause personnel exposures during the design phase; however, decisions made during the design process will affect exposures during facility operations and deactivation.

2.0 RPP DOCUMENT ORGANIZATION

This RPP defines the relationship between the BNFL Inc. RCP and RPP (Section 1.0). The remaining sections provide a description of the BNFL Inc. plans and measures for achieving compliance with the requirements of 10 CFR 835. The description of the as low as reasonably achievable (ALARA) design process was prepared using DOE Implementation Guide G-10 CFR 835/B2, Occupational ALARA Program (DOE 1994) for guidance.¹

Appendix A of this RPP addresses each of the requirements of 10 CFR 835 in one of three characteristic ways:

- This statement does not contain a requirement.
- This requirement does not apply to the design phase of the TWRS-P Project. No measure statement is required. (This statement is typically followed by a statement of future inclusion in the TWRS-P Project RPP.)
- Appendix A identifies the section of the RPP text that provides the plans and measures for achieving compliance with the specific 10 CFR 835 requirement.

The word "shall" is used in this RPP in relation to BNFL Inc. processes, actions, or program components that are required in order to achieve compliance with 10 CFR 835 requirements. These BNFL Inc. processes, actions, or program components are therefore enforceable. RPP text, which is provided to promote understanding of BNFL Inc. processes, actions, or program

¹ Compliance with U.S. Department of Energy Implementation Guides is not mandatory. Acknowledging the use of G-10 CFR 835/B2, or other guidance documents as noted in the Bibliography, in the preparation of this RPP, does not make compliance with G-10 CFR 835/B2, or any other document, enforceable.



components intentionally uses verbs such as “must”, “will”, “should”, or “may”. Compliance with procedures is a BNFL Inc. condition of employment and ensures conformance with the text descriptions presented in this RPP.

3.0 PURPOSE

The purpose of this RPP is to describe the BNFL Inc. plans and measures for achieving compliance with 10 CFR 835 requirements. Nothing in this RPP or in the implementing procedures and/or codes of practice shall be construed as limiting actions that may be necessary to protect health and safety.

A matrix of each 10 CFR 835 requirement and the BNFL Inc. plans and measures for achieving compliance with that specific requirement are contained in Appendix A, BNFL Inc. TWRS-P Compliance with 10 CFR 835 Requirements (Design Phase).

4.0 APPLICABILITY

A DOE activity shall be conducted in compliance with a documented RPP as approved by the DOE-RL. This RPP is applicable to BNFL Inc. TWRS-P Facility design and design modification activities, including final determination of the facility layout, process flow, equipment specifications, and decontamination provisions made for deactivation.

Outside the scope of this RPP are many TWRS-P Project activities that involve non-naturally-occurring radioactive materials or the potential for occupational radiation exposure to personnel. BNFL Inc. shall not initiate any task outside the scope of this RPP until an update of the RPP is approved by DOE-RL.

5.0 BNFL INC. COMPLIANCE WITH 10 CFR 835 REQUIREMENTS FOR TWRS-P DESIGN PHASE

BNFL Inc. will comply with 10 CFR 835, Occupational Radiation Protection, in the design, construction, and operation of the TWRS-P Facility. No person shall take, or cause to be taken, any action inconsistent with the requirements of 10 CFR 835 or any BNFL Inc. program, plan, schedule, or other process established for compliance with 10 CFR 835.

BNFL Inc. will ensure that individuals responsible for developing and implementing measures necessary for ensuring compliance with the requirements of 10 CFR 835 shall have the appropriate education, training, and skills to discharge these responsibilities.

In establishing compliance with 10 CFR 835, BNFL Inc. adopts the definitions of terms provided in 10 CFR 835.2. BNFL Inc. processes, actions, and program components for ensuring compliance with 10 CFR 835 will be implemented through procedures and codes of practice which use these terms in a manner consistent with the definitions provided in 10 CFR 835.2. None of the terms defined in 10 CFR 835.2 are used differently in the BNFL Inc. TWRS-P Project RPP.



The sections which follow addresses each functional element of 10 CFR 835 applicable during the TWRS-P Facility design phase: audits, records, training, and the application of the ALARA process. The functional elements are presented in the order in which the associated requirements appear in 10 CFR 835. This RPP addresses each requirement in 10 CFR 835 that is applicable to the TWRS-P Facility design phase.

5.1. MAINTENANCE OF THE RPP

This RPP is part of the Authorization Basis for the TWRS-P Project. The RPP shall be maintained in compliance with BNFL Inc. procedures and codes of practice for maintaining the project authorization basis. An update of the RPP shall be submitted to DOE-RL: whenever a change or an addition to the RPP is made; before the initiation of a task not within the scope of the RPP; or within 180 days of the effective date of any modifications to 10 CFR 835. DOE-RL may direct or make modifications to a RPP.

Consistent with the provisions of 10 CFR 835, changes, additions, or updates to the TWRS-P Project RPP may become effective without prior DOE-RL approval only if the changes do not decrease the effectiveness of the RPP and the RPP, as changed, continues to meet the requirements of 10 CFR 835. Assessments of the continued compliance and effectiveness of the RPP shall be performed by the Safety and Regulatory Programs Manager, or his/her designee. Proposed changes that decrease the effectiveness of the RPP shall not be implemented without submittal to and approval by the DOE-RL.

The TWRS-P initial RPP and any updates shall be considered approved 180 days after its submission unless rejected by DOE-RL at an earlier date.

5.2. AUDITS REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835

The policy for the TWRS-P Project audits and assessments system is presented in *Tank Waste Remediation System Privatization Project Quality Assurance Program* (BNFL Inc. 1998a). The Quality Assurance Program (QAP), Chapter 10, "Independent Assessments," describes the responsibilities and requirements for planning and conducting independent assessments.

The TWRS-P Project Quality Assurance (QA) Manager is responsible for planning and performing QA assessments, communicating the results of assessments to BNFL Inc. management, evaluating the adequacy of management responses to assessment deficiencies, conducting follow-up evaluations to verify that corrective actions have been accomplished as scheduled, and tracking identified deficiencies through completion of corrective actions.

The TWRS-P Project QA Manager shall ensure that internal audits of the RPP, including examination of program content, and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months. As provided by 10 CFR 835.3(e), the completion of the audit sequence may be extended by a period not to exceed 30 days to accommodate scheduling needs. These audits shall include program content and implementation. Audits and assessments shall be performed in accordance with approved procedures by qualified staff knowledgeable in the activity or process being assessed and who have sufficient authority and freedom from line organizations to carry out the responsibilities. Personnel who conduct assessments shall not be directly responsible for the work processes and systems being assessed.



In accordance with the QAP, Section 3.2.2, corrective actions shall be tracked on the Corrective Action Management System (CAMS) database and the completion verified (BNFL Inc. 1998a). Follow-up of completed corrective actions for effectiveness shall be through surveillance and audit by the TWRS-P Project QA Manager.

5.3. MANAGEMENT OF RECORDS REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835

BNFL Inc. shall ensure the creation of all records required to demonstrate compliance with 10 CFR 835. Unless otherwise specified in 10 CFR 835, records shall be retained until final disposition is authorized by DOE-RL. The policy for the TWRS-P Project records management system is presented in the QAP. The QAP, Chapter 4.0, "Documents and Records" provides the responsibilities and requirements for the preparation, review, approval, revision, and control of documents that specify or prescribe activities that affect quality (BNFL Inc. 1998a). The QAP also specifies the requirements for records management systems to include training records, design documents, and design review documents. The TWRS-P Project QA Manager is responsible for ensuring that the document control and records management systems meet applicable contractual and regulatory requirements. All BNFL Inc. records for radiological protection shall use the special units of curie, rad, roentgen, or rem including multiples or subdivisions of these units.

5.4. TRAINING REQUIRED TO DEMONSTRATE COMPLIANCE WITH 10 CFR 835

The TWRS-P Project training policy is presented in the QAP. The QAP, Chapter 2.0, "Personnel Training and Qualification" provides the requirements and responsibilities to ensure that personnel are qualified and appropriately trained to perform their work in a quality manner including their initial proficiency; maintenance of proficiency; and adaptation to new technologies, methods, or responsibilities (BNFL Inc. 1998a).

General Employee Training (GET), Radiological Worker Training, and Radiological Control Technician Training are not applicable during the Design Phase of TWRS-P Facility work. A detailed description of ALARA training is provided in Section 5.5.5 of this RPP.

5.5. BNFL INC. APPLICATION OF ALARA TO THE TWRS-P FACILITY DESIGN

The following subsections describe comprehensively how BNFL Inc. will apply ALARA to the TWRS-P Facility design. Each element of an ALARA program for facility design is addressed. The form and content of this section of the RPP is consistent with DOE Implementation Guide G-10 CFR 835/B2, *Occupational ALARA Program* (DOE 1994).

Although not referenced in their entirety, and therefore not enforceable, applicable portions of *Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)* (Munson 1988), and Regulatory Guide 8.8, *Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be As Low As Is Reasonably Achievable* (NRC 1976) were used to guide development of the BNFL Inc. ALARA design process.



5.5.1. ALARA Policy/Management Commitment

It is BNFL Inc.'s policy to conduct radiological operations in a manner that ensures the health and safety of all its employees, subcontractors, and the general public. To meet this objective, BNFL Inc. ensures that radiation exposures to its workers are maintained below regulatory limits and efforts are made to further reduce exposures ALARA. To meet this policy, BNFL Inc. will do the following:

- Ensure that reviews of regulatory requirements are performed to maintain 'State of the Art' Occupational Radiation Protection in all activities.
- Ensure that employees performing radiological work activities are trained.
- Ensure that technically competent personnel are responsible for implementing and overseeing the RCP.
- Establish and maintain line management accountability for radiation protection performance.
- Ensure measurements, analyses, and worker monitoring results are accurately and appropriately made and records maintained.
- Perform radiological operations in a manner that controls the spread of radioactive materials and reduces employee exposure, seeking to make exposure levels ALARA.
- Incorporate dose/contamination/waste reduction and minimization features into new facility designs.
- Perform oversight of radiological operations to ensure that client requirements are being met and appropriate radiological work practices are being implemented.



5.5.2. Organization and Responsibilities

TWRS-P Project General Manager - The General Manager is the approval authority for BNFL Inc. and has overall responsibility for achieving compliance with each applicable 10 CFR 835 requirement.

TWRS-P Project Manager - Manages the overall TWRS-P design effort and implements BNFL Inc. policies for TWRS-P Facility design phase work. Maintains the documented process used by the facility design staff to incorporate the ALARA process into all phases of facility design. Ensures that design personnel are trained to apply ALARA design criteria to the design and incorporate the ALARA design process into the design activity. Receives and implements Project Safety Committee (PSC)/ALARA Subcommittee (ASC) recommendations, as appropriate, or refers decisions for contested issues to the General Manager. Reviews assessment, surveillance, and audit reports; investigates adverse findings and takes timely, appropriate action. Ensures that adequate resources are applied to all functional elements of the TWRS-P Facility design function.

TWRS-P Project Engineering Manager - Establishes interface controls for design and data collection activities. Documents and approves design plans. Verifies that design criteria have been met. Ensures that design changes are documented and approved.

TWRS-P Project QA Manager - Assesses the design process to ensure the adequacy and satisfactory implementation of the design procedures. Participates in design reviews, as required. Reviews the results of technical and design reviews for compliance with QAP requirements. Evaluates subcontractor design control programs. Plans and performs QA assessments, including communication of assessment results and tracking identified deficiencies through completion of corrective actions. The assessment process shall ensure that each functional element of the RPP is evaluated on a frequency not less than every 3 years. Ensures that a document control and records management system meets all applicable requirements.

TWRS-P Project Operations Manager (Design Phase) – During the design phase, the Operations Manager is accountable to the General Manager for developing a comprehensive and effective safety culture, standards of operation, operating philosophies, and implementing safety programs. The Operations Manager provides experienced operations resources for operational input to the development of the design and commissioning of the facility and is responsible for all aspects of safety during operations. The Operations Manager is the Chairperson of the PSC.

TWRS-P Project Safety and Regulatory Programs Manager - Implements internal safety and oversight functions. Develops safety basis and safety-related performance measures. Evaluates proposed changes that involve the implementation of nuclear, radiological, environmental, and process safety. Identifies and evaluates laws and regulations that may affect TWRS-P Project safety programs. Has primary responsibility for the production of TWRS-P Project deliverables including authorizations, permits, and license applications. Ensures appropriate performance of shielding calculations, dose assessments, ALARA assessments, and optimization assessments in support of incorporating ALARA throughout the design process. Serves as Deputy Chairperson of the PSC.



TWRS-P Project Safety Committee - The TWRS-P Project PSC is a multidisciplinary advisory committee to the General Manager on matters related to overall nuclear, radiological, process, and occupational safety. Membership on the PSC requires general knowledge of the TWRS-P Project scope and purpose, independence from direct participation in the preparation of the material being reviewed, and technical expertise in the matter being considered. The Chairperson of the PSC is the BNFL Inc. TWRS-P Operations Manager. The PSC Chairperson is responsible for obtaining technical and/or subject matter experts and consultants/advisors, as required.

ALARA Subcommittee (ASC) - With respect to ALARA, the PSC uses a subcommittee of appropriately qualified personnel (the ASC) to provide a multidisciplinary overview of ALARA activities. The ASC is a standing subcommittee of the PSC (with members as appointed by the PSC Chairperson), that provides oversight for the implementation of the ALARA design process, and advises and assists the TWRS-P Project Manager in incorporating the ALARA design process into all stages of the TWRS-P Facility design activity. The ASC also reviews audits and assessments involving the ALARA process and monitors resolution of issues. Because eligibility precludes responsibility for the TWRS-P Facility design, the ASC constitutes an independent review.

An ALARA Coordinator is not required during the TWRS-P Project design phase. Because all activities are closely focused on the design effort, design processes are proceduralized, and appropriate oversight is provided by management, the PSC, and the ASC.

5.5.3. Administrative Control Levels

This RPP reflects the design phase of the TWRS-P Project only. "Administrative Control Levels," are described in DOE Implementation Guide G-10 CFR 835/B2, *Occupational ALARA Program* (DOE 1994) in relation to occupational exposure and are, therefore, not applicable to this RPP. The term "Administrative Control Level" is also used in *Initial Safety Analysis Report* (ISAR) (BNFL Inc. 1998b) during a discussion of occupational exposure limits. Values that are equivalent to those presented in ISAR Table 5-3 are utilized in this RPP as ALARA Design Criteria.

5.5.4. Radiological Performance Goals/Indicators

This RPP reflects the design phase of the TWRS-P Project only. Radiological Performance Goals/Indicators are not applicable to this RPP.

5.5.5. ALARA Training

Specific technical training (including ALARA training) shall be planned, scheduled, provided, documented, and maintained for personnel in their respective technical disciplines as defined by position descriptions and specific work assignments. A training matrix shall be maintained for defining and tracking training requirements.

Personnel requiring ALARA training shall be trained in the following areas:

- ALARA design criteria



- BNFL Inc. ALARA design process (to include applicable procedures and codes of practice)
- Identification and application of appropriate industry standards for ALARA design
- Company, project, technical, and personnel resources available on ALARA
- Applicable BNFL Inc. QA requirements for ALARA
- Generation and maintenance of ALARA records.

Personnel shall receive necessary training before their start of work.

5.5.6. Plans and Procedures

Plans and procedures for ALARA shall be commensurate with the activities authorized to be performed under this RPP. In particular, BNFL Inc. shall prepare, issue, and implement procedures and codes of practice that apply the ALARA process to design work for the TWRS-P Facility. Procedures describe the organizational responsibilities and outputs for a particular element of the ALARA process (these could be referred to as the “who” and “what”). Codes of practice describe how the activity is to be performed. Procedures and codes of practice shall be commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards.

BNFL Inc. shall document the following ALARA process elements through appropriate procedures and codes of practice:

- ALARA policy statement
- ALARA organization and responsibilities for TWRS-P Facility design
- Training content for ALARA design
- Responsibilities for, and the performance of, ALARA program reviews and audits
- TWRS-P Project ASC (a subcommittee of the PSC)
- The BNFL Inc. ALARA design process
- The BNFL Inc. process for optimization methodology and the value of the person-rem detriment
- Performance of audits for the ALARA functional element
- Retention of the records required to demonstrate compliance with 10 CFR 835 ALARA requirements.



Each BNFL Inc. procedure or code of practice shall be approved by TWRS-P Facility management and shall be subjected to a periodic review and update process to ensure on-going applicability to the TWRS-P Project.

5.5.7. Internal Assessments/Audits

Through the process of performing internal audits of all functional elements of the RCP, BNFL Inc. shall audit the application of the ALARA process to the TWRS-P Facility design. Such audits shall ensure that each functional element, including ALARA, is audited formally no less frequently than every 3 years.

As described in Section 5.5.6, appropriate procedures and codes of practice shall document management's responsibilities for reviewing, auditing, and evaluating the ALARA program. The audit process shall ensure that findings and proposed corrective actions are reported to the TWRS-P Project Manager, thereby ensuring timely and adequate response.

The audit process for ALARA shall ensure that the ALARA program is evaluated by individual(s) who have no direct responsibility for implementing the ALARA program.

5.5.8. Optimization Methodology

5.5.8.1. Process Description

It is not expected that a cost benefit analysis (CBA) will be used as the primary driver in every ALARA decision. The CBA is viewed as one of the inputs in an ALARA analysis, and depending on the particulars of the situation (the formality and degree of quantitative analysis should reflect the scale and type of problem under consideration), a CBA may not be required in order to arrive at an appropriate decision.

The method for performing a CBA shall be approved by TWRS-P Project management through the process of issuing the code of practice in which it appears. Use of the approved CBA methodology will ensure that quantitative methods are applied to the ALARA process, thereby ensuring that the ALARA process leads to consistent, rational, documentable, coherent decisions as to which dose-reduction and contamination-minimization efforts are reasonable. The overall role of a CBA in this process is summarized as follows:

- If an option is justified on the basis of a CBA, then it should be implemented.
- If an option is not cost effective on the CBA grounds, then it is necessary to consider whether any of the other factors identified in the ALARA design process make implementation appropriate, either when considered in isolation or as factors supporting a marginal ALARA case.

Previous experience may indicate that the magnitude of the collective dose does not justify any dose reduction actions based on a CBA.



The following general principles are consistent with BNFL Inc. implementing documents for a CBA:

- The quantified collective dose valuation should not be viewed as a precise indicator of whether a particular option is chosen or not. Instead, it provides a guide as to whether the option is reasonable in the circumstances and allows comparison with similarly evaluated options.
- Undue precision in a CBA calculation should be avoided, as it tends to imply a greater meaning than is appropriate. Additionally, all options being evaluated should utilize a similar level of precision.
- It is the dose that would be averted by an option that is the input to the assessment. The optimum CBA solution is determined where the cost of the next increment in protection would exceed the incremental person-rem detriment valuation: this is known technically as a "differential" CBA.
- All doses and total life cycle financial costs affected by the option under consideration should be considered. In some cases this will include doses and costs from construction, commissioning, operation, maintenance, modification, decommissioning, and waste management.
- Future financial costs can be discounted to Net Present Value - a typical discount rate to be applied to plant lifetime costs is 5%/yr. If even longer-term costs are likely to be significant (e.g., late decommissioning stages), further advice should be sought from appropriate BNFL Inc. financial and accounting organizations. In many cases, cost discounting will be a second-order effect and can be omitted.
- It is important to use realistic best estimate dose data for CBA assessments. In particular, note that prospective dose data from safety cases and design assessments often are conservative estimates and should be used with care.

5.5.8.2. Applied Value of Protection for Optimization

A key input parameter for CBA is the value of the person-rem detriment. BNFL Inc. policy is based on the United Kingdom National Radiation Protection Board (NRPB) guidance, together with an adjustment for United States commercial and DOE practices. Taking account of these factors, the following person-rem valuations for occupational exposure is appropriate for TWRS-P Project CBA calculations:

Minimum	-	\$ 2,000/person-rem
Maximum	-	\$10,000/person-rem

The \$2,000 value applies to exposures in the lower individual dose region, less than about 500 mrem/yr, which are most frequently encountered. The \$10,000 figure applies to exposures in the higher dose range, typically above 1 rem/yr. Intermediate values may be used as appropriate, provided that each case and its justification, is documented.

5.5.9. ALARA Design Process

5.5.9.1. Overview

The ALARA design process shall be applied in all stages of TWRS-P Facility design. Experience has shown that the greatest potential for significant dose savings at the lowest cost is achieved at the earliest stages of design. Therefore, primary emphasis in the ALARA process shall be TWRS-P Facility design considerations. Also, in general, there are greater potential benefits in the application of ALARA in design than during operation.

The following are general guidelines for consideration in the ALARA design process:

- All parts of the design will be shown to result in a dose that will be ALARA. The ALARA principle is applied to both collective dose and to individual doses as well as to general area dose rates.
- The mechanisms for achieving and demonstrating ALARA will be appropriate to the particular design stage, and the amount of effort to produce the demonstration will be consistent with the magnitude of the estimated dose. Iteration of the dose estimate as the design progresses may lead to a change in the effort put into the ALARA demonstration.

5.5.9.2. Hierarchy of Protection

A number of techniques and methods exist to ensure the TWRS-P Facility design will contribute to achieving occupational doses that are ALARA. Some methods are more effective, reliable, or cost effective than others. For this reason, the ALARA design process shall use a hierarchy of controls giving priority to those controls that are most effective. The hierarchy of protective measures is as follows:

- Alternative Agents and Processes - In all instances, consideration should be given to the removal or minimization of hazards by the use of alternative agents or processes. Consideration of exposure during the hazard analysis stage of process definition will contribute to the reduction of exposure.
- Engineered Safety Features - These may, in some cases, physically separate the employee from the hazard and are employed to reduce the magnitude and/or likelihood of radiological exposure. Engineered safety features may be either deterministic (ensuring by their design that safety limits are not exceeded) or probabilistic (low failure probability presenting low risk). Examples of engineered safety features are as follows:
 - Shielding
 - Ventilation
 - Containment
 - Remote handling
 - Fixed barriers
 - Interlocks
 - Passive fail-safe features
 - Active fail-safe features
 - Zone segregation

- Access control and delineation.
- Operational Safety Features - These are operational management controls applied to reduce exposure to the hazard in both routine operation and maintenance. These controls concentrate on methods and conduct of work and generally are not as reliable as engineered safety features. Examples are as follows:
 - Installed radiological monitoring devices
 - Portable radiological monitoring devices
 - Pre-planning and coordination of work tasks
 - Temporary barriers, labels, and notices
 - Training and qualification program
 - Procedures.
- Personal Protection Equipment (PPE) - Use of PPE is appropriate where it is judged beneficial to reinforce the protection afforded by other measures, personnel enter areas not intended for routine occupancy, or where the provisions available provide insufficient protection. PPE is generally considered to be the least desirable and least reliable method of applied protection.

5.5.10. ALARA Design Criteria

The ALARA design criteria shall be applied throughout the design of the TWRS-P Facility:

- 5.5.10.1. The primary methods used to minimize radiation exposure in controlled areas shall be physical design features (e.g., confinement, ventilation, remote handling, and shielding).
- 5.5.10.2. Administrative controls shall be employed only as supplemental methods to control radiation exposure.
- 5.5.10.3. For specific activities where use of physical design features is demonstrated to be impractical, administrative controls shall be used to maintain radiation exposures ALARA.
- 5.5.10.4. Optimization methods (i.e., cost benefit analyses) will be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls. It is not expected that formal collective dose cost benefit analyses would be used, or documented in all ALARA decisions. The formality and degree of quantitative analysis should reflect the scale and type of problem under consideration.
- 5.5.10.5. Regarding the control of airborne radioactive materials, the design objective shall be, under normal conditions, to avoid releases to the workplace atmosphere.
- 5.5.10.6. In any situation, confinement and ventilation shall normally be used to control the inhalation of airborne radioactive material by workers to levels that are ALARA.

- 5.5.10.7. The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning.
- 5.5.10.8. During routine operations, a combination of design features and administrative control procedures shall provide that the anticipated occupational dose to general employees shall not exceed the limits established at § 835.202; and the ALARA process is utilized for personnel exposures to ionizing radiation.
- 5.5.10.9. The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupancy (2,000 hours per year) shall be to maintain exposure levels below an average of 0.5 mrem per hour and as far below this average as is reasonably achievable.
- 5.5.10.10 The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above (e.g., less than 2,000 hours per year) shall be ALARA and shall not exceed 20 percent of the applicable standards in Sec. 835.202 which are:
- A total effective dose equivalent of 5 rems;
 - The sum of the deep dose equivalent for external exposure and the committed dose equivalent to any organ or tissue other than the lens of the eye of 50 rems;
 - A lens of the eye dose equivalent of 15 rems; and
 - A shallow dose equivalent of 50 rems to the skin or to any extremity.

5.5.11. ALARA Design Process Components

The BNFL Inc. ALARA design process shall be described in procedures and codes of practice that are approved by TWRS-P Project management. The ALARA design process shall consist of the following components:

- Completion of a baseline design proposal
- Identification and evaluation of alternatives impacting baseline case doses
- ALARA assessments
- Formal ALARA reviews
- Final decision process
- Incorporate changes into design
- ALARA documentation.

5.5.11.1. Baseline Design Proposal

For the TWRS-P Project, a baseline design proposal is a proposed facility, or portion of the facility, that meets the criteria outlined in Section 5.5.10, ALARA Design Criteria.

5.5.11.2. Identification of Alternatives

For each radiation exposure scenario evaluated during the ALARA process, alternatives are generated for later evaluation. The evaluation should not be initiated until all reasonable alternatives have been identified and documented. This evaluation ensures the alternatives are considered systematically and consistently.

Each alternative that provides less exposure (e.g., decreased source term and/or exposure time) and a lower exposure rate to personnel should be identified and evaluated. Candidates include the following:

- Substitution or minimization of source terms affecting personnel dose
- Increased reliability of processes and equipment
- Increasing distance and shielding to the source term
- Increasing effectiveness of engineered controls
- Decreasing the need for exposure
- Decreasing exposure time
- Modification of the facility layout or process flow.

5.5.11.3. ALARA Design Assessments

ALARA design assessments are conducted and documented for each part of the design. The following phases or components of the design should be assessed by the designer, either individually or in combination, with involvement by a radiological engineer, as appropriate:

- Process
- Operation and maintenance philosophy
- Plant layout (to include adequate provisions for access and egress to controlled areas, and adequacy of plant monitoring)
- Cell layouts
- Source minimization
- Contamination control
- Individual shield items (e.g., glovebox shielding, shield doors, shield windows)
- Bulk shielding (walls, ceilings, and floors)
- Construction/installation
- Design aspects of operation
- Design aspects of decommissioning.

An ALARA assessment during site selection normally is conducted. However, for the TWRS-P Project, the site has been pre-selected by the DOE. The site selection ALARA assessment, therefore, will not be conducted.

An estimate of the dose that will result from each design alternative and the associated cost are needed for the ALARA assessment. The best available estimate should be used, as large conservatisms could obscure the potential dose savings. Cost ranges should be included. Where applicable, cost uncertainties should be documented as part of the evaluation. Designers must record all assumptions used in the evaluations.

More than one alternative applied to an exposure situation may provide equivalent ALARA benefit. In these cases, operational experience of existing plants should be taken into account wherever it is reasonable to do so. Application of this experience may contribute to the estimation of dose, and also may indicate areas where dose reduction consistent with ALARA has been achieved previously.

In addition, designers should recognize that opportunities to apply the ALARA process occur during daily design activities. These actions must be documented and provided to the ASC for overall evaluation.

In the general case, the following factors should be considered in ALARA assessments:

- Any design modification to reduce dose might result in an increase of a conventional hazard (e.g., risk of injury from collision with equipment).
- Any design modification might result in greater design, construction, operating, or decommissioning costs.
- Any design modification might lead to difficulties in building, operating, or decommissioning the plant.

The creation of an additional hazard does not necessarily eliminate selection of an alternative under consideration. Risk from the resulting hazard could be mitigated to the point of no consequence. The advice of other safety disciplines should be sought in such cases. Whenever the risk from competing safety alternatives exists, the final decision should be based on minimizing the overall risk.

5.5.11.4. ALARA Design Reviews

At key stages of the design, as determined by the ASC, formal reviews will be performed to examine the design critically for improvements required to demonstrate ALARA compliance and to record key ALARA decisions (many of which will have been recorded in the documentation associated with the ALARA assessments). Recognizing that many minor ALARA decisions are made implicitly and documented by the design engineers during the course of the design, the ALARA reviews also can be used to record where dose reduction has been achieved by the use of "good engineering practices" (e.g., where a design modification has been made to achieve an improved standard of engineering, which will result in a notable dose saving).

These reviews should make use of appropriate checklists to ensure consistency. Reviews shall be conducted by personnel not involved directly in producing the design. The outcome of the reviews will record the key ALARA decisions made in each design stage.

5.5.11.5. Consensus Approval

It is anticipated that more than one alternative may be proposed that achieves the ALARA objective. When assessments on each alternative are completed, the ASC will select the optimum alternative. Subcommittee approval will constitute agreement of the majority of committee members. The ASC, through the PSC, will provide its recommendation(s) to the Project Manager for consideration and approval. If agreement is reached, the concepts are incorporated into the TWRS-P Facility design. Contested issues should be clearly identified, characterized, and negotiated between the ASC and the TWRS-P Project Manager to a final resolution. If this cannot be achieved, the TWRS-P General Manager will make the final decision.

5.5.11.6. Incorporate Changes into Design

Following a decision to incorporate the ALARA changes into the design; the changes will be implemented using authorized design change control procedures.

5.5.12. ALARA Documentation

All records pertaining to the ALARA design review process including formal ALARA design reviews, cost/benefit reviews, design process audits, and assessments that include ALARA shall be retained in accordance with BNFL Inc. records retention procedures.

5.5.13. Radiological Work/Experiment Planning

Because this RPP submittal is for TWRS-P Facility design work only, no element of radiological work or experiment planning need be addressed at this time.

5.5.14. Records

BNFL Inc. shall generate and retain all records necessary to demonstrate compliance with 10 CFR 835.1001. These records include ALARA training records, formal ALARA design reviews, cost/benefit reviews, design process audits, and assessments that include ALARA.

6.0 BIBLIOGRAPHY

(Recognition of these resources in the development of the TWRS-P RPP does not make them part of the RPP, or make them enforceable, unless already so.)

10 CFR 20, "Standards for Protection Against Radiation," *Code of Federal Regulations*, as amended.

10 CFR 820, "Procedural Rules for DOE Nuclear Activities," *Code of Federal Regulations*, as amended.



10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

BNFL plc, 1994, Corporate Health and Safety Manual, Vol. 3, "Codes of Practice - Application of ALARP to the Routine Radiation Exposure of Workers and the Public," BNFL plc, Risley, Warrington, U.K.

BNFL Inc., 1997, *TWRS P Project: Radiological and Nuclear Dose Standards for Facility and Co-Located Workers*, BNFL-5193-RES-01, Rev. 0, BNFL Inc., Richland, Washington.

BNFL Inc., 1998, *TWRS-P Project: Initial Safety Analysis Report*, BNFL-5193-ISAR-01, Rev. 0, BNFL Inc., Richland, Washington.

BNFL Inc., 1998a, *Tank Waste Remediation System Privatization Project Quality Assurance Program and Implementation Plan*, BNFL-5193-QAP-01, Rev. 4, BNFL Inc., Richland, Washington.

BNFL Inc., 1998b, *Tank Waste Remediation System Privatization Project Initial Safety Analysis Report*, BNFL-5193-ISAR-01, Rev. 0, BNFL Inc., Richland, Washington.

DOE, 1994, *Occupational ALARA Program*, Implementation Guide G-10 CFR 835/B2, Rev. 1, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1996, *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.

ICRP, 1989, *Optimization and Decision-making in Radiological Protection*, ICRP Publication 55, Ann. ICRP 20 No. 1.

ICRP, 1990, *Recommendations of the International Commission on Radiation Protection*, ICRP Publication 60 Ann. ICRP 21 Nos. 1-3.

Munson, L.H., 1988, *Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)*, PNL-6577, Pacific Northwest Laboratory, Richland, Washington.

NRC, 1976, *Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be As Low As Is Reasonably Achievable*, Regulatory Guide 8.8, Rev. 3, U.S. Nuclear Regulatory Commission, Washington, D.C.

WAC 246-247, "Radiation Protection - Air Emissions," *Washington Administrative Code*, as amended.



APPENDIX A

**BNFL INC. TANK WASTE REMEDIATION SYSTEM-PRIVATIZATION PROJECT
COMPLIANCE WITH 10 CFR 835 REQUIREMENTS (DESIGN PHASE)**



This page intentionally left blank.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
Subpart A	General Provisions	
1 Sec. 835.1(a) Scope	General. The rules in this part establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.	This statement does not contain a requirement.
2 Sec. 835.1(b)	<p>Exclusion. Except as discussed in paragraph (c) of this section, the requirements in this part do not apply to:</p> <ul style="list-style-type: none"> (1) Activities that are regulated through a license by the Nuclear Regulatory Commission or a State under an Agreement with the Nuclear Regulatory Commission, including activities certified by the Nuclear Regulatory Commission under section 1701 of the Atomic Energy Act; (2) Activities conducted under the authority of the Director, Naval Nuclear Propulsion Program, as described in Pub. L. 98-525; (3) Activities conducted under the Nuclear Explosives and Weapons Surety Program relating to the prevention of accidental or unauthorized nuclear detonations; (4) Radioactive material transportation as defined in this part; (5) DOE activities conducted outside the United States on territory under the jurisdiction of a foreign government to the extent governed by occupational radiation protection requirements agreed to between the United States and the cognizant government; or (6) Background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from participation as a subject in medical research programs. 	This statement does not contain a requirement.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
3 Sec. 835.1(c)	Occupational doses received as a result of excluded activities and radioactive material transportation, as listed in paragraphs (b)(1) through (b)(5) of this section, shall be considered when determining compliance with the occupational dose limits at §§ 835.202 and 835.207, and with the limits for the embryo/fetus at § 835.206. Occupational doses resulting from authorized emergency exposures and planned special exposures shall not be considered when determining compliance with the dose limits at §§ 835.202 and 835.207.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site.
4 Sec. 835.2 (a) & (b)		As discussed in Section 5.0 of the text of this RPP, BNFL Inc. accepts the definitions of Sec. 835.2(a) and (b).
5 Sec.835.2(c)	Terms defined in the Atomic Energy Act and not defined in this part are used consistent with the meanings given in the Act.	This statement does not contain a requirement. BNFL Inc. accepts this convention for definitions not provided in 10 CFR 835.
6 Sec. 835.3(a) General rule.	No person or DOE personnel shall take or cause to be taken any action inconsistent with the requirements of: (1) This part; or (2) Any program, plan, schedule, or other process established by this part.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.0 of the text of this RPP.
7 Sec. 835.3(b)	With respect to a particular DOE activity, contractor management shall be responsible for compliance with the requirements of this part.	Compliance with this requirement is achieved through the assignment of responsibility as stated in Section 5.5.2 of the text of this RPP: "The General Manager is the approval authority for BNFL Inc. and has overall responsibility for achieving compliance with each applicable 10 CFR 835 requirement."
8 Sec. 835.3(c)	Where there is no contractor for a DOE activity, DOE shall ensure implementation of and compliance with the requirements of this part.	This 10 CFR 835 requirement is not applicable to the TWRS-P Project. No measure statement is required.
9 Sec. 835.3(d)	Nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 3.0 of the text of this RPP.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
10 Sec. 835.3(e)	For those activities that are required by §§ 835.102, 835.901(e), 835.1202(a), and 835.1202(b), the time interval to conduct these activities may be extended by a period not to exceed 30 days to accommodate scheduling needs.	The plans and measures for achieving compliance with the Sec. 835.102 requirements of 10 CFR 835.3(e) are described in Section 5.2 of the text of this RPP. The plans and measures for achieving compliance with the balance of the requirements of Sec. 835.3(e) will be addressed prior to activities with the potential for occupational radiation exposure, activities requiring access to controlled areas, or the presence of accountable sealed radioactive sources.
11 Sec. 835.4 Radiological units	Unless otherwise specified, the quantities used in the records required by this part shall be clearly indicated in special units of curie, rad, roentgen, or rem, including multiples and subdivisions of these units. The SI units, Becquerel (Bq), gray (Gy), and sievert (Sv), are only provided parenthetically in this part for reference with scientific standards.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.
Subpart B	Management and Administrative Requirements	
12 Sec. 835.101(a) Radiation protection programs	A DOE activity shall be conducted in compliance with a documented radiation protection program (RPP) as approved by the DOE.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 4.0 of the text of this RPP.
13 Sec. 835.101(b)	The DOE may direct or make modifications to a RPP.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.1 of the text of this RPP.
14 Sec. 835.101(c)	The content of each RPP shall be commensurate with the nature of the activities performed and shall include formal plans and measures for applying the as low as reasonably achievable (ALARA) process to occupational exposure.	<p>The content of this RPP is described in Section 1.0, of the text of this RPP.</p> <p>"The RPP is developed and submitted for regulatory approval in stages corresponding to the status of the TWRS-P Project. This initial RPP submittal describes the plans and measures for achieving compliance with the requirements of 10 CFR 835 that are applicable to the TWRS-P Facility design phase."</p> <p>The plans and measures for applying the as low as reasonably achievable (ALARA) process to the TWRS-P Facility design are described in Section 5.5 of the text of this RPP.</p>
15 Sec. 835.101(d)	The RPP shall specify the existing and/or anticipated operational tasks that are intended to be within the scope of the RPP. Except as provided in Sec. 835.101(h), any task outside the scope of a RPP shall not be initiated until an update of the RPP is approved by DOE.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 4.0 of the text of this RPP.:



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
16 Sec. 835.101(e)	The content of the RPP shall address, but shall not necessarily be limited to, each requirement in this part.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.0 of the text of this RPP.
17 Sec. 835.101(f)	The RPP shall include plans, schedules, and other measures for achieving compliance with regulations of this part. Unless otherwise specified in this part, compliance with amendments to this part shall be achieved no later than 180 days following approval of the revised RPP by DOE. Compliance with the requirements of § 835.402(d) for radiobioassay program accreditation shall be achieved no later than January 1, 2002.	This matrix provides TWRS-P plans and measures for achieving compliance with the requirements of 10 CFR 835. 10 CFR 835.402(d) is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of internal individual exposures.
18 Sec. 835.101(g)	An update of the RPP shall be submitted to DOE: (1) Whenever a change or an addition to the RPP is made; (2) Prior to the initiation of a task not within the scope of the RPP; or (3) Within 180 days of the effective date of any modifications to this part.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.1 of the text of this RPP.
19 Sec. 835.101 (h)	Changes, additions, or updates to the RPP may become effective without prior Department approval only if the changes do not decrease the effectiveness of the RPP and the RPP, as changed, continues to meet the requirements of this part. Proposed changes that decrease the effectiveness of the RPP shall not be implemented without submittal to and approval by the Department.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.1 of the text of this RPP.
20 Sec. 835.101(i)	An initial RPP or an update shall be considered approved 180 days after its submission unless rejected by DOE at an earlier date.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.1 of the text of this RPP.
21 Sec. 835.102 Internal audits	Internal audits of the radiation protection program, including examination of program content and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.2 of the text of this RPP.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
22 Sec. 835103 Education, training, and skills	Individuals responsible for developing and implementing measures necessary for ensuring compliance with the requirements of this part shall have the appropriate education, training, and skills to discharge these responsibilities.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.0 of the text of this RPP.
23 Sec. 835.104 Written procedures	Written procedures shall be developed and implemented as necessary to ensure compliance with this part, commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.6 of the text of this RPP.
Subpart C	Standards for Internal and External Exposure	
24 Sec. 835.202(a) Occupational dose limits for general employees.	Except for planned special exposures conducted consistent with § 835.204 and emergency exposures authorized in accordance with § 835.1302, the occupational dose received by general employees shall be controlled such that the following limits are not exceeded in a year: (1) A total effective dose equivalent of 5 rems (0.05 sievert); (2) The sum of the deep dose equivalent for external exposures and the committed dose equivalent to any organ or tissue other than the lens of the eye of 50 rems (0.5 sievert); (3) A lens of the eye dose equivalent of 15 rems (0.15 sievert); and (4) A shallow dose equivalent of 50 rems (0.5 sievert) to the skin or to any extremity.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
25 Sec. 835.202(b)	All occupational doses received during the current year, except doses resulting from planned special exposures conducted in compliance with § 835.204 and emergency exposures authorized in accordance with § 835.1302, shall be included when demonstrating compliance with §§ 835.202(a) and 835.207.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
26 Sec. 835.202(c)	Doses from background, therapeutic and diagnostic medical radiation, and participation as a subject in medical research programs shall not be included in dose records or in the assessment of compliance with the occupational dose limits.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
27 Sec. 835.203(a) Combining internal and external dose equivalents	The total effective dose equivalent during a year shall be determined by summing the effective dose equivalent from external exposures and the committed effective dose equivalent from intakes during the year.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
28 Sec. 835.203(b)	Determinations of the effective dose equivalent shall be made using the weighting factor values provided in Sec. 835.2.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
29 Sec. 835.204(a) Planned special exposures.	<p>A planned special exposure may be authorized for a radiological worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in Sec. 835.202(a), provided that each of the following conditions is satisfied:</p> <ol style="list-style-type: none"> (1) The planned special exposure is considered only in an exceptional situation when alternatives that might prevent a radiological worker from exceeding the limit in Sec. 835.202(a) are unavailable or impractical; (2) The contractor management (and employer, if the employer is not the contractor) specifically requests the planned special exposure, in writing; and (3) Joint written approval is received from the appropriate DOE Headquarters program office and the Secretarial Officer responsible for environment, safety and health matters. 	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
30 Sec. 835.204(b)	Prior to requesting an individual to participate in an authorized planned special exposure, the individual's dose from all previous planned special exposures and all doses in excess of the occupational dose limits shall be determined.	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.
31 Sec. 835.204(c)	An individual shall not receive a planned special exposure that, in addition to the doses determined in Sec. 835.204(b), would result in a dose exceeding the following: (1) In a year, the numerical values of the dose limits established at § 835.202(a); and (2) Over the individual's lifetime, five times the numerical values of the dose limits established at § 835.202(a).	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.
32 Sec. 835.204(d)	Prior to a planned special exposure, written consent shall be obtained from each individual involved. Each such written consent shall include: (1) The purpose of the planned operations and procedures to be used; (2) The estimated doses and associated potential risks and specific radiological conditions and other hazards which might be involved in performing the task; and (3) Instructions on the measures to be taken to keep the dose ALARA considering other risks that may be present	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.
33 Sec. 835.204(e)	Records of the conduct of a planned special exposure shall be maintained and a written report submitted within 30 days after the planned special exposure to the approving organizations identified in Sec. 835.204(a)(3).	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.
34 Sec. 835.204(f)	The dose from planned special exposures is not to be considered in controlling future occupational dose of the individual under Sec. 835.202(a), but is to be included in records and reports required under this part.	This 10 CFR 835 requirement does not need to be addressed in the TWRS-P RPP for the design phase.



BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
35 Sec. 835.205(a) Determination of compliance for non-uniform exposure of the skin.	Non-uniform exposures of the skin from X-rays, beta radiation, and/or radioactive material on the skin are to be assessed as specified in this section.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.



BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
36 Sec. 835.205(b)	<p>For purposes of demonstrating compliance with Sec. 835.202(a)(4), assessments shall be conducted as follows:</p> <p>(1) <i>Area of skin irradiated is 100 cm² or more.</i> The non-uniform dose equivalent received during the year shall be averaged over the 100 cm² of the skin receiving the maximum dose, added to any uniform dose equivalent also received by the skin, and recorded as the shallow dose equivalent to any extremity or skin for the year.</p> <p>(2) <i>Area of skin irradiated is 10 cm² or more, but is less than 100 cm².</i> The non-uniform dose equivalent (H) to the irradiated area received during the year shall be added to any uniform dose equivalent also received by the skin and recorded as the shallow dose equivalent to any extremity or skin for the year. H is the dose equivalent averaged over the 1 cm² of skin receiving the maximum absorbed dose, D, reduced by the fraction f, which is the irradiated area in cm² divided by 100 cm² (i.e., H=fD). In no case shall a value of f less than 0.1 be used.</p> <p>(3) <i>Area of skin irradiated is less than 10 cm².</i> The non-uniform dose equivalent shall be averaged over the 1 cm² of skin receiving the maximum dose. This dose equivalent shall:</p> <p>(i) Be recorded in the individual's occupational exposure history as a special entry; and</p> <p>(ii) Not be added to any other shallow dose equivalent to any extremity or skin recorded as the dose equivalent for the year.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.</p>



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
37 Sec. 835.206(a) Limits for the embryo/fetus	The dose equivalent limit for the embryo/fetus from the period of conception to birth, as a result of occupational exposure of a declared pregnant worker, is 0.5 rem (0.005 sievert).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of individual exposures.
38 Sec. 835.206(b)	Substantial variation above a uniform exposure rate that would satisfy the limits provided in Sec. 835.206(a) shall be avoided.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities that are likely to result in a TEDE \geq 50 mrem/yr.
39 Sec. 835.206(c)	If the dose equivalent to the embryo/fetus is determined to have already exceeded 0.5 rem (0.005 sievert) by the time a worker declares her pregnancy, the declared pregnant worker shall not be assigned to tasks where additional occupational exposure is likely during the remaining gestation period.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of individual exposures.
40 Sec. 835.207 Occupational dose limits for minors	The dose equivalent limits for minors occupationally exposed to radiation and/or radioactive materials at a DOE activity are 0.1 rem (0.001 sievert) total effective dose equivalent in a year and 10% of the occupational dose limits specified at § 835.202(a)(3) and (a)(4).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
41 Sec. 835.208 Limits for members of the public entering a controlled area	The total effective dose equivalent limit for members of the public exposed to radiation and/or radioactive material during access to a controlled area is 0.1 rem (0.001 sievert) in a year.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
42 Sec. 835.209(a) Concentrations of radioactive material in air	The derived air concentration (DAC) values given in appendices A and C of this part shall be used in the control of occupational exposures to airborne radioactive material.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site.
43 Sec. 835.209(b)	The estimation of internal dose shall be based on bioassay data rather than air concentration values unless bioassay data are: (1) Unavailable; (2) Inadequate; or (3) Internal dose estimates based on air concentration values are demonstrated to be as or more accurate.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of internal individual exposures.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
Subpart E	Monitoring of Individuals and Areas	
44 Sec. 835.401(a) General requirements	Monitoring of individuals and areas shall be performed to: <ol style="list-style-type: none"> (1) Demonstrate compliance with the regulations in this part; (2) Document radiological conditions; (3) Detect changes in radiological conditions; (4) Detect the gradual buildup of radioactive material; (5) Verify the effectiveness of engineering and process controls in containing radioactive material and reducing radiation exposure; and (6) Identify and control potential sources of individual exposure to radiation and/or radioactive material. 	This requirement is not applicable to the TWRS-P design phase. This requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is the potential for airborne or surface contamination or the presence of radioactive material.
45 Sec. 835.401(b)	Instruments and equipment used for monitoring shall be: <ol style="list-style-type: none"> (1) Periodically maintained and calibrated on an established frequency; (2) Appropriate for the type(s), levels, and energies of the radiation(s) encountered; (3) Appropriate for existing environmental conditions; and (4) Routinely tested for operability. 	This requirement is not applicable to the TWRS-P design phase. This requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is the potential for airborne or surface contamination or the presence of radioactive material.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
46 Sec. 835.402(a) Individual monitoring.	<p>For the purpose of monitoring individual exposures to external radiation, personnel dosimetry shall be provided to and used by:</p> <ul style="list-style-type: none"> (1) Radiological workers who, under typical conditions, are likely to receive one or more of the following: <ul style="list-style-type: none"> (i) An effective dose equivalent to the whole body of 0.1 rem (0.001 sievert) or more in a year; (ii) A shallow dose equivalent to the skin or to any extremity of 5 rems (0.05 sievert) or more in a year; (iii) A lens of the eye dose equivalent of 1.5 rems (0.015 sievert) or more in a year; (2) Declared pregnant workers who are likely to receive from external sources a dose equivalent to the embryo/fetus in excess of 10 percent of the limit at Sec. 835.206(a); (3) Occupationally exposed minors likely to receive a dose in excess of 50 percent of the applicable limits at § 835.207 in a year from external sources; (4) Members of the public entering a controlled area likely to receive a dose in excess of 50 percent of the limit at § 835.208 in a year from external sources; and (5) Individuals entering a high or very high radiation area. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of individual exposures.</p>



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
47 Sec. 835.402(b)	<p>External dose monitoring programs implemented to demonstrate compliance with § 835.402(a) shall be adequate to demonstrate compliance with the dose limits established in subpart C of this part and shall be:</p> <ol style="list-style-type: none"> (1) Accredited, or excepted from accreditation, in accordance with the DOE Laboratory Accreditation Program for Personnel Dosimetry; or (2) Determined by the Secretarial Officer responsible for environment, safety and health matters to have performance substantially equivalent to that of programs accredited under the DOE Laboratory Accreditation Program for Personnel Dosimetry. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of external individual exposures.</p>
48 Sec. 835.402(c)	<p>For the purpose of monitoring individual exposures to internal radiation, internal dosimetry programs (including routine bioassay programs) shall be conducted for:</p> <ol style="list-style-type: none"> (1) Radiological workers who, under typical conditions, are likely to receive a committed effective dose equivalent of 0.1 rem (0.001 sievert) or more from all occupational radionuclide intakes in a year; (2) Declared pregnant workers likely to receive an intake or intakes resulting in a dose equivalent to the embryo/fetus in excess of 10 percent of the limit stated in Sec. 835.206(a); (3) Occupationally exposed minors who are likely to receive a dose in excess of 50 percent of the applicable limit stated at § 835.207 from all radionuclide intakes in a year; or (4) Members of the public entering a controlled area likely to receive a dose in excess of 50 percent of the limit stated at § 835.208 from all radionuclide intakes in a year. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to conditions requiring the monitoring of internal individual exposures.</p>



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
49 Sec. 835.402(d)	<p>Internal dose monitoring programs implemented to demonstrate compliance with § 835.402(c) shall be adequate to demonstrate compliance with the dose limits established in subpart C of this part and shall be:</p> <p>(1) Accredited, or excepted from accreditation, in accordance with the DOE Laboratory Accreditation Program for Radiobioassay; or,</p> <p>(2) Determined by the Secretarial Officer responsible for environment, safety and health matters to have performance substantially equivalent to that of programs accredited under the DOE Laboratory Accreditation Program for Radiobioassay.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site.</p>
50 Sec. 835.403(a) Air monitoring	<p>Monitoring of airborne radioactivity shall be performed:</p> <p>(1) Where an individual is likely to receive an exposure of 40 or more DAC-hours in a year; or</p> <p>(2) As necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides have been prescribed.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted in the presence of airborne radioactive material.</p>
51 Sec. 835.403(b)	<p>Real-time air monitoring shall be performed as necessary to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted in the presence of airborne radioactive material.</p>



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
52 Sec. 835.405(a) Receipt of packages containing radioactive materials	If packages containing quantities of radioactive material in excess of a Type A quantity (as defined at 10 CFR 71.4) are expected to be received from radioactive material transportation, arrangements shall be made to either: (1) Take possession of the package when the carrier offers it for delivery; or (2) Receive notification as soon as practicable after arrival of the package at the carrier's terminal and to take possession of the package expeditiously after receiving such notification.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the expected receipt from radioactive material transportation of quantities of radioactive materials in excess of a Type A quantity (as defined at 10 CFR 71.4).
53 Sec. 835.405(b)	Upon receipt from radioactive material transportation, external surfaces of packages known to contain radioactive material shall be monitored if the package: (1) Is labeled with a Radioactive White I, Yellow II, or Yellow III label (as specified at 49 CFR 172.403 and 172.436-440); or (2) Has been transported as low specific activity material (as defined at 10 CFR 71.4) on an exclusive use vehicle (as defined at 10 CFR 71.4); or (3) Has evidence of degradation, such as packages that are crushed, wet, or damaged.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the expected receipt from radioactive material transportation of quantities of radioactive materials in excess of a Type A quantity (as defined at 10 CFR 71.4).
54 Sec. 835.405(c)	The monitoring required by paragraph (b) of this section shall include: (1) Measurements of removable contamination levels, unless the package contains only special form (as defined at 10 CFR 71.4) or gaseous radioactive material; and (2) Measurements of the radiation levels, unless the package contains less than a Type A quantity (as defined at 10 CFR 71.4) of radioactive material.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the expected receipt from radioactive material transportation of quantities of radioactive materials in excess of a Type A quantity (as defined at 10 CFR 71.4).



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
55 Sec. 835.405(d)	The monitoring required by paragraph (b) of this section shall be completed as soon as practicable following receipt of the package, but not later than 8 hours after the beginning of the working day following receipt of the package.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the expected receipt from radioactive material transportation of quantities of radioactive materials in excess of a Type A quantity (as defined at 10 CFR 71.4).
Subpart F	Entry Control Program	
56 Sec. 835.501(a) Radiological areas.	Personnel entry control shall be maintained for each radiological area.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
57 Sec. 835.501(b)	The degree of control shall be commensurate with existing and potential radiological hazards within the area.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
58 Sec. 835.501(c)	One or more of the following methods shall be used to ensure control: (1) Signs and barricades; (2) Control devices on entrances; (3) Conspicuous visual and/or audible alarms; (4) Locked entrance ways; or (5) Administrative controls.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
59 Sec. 835.501(d)	Written authorizations shall be required to control entry into and perform work within radiological areas. These authorizations shall specify radiation protection measures commensurate with the existing and potential hazards.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
60 Sec. 835.501(e)	No control(s) shall be installed at any radiological area exit that would prevent rapid evacuation of personnel under emergency conditions.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.



BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
61 Sec. 835.502(a) High and very high radiation areas.	The following measures shall be implemented for each entry into a high radiation area: (1) The area shall be monitored as necessary during access to determine the exposure rates to which the individuals are exposed; and (2) Each individual shall be monitored by a supplemental dosimetry device or other means capable of providing an immediate estimate of the individual's integrated deep dose equivalent during the entry.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the likely need for high radiation areas.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
62 Sec. 835.502(b) Physical controls	<p>One or more of the following features shall be used for each entrance or access point to a high radiation area where radiation levels exist such that an individual could exceed a deep dose equivalent to the whole body of 1 rem (0.01 sievert) in any one hour at 30 centimeters from the source or from any surface that the radiation penetrates:</p> <ol style="list-style-type: none"> (1) A control device that prevents entry to the area when high radiation levels exist or upon entry causes the radiation level to be reduced below that level defining a high radiation area; (2) A device that functions automatically to prevent use or operation of the radiation source or field while individuals are in the area; (3) A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; (4) Entryways that are locked. During periods when access to the area is required, positive control over each entry is maintained; (5) Continuous direct or electronic surveillance that is capable of preventing unauthorized entry; (6) A control device that will automatically generate audible and visual alarm signals to alert personnel in the area before use or operation of the radiation source and in sufficient time to permit evacuation of the area or activation of a secondary control device that will prevent use or operation of the source. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the likely need for high radiation areas.</p>
63 Sec. 835.502(c) Very high radiation areas	<p>In addition to the above requirements, additional measures shall be implemented to ensure individuals are not able to gain unauthorized or inadvertent access to very high radiation areas.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the likely need for very high radiation areas.</p>



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
64 Sec. 835.502(d)	No control(s) shall be established in a high or very high radiation area that would prevent rapid evacuation of personnel.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the likely need for high or very high radiation areas.
Subpart G	Posting and Labeling	
65 Sec. 835.601(a) General requirements	Except as otherwise provided in this subpart, postings and labels required by this subpart shall include the standard radiation warning trefoil in black or magenta imposed upon a yellow background.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
66 Sec. 835.601(b)	Signs required by this subpart shall be clearly and conspicuously posted and may include radiological protection instructions.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
67 Sec. 835.601(c)	The posting and labeling requirements in this subpart may be modified to reflect the special considerations of DOE activities conducted at private residences or businesses. Such modifications shall provide the same level of protection to individuals as the existing provisions in this subpart.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
68 Sec. 835.602(a) Controlled areas.	Each access point to a controlled area (as defined in Sec. 835.2) shall be posted, whenever radiological areas or radioactive material areas exist in the area. Individuals who enter only controlled areas without entering radiological areas or radioactive material areas are not expected to receive a total effective dose equivalent of more than 0.1 rem (0.001 sievert) in a year.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
69 Sec. 835.602(b)	Signs used for this purpose may be selected by the contractor to avoid conflict with local security requirements.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
70 Sec. 835.603 Radiological areas and radioactive material areas	<p>Each access point to radiological areas and radioactive material areas (as defined at Sec. 835.2) shall be posted with conspicuous signs bearing the wording provided in this section.</p> <p>(a) <i>Radiation area.</i> The words "Caution, Radiation Area" shall be posted at each radiation area</p> <p>(b) <i>High radiation area.</i> The words "Caution, High Radiation Area" or "Danger, High Radiation Area" shall be posted at each high radiation area.</p> <p>(c) <i>Very high radiation area.</i> The words "Grave Danger, Very High Radiation Area" shall be posted at each very high radiation area.</p> <p>(d) <i>Airborne radioactivity area.</i> The words "Caution, Airborne Radioactivity Area" or "Danger Airborne Radioactivity Area" shall be posted at each airborne radioactivity area.</p> <p>(e) <i>Contamination area.</i> The words "Caution, Contamination Area" shall be posted at each contamination area.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.</p>
	<p>(f) <i>High contamination area.</i> The words "Caution High Contamination Area" or "Danger, High Contamination Area" shall be posted at each high contamination area.</p> <p>(g) <i>Radioactive material area.</i> The words "Caution, Radioactive Material(s)" shall be posted at each radioactive material area.</p>	
71 Sec. 835.604(a) Exceptions to posting requirements	<p>Areas may be excepted from the posting requirements of § 835.603 for periods of less than 8 continuous hours when placed under continuous observation and control of an individual knowledgeable of, and empowered to implement, required access and exposure control measures.</p>	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.</p>



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
72 Sec. 835.604(b)	Areas may be excepted from the radioactive material area posting requirements of § 835.603(g) when: (1) Posted in accordance with § 835.603(a) through (f); or (2) Each item or container of radioactive material is labeled in accordance with this subpart such that individuals entering the area are made aware of the hazard; or (3) The radioactive material of concern consists solely of structures or installed components which have been activated (i.e. such as by being exposed to neutron radiation or particles produced in an accelerator).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
73 Sec. 835.604(c)	Areas containing only packages received from radioactive material transportation labeled and in non-degraded condition need not be posted in accordance with § 835.603 until the packages are monitored in accordance with § 835.405.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the expected receipt from transportation of quantities of radioactive materials in excess of a Type A quantity (as defined at 10 CFR 71.4).
74 Sect. 835.605 Labeling items and containers	Except as provided in § 835.606, each item or container of radioactive material shall bear a durable, clearly visible label bearing the standard radiation warning trefoil and the words "Caution, Radioactive Material" or "Danger, Radioactive Material." The label shall also provide sufficient information to permit individuals handling, using, or working in the vicinity of the items or containers, to take precautions to avoid or control exposures.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
75 Sec.835.606(a) Exceptions to labeling requirements	Items and containers may be excepted from the radioactive material labeling requirements of § 835.605 when: (1) Used, handled, or stored in areas posted and controlled in accordance with this subpart and sufficient information is provided to permit individuals to take precautions to avoid or control exposures; or (2) The quantity of radioactive material is less than one tenth of the values specified in appendix E of this part; or (3) Packaged, labeled, and marked in accordance with the regulations of the Department of Transportation or DOE Orders governing radioactive material transportation; or (4) Inaccessible, or accessible only to individuals authorized to handle or use them, or to work in the vicinity; or (5) Installed in manufacturing, process, or other equipment, such as reactor components, piping, and tanks; or (6) The radioactive material consists solely of nuclear weapons or their components.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
76 Sec. 835.606(b)	Radioactive material labels applied to sealed radioactive sources may be excepted from the color specifications of § 835.601(a).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the presence of sealed radioactive sources.
Subpart H	Records	
77 Sec. 835.701(a) General provisions.	Records shall be maintained to document compliance with this part and with radiation protection programs required by Sec. 835.101.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.
78 Sec. 835.701(b)	Unless otherwise specified in this subpart, records shall be retained until final disposition is authorized by DOE.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
79 Sec. 835.702(a) Individual monitoring records.	Records shall be maintained to document doses received by all individuals for whom monitoring was required pursuant to Sec. 835.402 and to document doses received during planned special exposures, unplanned doses exceeding the monitoring thresholds of Sec. 835 .402, and authorized emergency exposures.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.
80 Sec. 835.702(b)	The results of individual external and internal dose monitoring that is performed, but not required by Sec. 835.402, shall be recorded. Recording of non-uniform shallow dose equivalent to the skin is not required if the dose is less than 2 percent of the limit specified for the skin at Sec. 835.202(a)(4).	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
81 Sec. 835.702(c)	<p>The records required by this section shall:</p> <ol style="list-style-type: none"> (1) Be sufficient to evaluate compliance with subpart C of this part; (2) Be sufficient to provide dose information necessary to complete reports required by subpart I of this part; (3) Include the following quantities for external dose received during the year: <ol style="list-style-type: none"> (i) The effective dose equivalent from external sources of radiation (deep dose equivalent may be used as effective dose equivalent for external exposure); (ii) The lens of the eye dose equivalent; (iii) The shallow dose equivalent to the skin; and (iv) The shallow dose equivalent to the extremities. (4) Include the following information for internal dose resulting from intakes received during the year: <ol style="list-style-type: none"> (i) Committed effective dose equivalent; (ii) Committed dose equivalent to any organ or tissue of concern; and (iii) Identity of radionuclides. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.</p>



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
	<p>(5) Include the following quantities for the summation of the external and internal dose:</p> <ul style="list-style-type: none"> (i) Total effective dose equivalent in a year; (ii) For any organ or tissue assigned an internal dose during the year, the sum of the deep dose equivalent from external exposures and the committed dose equivalent to that organ or tissue; and (iii) Cumulative total effective dose equivalent <p>(6) Include the dose equivalent to the embryo/fetus of a declared pregnant worker.</p>	
82 Sec. 835.702(d)	Documentation of all occupational doses received during the current year, except for doses resulting from planned special exposures conducted in compliance with § 835.204 and emergency exposures authorized in accordance with § 835.1302(d), shall be obtained to demonstrate compliance with Sec. 835.202(a). If complete records documenting previous occupational dose during the year cannot be obtained, a written estimate signed by the individual may be accepted to demonstrate compliance.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
83 Sec. 835.702(e)	For radiological workers whose occupational dose is monitored in accordance with § 835.402, reasonable efforts shall be made to obtain complete records of prior years occupational internal and external doses.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
84 Sec. 835.702(f)	The records specified in this section that are identified with a specific individual shall be readily available to that individual.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
85 Sec. 835.702(g)	Data necessary to allow future verification or reassessment of the recorded doses shall be recorded.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
86 Sec. 835.702(h)	All records required by this section shall be transferred to the DOE upon cessation of activities at the site that could cause exposure to individuals.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
Sec. 835.703 Other monitoring records.	The following information shall be documented and maintained:	
87 Sec. 835.703(a)	Results of monitoring for radiation and radioactive material as required by subparts E and L of this part, except for monitoring required by Sec. 835.1102(d).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
88 Sec. 835.703(b)	Results of monitoring used to determine individual occupational dose from external and internal sources;	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
89 Sec. 835.703(c)	Results of monitoring for the release and control of material and equipment as required by Sec. 835.1101; and	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
90 Sec. 835.703(d)	Results of maintenance and calibration performed on instruments and equipment as required by Sec. 835.401(b).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
91 Sec. 835.704(a) Administrative records.	Training records shall be maintained, as necessary, to demonstrate compliance with Secs. 835.901.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.3 of the text of this RPP.
92 Sec. 835.704(b)	Actions taken to maintain occupational exposures as low as reasonably achievable, including the actions required for this purpose by Sec. 835.101, as well as facility design and control actions required by Secs. 835.1001, 835.1002, and 835.1003, shall be documented.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Sections 5.5.12 and 5.5.14 of the text of this RPP.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
93 Sec. 835.704(c)	Records shall be maintained to document the results of internal audits and other reviews of program content and implementation.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Sections 5.2 and 5.3 of the text of this RPP.
94 Sec. 835.704(d)	Written declarations of pregnancy, including the estimated date of conception, and revocations of declarations of pregnancy shall be maintained.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
95 Sec. 835.704(e)	Changes in equipment, techniques, and procedures used for monitoring shall be documented.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
96 Sec. 835.704(f)	Records shall be maintained as necessary to demonstrate compliance with the requirements of §§ 835.1201 and 835.1202 for sealed radioactive source control, inventory, and source leak tests.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to the presence of sealed radioactive sources.
Subpart I	Reports to Individuals	
97 Sec. 835.801(a) Reports to individuals.	Radiation exposure data for individuals monitored in accordance with Sec. 835.402 shall be reported as specified in this section. The information shall include the data required under Sec. 835.702(c). Each notification and report shall be in writing and include: the DOE site or facility name, the name of the individual, and the individual's social security number, employee number, or other unique identification number.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P-RPP prior to conditions requiring the monitoring of individual exposures.
98 Sec. 835.801(b)	Upon the request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by that employee based on available information shall be provided at the time of termination, if requested.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P-RPP prior to conditions requiring the monitoring of individual exposures.
99 Sec. 835.801(c)	Each DOE- or DOE-contractor-operated site or facility shall, on an annual basis, provide a radiation dose report to each individual monitored during the year at that site or facility in accordance with Sec. 835.402.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P-RPP prior to conditions requiring the monitoring of individual exposures.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
100 Sec. 835.801(d)	Detailed information concerning any individual's exposure shall be made available to the individual upon request of that individual, consistent with the provisions of the Privacy Act (5 U.S.C. 552a).	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P-RPP prior to conditions requiring the monitoring of individual exposures.
101 Sec. 835.801(e)	When a DOE contractor is required to report to the Department, pursuant to Departmental requirements for occurrence reporting and processing, any exposure of an individual to radiation and/or radioactive material, or planned special exposure in accordance with Sec. 835.204(e), the contractor shall also provide that individual with a report on his or her exposure data included therein. Such report shall be transmitted at a time not later than the transmittal to the Department.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P-RPP prior to conditions requiring the monitoring of individual exposures.
Subpart J	Radiation Safety Training	
102 Sec. 835.901(a) Radiation safety training	Each individual shall complete radiation safety training on the topics established at § 835.901(c) commensurate with the hazards in the area and the required controls: (1) Before being permitted unescorted access to controlled areas; and (2) Before receiving occupational dose during access to controlled areas at a DOE site or facility.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
103 Sec. 835.901(b)	Each individual shall demonstrate knowledge of the radiation safety training topics established at § 835.901(c), commensurate with the hazards in the area and required controls, by successful completion of an examination and performance demonstrations: (1) Before being permitted unescorted access to radiological areas; and (2) Before performing unescorted assignments as a radiological worker.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
104 Sec. 835.901(c)	<p>Radiation safety training shall include the following topics, to the extent appropriate to each individual's prior training, work assignments, and degree of exposure to potential radiological hazards:</p> <ol style="list-style-type: none"> (1) Risks of exposure to radiation and radioactive materials, including prenatal radiation exposure; (2) Basic radiological fundamentals and radiation protection concepts; (3) Physical design features, administrative controls, limits, policies, procedures, alarms, and other measures implemented at the facility to manage doses and maintain doses ALARA, including both routine and emergency actions; (4) Individual rights and responsibilities as related to implementation of the facility radiation protection program; (5) Individual responsibilities for implementing ALARA measures required by § 835.101; and (6) Individual exposure reports that may be requested in accordance with § 835.801. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.</p>
105 Sec. 835.901(d)	<p>When an escort is used in lieu of training in accordance with paragraph (a) or (b) of this section, the escort shall:</p> <ol style="list-style-type: none"> (1) Have completed radiation safety training, examinations, and performance demonstrations required for entry to the area and performance of the work; and (2) Ensure that all escorted individuals comply with the documented radiation protection program. 	<p>This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.</p>



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
106 Sec. 835.901(e)	Radiation safety training shall be provided to individuals when there is a significant change to radiation protection policies and procedures that may affect the individual and at intervals not to exceed 24 months. Such training provided for individuals subject to the requirements of § 835.901(b)(1) and (b)(2) shall include successful completion of an examination.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
Subpart K	Design and Control	
107 Sec. 835.1001(a) Design and control.	Measures shall be taken to maintain radiation exposure in controlled areas ALARA through physical design features and administrative control. The primary methods used shall be physical design features (e.g., confinement, ventilation, remote handling, and shielding). Administrative controls shall be employed only as supplemental methods to control radiation exposure.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Sections 5.5, 5.5.10.1, and 5.5.10.2 of the text of this RPP.
108 Sec. 835.1001(b)	For specific activities where use of physical design features is demonstrated to be impractical, administrative controls shall be used to maintain radiation exposures ALARA.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.10.3 of the text of this RPP.
Sec. 835.1002 Facility design and modifications	During the design of new facilities or modification of existing facilities, the following objectives shall be adopted:	
109 Sec. 835.1002(a)	Optimization methods shall be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Sections 5.5.8 and 5.5.10.4 of the text of this RPP.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
110 Sec. 835.1002(b)	The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 mrem (5 microsieverts) per hour and as far below this average as is reasonably achievable. The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above shall be ALARA and shall not exceed 20 percent of the applicable standards in Sec. 835.202.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.10.9 and 5.5.10.10 of the text of this RPP.
111 Sec. 835.1002(c)	Regarding the control of airborne radioactive material, the design objective shall be, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA; confinement and ventilation shall normally be used.	The plans and measures for achieving compliance with these 10 CFR 835 requirements are described in Sections 5.5.10.5 and 5.5.10.6 of the text of this RPP.
112 Sec. 835.1002(d)	The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning.	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.10.7 of the text of this RPP.
113 Sec. 835.1003(a) Workplace controls	During routine operations, the combination of physical design features and administrative controls shall provide that: (a) The anticipated occupational dose to general employees shall not exceed the limits established at § 835.202; and	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.10.8 of the text of this RPP.
114 Sec. 835.1003(b)	The ALARA process is utilized for personnel exposures to ionizing radiation	The plans and measures for achieving compliance with this 10 CFR 835 requirement are described in Section 5.5.10.8 of the text of this RPP.



**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
Subpart L	Radioactive Contamination Control	
115 Sec. 835.1101(a) Control of material and equipment	<p>Except as provided in paragraphs (b) and (c) of this section, material and equipment in contamination areas, high contamination areas, and airborne radioactivity areas shall not be released to a controlled area if:</p> <p>(1) Removable surface contamination levels on accessible surfaces exceed the removable surface contamination values specified in appendix D of this part; or</p> <p>(2) Prior use suggests that the removable surface contamination levels on inaccessible surfaces are likely to exceed the removable surface contamination values specified in appendix D of this part.</p>	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted in the presence of radioactive contamination.
116 Sec. 835.1101(b)	Material and equipment exceeding the removable surface contamination values specified in appendix D of this part may be conditionally released for movement on-site from one radiological area for immediate placement in another radiological area only if appropriate monitoring is performed and appropriate controls for the movement are established and exercised.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
117 Sec. 835.1101(c)	<p>Material and equipment with fixed contamination levels that exceed the total contamination values specified in appendix D of this part may be released for use in controlled areas outside of radiological areas only under the following conditions:</p> <p>(1) Removable surface contamination levels are below the removable surface contamination values specified in appendix D of this part; and</p> <p>(2) The material or equipment is routinely monitored and clearly marked or labeled, to alert personnel of the contaminated status.</p>	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
118 Sec. 835.1102(a) Control of areas	Appropriate controls shall be maintained and verified which prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
119 Sec. 835.1102(b)	Any area in which contamination levels exceed the values specified in appendix D of this part shall be controlled in a manner commensurate with the physical and chemical characteristics of the contaminant, the radionuclides present, and the fixed and removable surface contamination levels.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
120 Sec. 835.1102(c)	Areas accessible to individuals where the measured total surface contamination levels exceed, but the removable surface contamination levels are less than, corresponding surface contamination values specified in appendix D of this part, shall be controlled as follows when located outside of radiological areas: (1) The area shall be routinely monitored to ensure the removable surface contamination level remains below the removable surface contamination values specified in appendix D of this part; and (2) The area shall be conspicuously marked to warn individuals of the contaminated status.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
121 Sec. 835.1102(d)	Individuals exiting contamination, high contamination, or airborne radioactivity areas shall be monitored, as appropriate, for the presence of surface contamination.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
122 Sec. 835.1102 (e)	Protective clothing shall be required for entry to areas in which removable contamination exists at levels exceeding the removable surface contamination values specified in appendix D of this part.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
Subpart M	Sealed Radioactive Source Control	
123 Sec. 835.1201 Sealed radioactive source control	Sealed radioactive sources shall be used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving sealed radioactive sources.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
124 Sec. 835.1202(a)	Each accountable sealed radioactive source shall be inventoried at intervals not to exceed six months. This inventory shall: (1) Establish the physical location of each accountable sealed radioactive source; (2) Verify the presence and adequacy of associated postings and labels; and (3) Establish the adequacy of storage locations, containers, and devices.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving accountable sealed radioactive sources.
125 Sec. 835.1202(b)	Except for sealed radioactive sources consisting solely of gaseous radioactive material or tritium, each accountable sealed radioactive source shall be subject to a source leak test upon receipt, when damage is suspected, and at intervals not to exceed six months. Source leak tests shall be capable of detecting radioactive material leakage equal to or exceeding 0.005 microcurie.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving accountable sealed radioactive sources.
126 Sec. 835.1202(c)	Notwithstanding the requirements of paragraph (b) of this section, an accountable sealed radioactive source is not subject to periodic source leak testing if that source has been removed from service. Such sources shall be stored in a controlled location, subject to periodic inventory as required by paragraph (a) of this section, and subject to source leak testing prior to being returned to service.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving accountable sealed radioactive sources.
127 Sec. 835.1202(d)	Notwithstanding the requirements of paragraphs (a) and (b) of this section, an accountable sealed radioactive source is not subject to periodic inventory and source leak testing if that source is located in an area that is unsafe for human entry or otherwise inaccessible.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving accountable sealed radioactive sources.
128 Sec. 835.1202(e)	An accountable sealed radioactive source found to be leaking radioactive material shall be controlled in a manner that minimizes the spread of radioactive contamination.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities involving accountable sealed radioactive sources.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
Subpart N	Emergency Exposure Situations	
129 Sec. 835.1301(a) General provisions	A general employee whose occupational dose has exceeded the numerical value of any of the limits specified in Sec. 835.202 as a result of an authorized emergency exposure may be permitted to return to work in radiological areas during the current year providing that all of the following conditions are met: (1) Approval is first obtained from the contractor management and the Head of the responsible DOE field organization; (2) The individual receives counseling from radiological protection and medical personnel regarding the consequences of receiving additional occupational exposure during the year; and (3) The affected employee agrees to return to radiological work.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
130 Sec. 835.1301(b)	All doses exceeding the limits specified in Sec. 835.202 shall be recorded in the affected individual's occupational dose record.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
131 Sec. 835.1301(c)	When the conditions under which a dose was received in excess of the limits specified in Sec. 835.202, except those received in accordance with Sec. 835.204, have been eliminated, operating management shall notify the Head of the responsible DOE field organization.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
132 Sec. 835.1301(d)	Operations after a dose was received in excess of the limits specified in Sec. 835.202, except those received in accordance with Sec. 835.204 may be resumed only with the approval of DOE.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities with the potential for occupational radiation exposure. Such activities include surveillance of a potentially contaminated site or radiography.
133 Sec. 835.1302(a) Emergency exposure situations.	The risk of injury to those individuals involved in rescue and recovery operations shall be minimized.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.



**TWRS-P PROJECT
RADIATION PROTECTION PROGRAM FOR DESIGN
BNFL-TWP-SER-003, Rev. 2**

**BNFL INC. TWRS-P COMPLIANCE WITH 10 CFR 835 REQUIREMENTS
(DESIGN PHASE)**

Requirement # 10 CFR 835 Citation	Requirement	Plans and Measures for Achieving Compliance
134 Sec. 835.1302(b)	Operating management shall weigh actual and potential risks against the benefits to be gained.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
135 Sec. 835.1302(c)	No individual shall be required to perform a rescue action that might involve substantial personal risk.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
136 Sec. 835.1302(d)	Each individual authorized to perform emergency actions likely to result in occupational doses exceeding the values of the limits provided at § 835.202(a) shall be trained in accordance with § 835.901(b) and briefed beforehand on the known or anticipated hazards to which the individual will be subjected.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities conducted where there is a potential for airborne or surface contamination or the presence of radioactive material.
137 Sec. 835.1304(a) Nuclear accident dosimetry.	Installations possessing sufficient quantities of fissile material to potentially constitute a critical mass, such that the excessive exposure of individuals to radiation from a nuclear accident is possible, shall provide nuclear accident dosimetry for those individuals.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities if there is a potential for nuclear criticality.
138 Sec. 835.1304(b)	Nuclear accident dosimetry shall include the following: (1) A method to conduct initial screening of individuals involved in a nuclear accident to determine whether significant exposures to radiation occurred; (2) Methods and equipment for analysis of biological materials; (3) A system of fixed nuclear accident dosimeter units; and (4) Personal nuclear accident dosimeters.	This requirement is not applicable to the TWRS-P design phase. This 10 CFR 835 requirement shall be addressed in the TWRS-P RPP prior to activities if there is a potential for nuclear criticality.