U.S. Department of Energy
Office of River Protection
Mr. R. J. Schepens
Manager
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

CCN: 040383

Dear Mr. Schepens:

CONTRACT NO. DE-AC27-01RV14136 – TRANSMITTAL FOR APPROVAL – AUTHORIZATION BASIS CHANGE NOTICE 24590-WTP-ABCN-ESH-02-025, REVISION 0, *AUTHORIZATION BASIS MAINTENANCE*

Reference: CCN 042209, Letter, R. J. Schepens, ORP, to R. F. Naventi, BNI, "Office of River Protection Position on Contractor-Initiated Changes to the Authorization Basis," 02-OSR-0430, dated September 18, 2002.

Bechtel National, Inc. (BNI) is submitting Authorization Basis Change Notice (ABCN), 24590-WTP-ABCN-ESH-02-025, Revision 0, to the U.S. Department of Energy (DOE), Office of River Protection for approval (attached). This ABCN implements RL/REG-97-13, Revision 9, *Office of Safety Regulation Position on Contractor-Initiated Changes to the Authorization Basis.* This authorization basis (AB) change modifies and/or clarifies various processes used by the Hanford Tank Waste Treatment and Immobilization project to change the AB documents.

Approval of this ABCN is requested by October 24, 2002. Expedited approval will result in fewer ABCNs requiring DOE approval (for administrative control changes), thus saving time and effort for both DOE and BNI.

An electronic copy of ABCN 24590-WTP-ABCN-ESH-02-025, Revision 0, is provided for the DOE's information and use.

Please contact Mr. Bill Spezialetti at (509) 371-4654 for any questions or comments.

Very truly yours,

R. F. Naventi
Project Manager

MP/slr

Attachment: Authorization Basis Change Notice (ABCN), 24590-WTP-ABCN-ESH-02-025, Revision 0, plus attachments

cc: Name (ALPHABETIZE)	Organization	MSIN
Barr, R. C. w/a (1 hard copy and 1 electronic copy)	OSR	H6-60
Barrett, M. K. w/a	ORP	H6-60
Beranek, F. w/o	WTP	MS6-P1
Betts, J. P. w/o	WTP	MS4-A1
Dickey, R. L. w/a	WTP	MS6-R1
DOE Correspondence Control w/a	ORP	H6-60
Erickson, L. w/a	ORP	H6-60
Gibson, K. D. w/a	WTP	MS6-R1
Klein, D. A. w/a	WTP	MS6-P1
Naventi, R. F. w/o	WTP	MS4-A1
Ollero, J. E. w/o	ORP	H6-60
PDC w/a	WTP	MS5-K1
Platt, M. A. w/o	WTP	MS6-R1
QA Project Files w/a	WTP	MS4-A2
Ryan, T. B. w/a	WTP	MS6-R1
Spezialetti, W. R. w/o	WTP	MS6-P1
Struthers, D. J. w/o	ORP	H6-60
Swailes, J. H. w/a	ORP	H6-60
Taylor, W. J. w/a	ORP	H6-60
Veirup, A. R. w/o	WTP	MS4-A1

Authorization Basis Change Notice

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

I. ABCN Review and Approval Signatures

A. ABCN Preparation

	Print/Type Name	Signature	Date
Preparer:	Mark Platt		
Reviewer:	Rodger Dickey		

B. Required Reviewers

Review Required? *For each person checked, that signature block must be completed.*

Review Required?	Role	Print/Type Name	Signature	Date
☒	ES&H Manager	Fred Beranek		
☒	QA Manager	George Shell		
☒	PSC Chair	Bill Poulson		
☒	Commissioning/Training Manager	Jim Wilson		
☒	Engineering Manager	Fred Marsh		
☒	Construction Manager	Bill Clements		
☒	Area Project Manager	Bob Lawence		
☒	Research & Technology Manager	Todd Wright		
☐	PMT Chair	Dennis Klein		
☐	Other Affected Organization			
☐	Other Affected Organization			
☐	Other Affected Organization			

C. ABCN Approval

	Print/Type Name	Signature	Date
WTP Project Manager	Ron Naventi		

Authorization Basis Change Notice

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

II. Description of the Proposed Change to the Authorization Basis

D. Affected AB Documents:

Title	Document Number	Revision
Integrated Safety Management Plan (ISMP)	24590-WTP-ISMP-ESH-01-001	1

Decision to Deviate ☐ Yes ☐ No

If yes, DTD Number/Revision ______ DTD Closure Date: ______

Initiating Document Number/Revision RL/REG-97-13 Revision 9

E. Describe the proposed changes to the Authorization Basis Documents:

See Attachment 1 for detailed AB document changes (redline and clean copy versions).

The purpose of this ABCN is to implement Revision 9 (dated 8/16/2002) to DOE document RL/REG-97-13, *Office of Safety Regulation Position on Contractor-Initiated Changes to the Authorization Basis,* and to modify and/or clarify various processes used by the RPP-WTP project to change the authorization basis. Proposed changes to the Integrated Safety Manmagement Plan (ISMP) section 3.3.3, entitled Changes to the Authorization Basis, can be summarized as follows:

1. Adds wording to the Safety Evaluation sections of the ISMP for changing administrative controls to include conformance to the SRD as an additional requirement.

2. Adds a specific requirement that Safety Evaluations provide rationale that show all DOE approval thresholds (8 items for facility changes, 5 items for administrative control changes) are met. The consequence of this new requirement will be formal written Safety Evaluations, as separate, numbered project records, for each AB change, including decisions to deviate.

3. Relieves the requirement to maintain the PSAR and LCAR page changes current with facility changes affecting these AB documents. Adds a new annual update of the PSAR and LCAR by March 30 for all changes made during the previous calendar year. The consequence of this new AB maintenance process is the creation of two different AB change forms. An “Authorization Basis Change Notice” (ABCN) will be the vehicle for BNI-approved changes to the AB, notification of DOE of the changes in summary form, and for tracking the changes prior to the annual AB document update. An “Authorization Basis Amendment Request” (ABAR) will become the vehicle for requesting DOE-approved AB changes whenever that process is required and for use when submitting the annual update for DOE approval.

4. Adds a new condition that DOE may rescind BNI-approved AB changes (i.e., reject ABCNs) within 60 days of notification.

5. Removes the reduction in commitment and reduction in effectiveness thresholds for DOE approval for administrative control AB changes. The consequence of this change will be to give BNI broader authority to change administrative control AB requirements associated with implementing procedures, plans, programs, and management processes. These changes must still meet the five safety evaluation criteria described in RL/REG-97-13 and could be rejected by DOE within 60 days of notification.

6. Removes the Decision to Deviate (DTD) option for BNI-approved changes to the AB. The consequence of this change is that for facility changes affecting the AB that BNI can approve, an ABCN

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

E. Describe the proposed changes to the Authorization Basis Documents:

will need to be approved prior to the implementation of the physical change. The impact is that these types of AB changes will require the quick turnaround of the ABCN (in a matter of days) to compensate for the loss of flexibility previously provided by the DTD. Only one DTD of this type has been prepared by BNI through August 2002 (DTD for concrete as backfill/LCAR change).

F. List associated ABCNs and AB documents, if any:

None

G. Explain why the change is needed:

The change is needed to incorporate Revision 9 to RL/REG-97-13.

H. List the implementation activities and the projected completion dates:

Activity	**Date**
Inform DOE that AB has been revised and formally transmit electronic version	30 days following DOE approval
Distribute revised controlled copy pages / update WTP Library	30 days following DOE approval

Revise the following implementing documents:

	Documents	**Describe extent of revisions**	**Date**
1	24590-WTP-GPP-SREG-002, *Authorization Basis Maintenance*	Extensive rewrite to incorporate the ABCR, the formal Safety Evaluation, the annual PSAR/LCAR update process	60 days following DOE approval
2	24590-WTP-3DP-G04B-00046, *Engineering Drawings*	Revise Decision to Deviate process	60 days following DOE approval
3	24590-WTP-GPP-SREG-009, *Safety Screening and Safety Evaluations*	Write new procedure combining checklists from 24590-WTP-GPG-SREG-002, *ES&H Review of Documents* and 24590-WTP-GPG-ENG-030, *Safety Screen for Design Changes*	60 days following DOE approval

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

	Documents	**Describe extent of revisions**	**Date**
4	24590-WTP-CBT-TRA-000900, *Authorization Basis Maintenance*	Revise training module and lesson plan	60 days following DOE approval

	Describe other activities:	**Date**
1	N/A	
2		

III. Evaluation of the Proposed Change

I. Is DOE approval required? Answer questions for Administrative Control changes OR Facility changes, not both.

For an <u>Administrative Control</u> change: **Yes** **No**

1. Does the revision involve the deletion or modification of a standard previously identified or established in the SRD? ☒ Yes ☐ No

   Explain:

   This ABCN proposes changes to ISMP Section 3.3.3, which is a listed standard under SRD Safety Criterion 3.1-7, 9.0-4, and 9.1-4. For each safety criteria, the reference to ISMP Section 3.3.3, Changes to the Authorization Basis, ensures that AB changes are conducted in accordance with the ISMP. The wording in the ISMP and the precise change processes and documentation are in accordance with RL/REG-97-13, as specified in the BNI Contract with DOE. This ABCN reconciles the ISMP with Revision 9 to RL/REG-97-13. This ABCN does not cause a change to the SRD document itself.

2. Does the revision result in a reduction in commitment currently described in the AB? ☒ Yes ☐ No

   Explain:

   Since this change to the ISMP removes the previous "reduction in commitment" and "reduction in effectiveness" tests for administrative control changes to the AB, the impact of this change is, itself, a reduction in commitment. However, since the change has been directed by DOE in the form of a change to RL/REG-97-13 (a Contractual requirement), this change is required.

   This change also relieves the requirement to maintain the PSAR and LCAR page changes (approved by the Contrator) current with facility changes affecting these AB documents. The change allows an annual update of the PSAR and LCAR by March 30 for all changes made during the previous calendar year. The consequence of this new AB maintenance process is the creation of two different AB change forms. An "Authorization Basis Change Notice" (ABCN) will be the vehicle for BNI-approved changes to the AB, notification of DOE of the change in summary form, and for tracking the change prior to the annual update. An "Authorization Basis Amendment Request" (ABAR) will become the vehicle for requesting DOE-approved AB changes whenever that process is required and for use when submitting the annual AB document update for DOE approval.

   The impact of the annual update is a reduction in commitment to maintain the entire AB current at all times.

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

		Yes	No
3.	Does the revision result in a reduction in the effectiveness of any procedure, program, or plan described in the AB?	☐	☒

Explain:

As described in 2, above, the removal of the reduction in commitment and effectiveness tests and the removal of the requirement to maintain the AB current at all times does change the AB maintenance program described in the ISMP. However, procedure, program, and plan effectiveness are maintained because of the continuing requirements to do safety evaluations, management review and approvals, document retention and retrieval, DOE reviews, and other administrative processes to ensure the safety of the WTP prior to executing any change to the facility or administrative control.

For a Facility (technical) change:

		Yes	No
1.	Does the revision involve the deletion or modification of a standard previously identified or established in the SRD? Explain:	☐	☐
2.	Does the revision create a new Design Basis Event (DBE)? Explain:	☐	☐
3.	Does the revision result in the more than a minimal increase in the frequency or consequence of an analyzed DBE as described in the Safety Analysis Report? Explain:	☐	☐
4.	Does the revision result in more than a minimal decrease in the Safety Functions of important-to-safety SSCs or change how a Safety Design Class SSC meets its respective safety function? Explain:	☐	☐

J. Complete the safety evaluation by describing how the revision to the AB:

1. will continue to comply with all applicable laws and regulations (e.g., 10 CFR 830, 10 CFR 835), conform to top-level safety standards (e.g., DOE/RL-96-0006), and provide adequate safety.

This change complies with the requirement of 10 CFR 830.202, Safety Basis, by requiring the maintenance of the “safety basis”, (i.e., the Authorization Basis documents) via an annual update for DOE approval. This change complies with the requirements of DOE/RL-96-0006, section 4.1.3.1 requiring the establishment, documentation, submission, and maintenance of an Authorization Basis. This change continues to provide adequate safety because RL/REG-97-13 and the ISMP still require safety evaluations, management review and approval processes, document retention and retrieval practices, DOE review, and other work control processes to ensure the safety of the WTP prior to executing any change to the facility or administrative controls.

ABCN Number 24590-WTP-ABCN-ESH-02-025 Revision 0

ABCN Title Authorization Basis Maintenance

2. will continue to conform to the contract requirements associated with the authorization basis document(s) affected by the revision.

   This change continues to conform to the Contract requirements associated with the ISMP since the change implements the requirements of the latest revision to RL/REG-97-13, which is required by the Contract, Standard 7 (e)(2)(iii).

3. will not result in inconsistencies with other commitments and descriptions contained in portions of the authorization basis or an authorization agreement not being revised.

   This change does not result in inconsistencies with requirements and descriptions contained in the SRD, QAM, RPP, HAR, ISAR, LCAR, PSAR, the Limited Construction Authorization Agreement, or the Construction Authorization Ageement Between The U.S. Department of Energy, Office of River Protection and Bechtel National, Inc.

K. Justification of the Proposed Change

If the change requires DOE approval, provide a justification that demonstrates that the proposed change is safe.

This change continues to provide adequate safety because RL/REG-97-13 and the ISMP, as implemented by project procedures, still require safety evaluations, management review and approval processes, document retention and retrieval practices, DOE reviews, and other work control processes to ensure the safety of the WTP prior to executing any change to the facility or administrative controls.

L. Certification of Continued SRD Adequacy

Based on evaluations from III.I, if either question III.I.1 is marked "Yes", Project Manager certification is required. The Project Manager's signature certifies that the revised SRD continues to identify a set of standards that provides adequate safety, complies with WTP applicable laws and regulations, and conforms with top-level safety standards and principles. This certification is based on adherence to the DOE/RL-96-0004 standards identification process and successful completion of review and confirmation by the PSC.

WTP Project Manager:	Ron Naventi		
	Print/Type Name	*Signature*	*Date*

M. List of Attachments

1. Proposed changes to the ISMP.

24590-WTP-ABCN-ESH-02-025 Rev 0

Attachment 1

24590-WTP-ABCN-ESH-02-025, Revision 0

# of pages (including cover sheet): 43

3.0 Conformance to Top-Level Safety Standards and Principles

This chapter discusses the methods used to conform to top-level safety standards and principles. The top-level standards and principles include any of the safety standards or principles established in DOE/RL-96-0006, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b). Among the many topics covered in the following sections are defense-in-depth, quality assurance, safety culture, training and qualification of personnel, emergency preparedness and internal safety oversight. Integrated Safety Management Plan (ISMP) Section 4.1.1, "Development of the Safety Requirements Document", provides additional information on how the top-level safety standards have been addressed for the Project.

3.1 Defense-In-Depth

3.1.1 Approach to Defense-in-Depth

The BNI approach to the control of hazardous situations is by prevention and mitigation. Prevention of hazardous situations takes place either by removing the hazard or hazardous situation by design (for example, by substituting a non-hazardous chemical for a hazardous chemical) or by providing administrative and engineered controls such that the frequency of the hazardous situation is acceptably low. Mitigation of hazardous situations is accomplished by providing reliable and robust protection such that, if the hazardous situation were to occur, its consequences would be acceptably low. This reliability and robustness is achieved, in part, by the preference for passive engineered features with their inherent safety. Administrative controls for accident prevention include training and procedures related to normal operation and facility maintenance and the commitment to a strong safety culture (Section 3.4 "Safety/Quality Culture"). Engineered features that enhance accident prevention and mitigation include application of proven engineering practices (Section 3.7, "Proven Engineering Practices").

BNI uses a deterministic approach to control hazardous situations. This is accomplished in tandem with the evolving design. Early recognition of hazardous situations when the design is most flexible allows maximum use of this approach. Where hazardous situations cannot be removed by design, protection is identified to prevent or mitigate the hazardous situation. The degree of protection applied is commensurate with the consequence and frequency of the hazardous situation. Defense-in-depth means that multiple layers of protection are applied against the hazardous situation such that no one layer of protection is completely relied on to ensure safe operation of the facility. The number of layers of protection, or barriers, is dependent upon the severity (i.e., consequence) of the hazardous situation to be prevented or mitigated. The analysis to show compliance to the accident risk goals (SRD Safety Criteria 1.0-3 and 1.0-5) may identify the need not only for additional barriers to satisfy the accident risk goals, but also to achieve additional defense-in-depth. One aspect of defense in depth is that no single failure of protection will allow a hazardous situation to occur. Protection is either passive or active; passive protection features are inherent features of the design that provides protection without the need for any action (e.g., shielding).

An element of the line of defense against the occurrence of hazardous situations is training and procedures that serve to reduce the probability of operator error and facilitate prompt and proper operator response to offnormal conditions. This prompt and reliable operator response serves to reduce the challenges to preventative and mitigative engineered safety features.

While operator response is an element of defense-in-depth in achieving effective mitigation of accident conditions, in the evaluation of the consequence of accidents to the chemical and radiological exposure standards, credit is normally taken only for engineered features.

When offnormal situations occur, the protection against release of radiological and chemical materials is ensured through multiple confinement barriers. Primary confinement is the process vessels, piping, and the dedicated process vessel ventilation system (with filtration). Secondary confinement is the cell or glovebox and its ventilation system. Tertiary confinement is provided by the operating corridor outside the cell together with another dedicated ventilation system. Design features that reduce exposure are conservatively assessed to ensure adequate protection against hazardous situations.

Design features that offer defense against the potential for exposure include shielded maintenance areas (bulges), ventilation systems providing filtered release, and area radiation and airborne monitoring systems that warn personnel of changing or unsafe conditions.

The application of the requirements of the quality assurance program during design, procurement, construction, commissioning, inspections, operations, maintenance, and modifications provides assurance that the engineered and administrative controls perform as required. Surveillances of specific project activities are conducted to determine compliance of in-process activities to quality assurance program requirements. Performance monitoring is used to verify that the necessary programs, plans, and procedures are established and implemented to ensure that activities are maintained in compliance with the applicable requirements.

Emergency preparedness is the final element of the Project approach to defense-in-depth. Emergency preparedness provides assurance that, should a significant radiological and chemical release occur, prompt action can be achieved to limit the exposure to the public and workers. Emergency preparedness includes emergency plan implementing procedures as administrative controls and instrumentation to detect and monitor the progression of accidents as engineered features.

Defense-in-depth is applied by specifying that protection against a hazardous situation is always a combination of engineered features and administrative controls providing prevention and mitigation. This means that excessive reliance is not placed on any one system to provide the majority of protection. Each protection system (i.e., mitigative or preventative, engineered, and administrative) provides the required degree of protection on its own. The design process bins hazardous situations according to their assessed consequences and frequency, which results in obtaining a hierarchy of hazardous situations according to their severity. The more severe the hazardous situation, the greater the level of protection specified. For hazardous situations identified as having the potential to exceed the public or worker exposure standards, certain engineered features are designated as Safety Design Class (see ISMP Section 1.3.10, "Classification of Structures, Systems, and Components"). These engineered features are subject to additional design, quality assurance, operational, and maintenance requirements adding confidence in their ability to perform their specified safety function.

An example of the application of defense-in-depth is the protection provided against entry into a melter maintenance room when the melter cell shield door is open. The first line of defense against such entry is training and procedures. The training informs personnel of the high radiation field present when the melter cell shield door is open and the procedures to be followed for entry into the melter maintenance room. Procedures are used to control entry into a melter maintenance room including the use of a personnel access door key lock. Engineered features that protect against inappropriate entry include a door interlock that inhibits entry when a high radiation field exists in the maintenance room.

Facility design germane to defense-in-depth typically includes SSCs that function as the following:

1) Barriers to contain uncontrolled hazardous material or energy release
2) Preventative systems to prevent hazardous situations and to protect barriers
3) Systems to mitigate uncontrolled hazardous material or energy release given barrier failure
4) Interlocks and controls to prevent hazardous situations
5) Indication and alarms that warn of the occurrence of hazardous situations
6) Interlocks and controls to prevent access to high radiation sources

Administrative controls are linked to the overall safety management programs that directly control operation. Administrative features include the following aspect of operator interfaces:

1) Procedural restriction or limits imposed
2) Manual monitoring or critical parameters
3) Equipment support functions

In addition, risk analyses are performed to confirm that facility accident risk goals of *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006 (DOE-RL 1996b) are met. These risk analyses may show that certain events are significant contributors to the overall accident risk. Additional defense-in-depth items will be specified to reduce that risk. Conversely, if the risk assessment identifies areas of excessive conservation, unnecessary controls may be removed.

In summary, defense-in-depth is applied in the following manner:

1) Conservative identification of the hazardous situation
2) Conservatism is applied in assessing design features for normal operations such that they also provide protection against hazardous situations
3) If the hazardous situation cannot be eliminated from the design the potential consequence of the hazardous situation is conservatively assessed. This can be qualitative assessment (use of a binning matrix and judgement) or a quantitative frequency and consequence calculations if deemed appropriate

4) Use of operator training and procedures as an element of defense-in-depth (i.e., the operator responds appropriately to the development of a hazardous situation to return the facility to normal operation or to place the facility in a safe state)
5) The combination of engineered features and administrative controls provided depend on the overall severity class of the hazardous situation
6) If the potential for exceeding the public or worker radiological or chemical exposures standards exists, Safety Design Class engineered features are specified
7) Application of the quality assurance program to design, procurement, construction, and operation to provide additional assurance that administrative and engineered controls are effective
8) Emergency preparedness to provide assurance that, should a significant radiological and chemical release occur, prompt action can be achieved to limit the exposure to the public and workers

Implementation of defense-in-depth for the Project is accomplished by the *Implementing Standard for Defense In Depth*.

3.2 Safety Responsibilities

BNI recognizes its corporate responsibility for safety during the design, construction, and commissioning (DC&C) phase of the project. Safety responsibilities are assigned to and by the Project Manager. The DC&C responsibilities are assigned to functional areas as shown in ISMP Tables 9-1 through 9-3. The roles assigned to organizations are provided in ISMP Chapter 11.0, "Organization Roles, Responsibilities, and Authorities". By these assignments, facility safety becomes a facility-wide responsibility with safety responsibilities identified for each functional area.

In addition, by these assignments, assurance is provided that the roles identified in the Safety Analysis Reports are carried out.

The Facility design is based on the design and operational experience gained at other nuclear and chemical facilities. As such, the potential hazards are well understood and lessons learned from earlier facilities are applied.

Part of the preparatory work for hazard identification studies is to review safety and incident reports from similar operating facilities to ensure that credible events are considered at an early stage in the design. For the WTP, the operating histories of Sellafield's Vitrification Plants, Site Ion Exchange Plant, the Enhanced Actinide Removal Plant, the Savannah River Project, and the Hanford Site plants are reviewed to take account of their operating experience. In this way, lessons learned are incorporated into the WTP design and plans for operation. One such example is ion exchange resin stability. An explosion occurred at the Hanford Z-Plant because of contact between an organic ion exchange resin and strong nitric acid (HRC 1976). Because the WTP uses both organic ion exchange resins and strong nitric acid within its processes, careful consideration is being given to design of ion exchange resin handling and storage for the WTP. Section 4.4.1, "Comparison to the Hazards Analysis Results of Other Facilities", of the Hazard Analysis Report (HAR) provides a discussion of the application of lessons learned at other facilities to the Facility process hazards analysis (PHA) and design.

3.3 Authorization Basis

In this section, the content, control, and update of the authorization basis are discussed. The authorization basis is the composite of information provided by a Contractor in response to radiological, nuclear, and process safety requirements that is the basis on which the DOE grants permission to perform regulated activities.

3.3.1 Content of the Authorization Basis

The authorization basis for WTP includes the documentation discussed in the following sections. This documentation includes that information submitted in connection with a request for Standards Approval, a request for Construction Authorization, or a request for Operations Authorization as described in DOE/RL-96-0003, *DOE Process for Radiological, Nuclear, and Process Safety Regulation of the RPP Waste Treatment Plant Contractor*, and any other information submitted by BNI in connection with these requests (DOE/RL 2001). Amendments to this information may be in the form of revisions to the previously submitted documents, or new information that supplements previously submitted information. The authorization basis begins at the Standards Approval regulatory action and continues throughout the design, constructions, operation, and deactivation of the WTP. The following Sections 3.3.1.1 through 3.3.1.8 delineate the elements of the authorization basis.

3.3.1.1 Integrated Safety Management Plan

The ISMP defines the process by which applicable laws, regulations, and standards are incorporated into design, procedures, and training to ensure adequate safety of the public, workers, and the environment. Further detail is provided in ISMP Section 1.1, “Introduction”.

3.3.1.2 Safety Requirements Document

The Safety Requirements Documents (SRD) defines the radiological, nuclear, and process safety objectives and standards ensuring the WTP is designed, constructed, operated, and deactivated in a manner that protects the health and safety of the public and workers and protection of the environment. These safety objectives and standards (SRD Safety Criteria), are included as a part of the WTP authorization basis to establish a formal agreement with the regulator on the necessary facility design features and management processes and the expectations on the features and processes required to safely achieve the defined work of processing Hanford tank waste. The “Radiological Exposure Standards for the Project” is included in the SRD.

Additional information on the SRD is provided in ISMP Section 4.1, “Safety Management Processes”.

3.3.1.3 Safety Analysis Reports

The Safety Analysis Reports (SAR) document the safety analysis for the facility to demonstrate that it can be safely operated, maintained, and shut down. The Initial Safety Analysis Report (ISAR) was developed during Part A based upon a conceptual design of the facility. Those portions of the ISAR that relate to the fundamental aspects of design are considered to be part of the authorization basis. The Preliminary Safety Analysis Report (PSAR) is based on the facility design and plans for construction and demonstrates adequate planning for the operational phase. The Final Safety Analysis Report (FSAR) documents the completed design and construction and provides details on the plans for operation. The

FSAR includes facility and process drawings and fabrication and construction specifications important to the safety analysis of the facility. Specifications and drawings not submitted to the regulator are not part of the authorization basis. The FSAR identifies significant changes made in the facility design and plans for operation from what was presented in the PSAR. Near the end of waste processing activities, the FSAR will be expanded as necessary to discuss the WTP operating history as it affects deactivation, the hazards associated with deactivation, and the condition of the facility when it is turned over to DOE for decontamination and decommissioning.

3.3.1.4 Technical Safety Requirements (TSR)

The TSRs are based on the accident analyses included in the Final Safety Analysis Report (FSAR), as related to protection of the public and workers from chemical and radiological exposures. The TSRs are maintained current so that they reflect the WTP configuration, as it is analyzed in the FSAR. The TSRs include items in the following categories, as dictated by the WTP FSAR:

- Use and Application
- Safety Limits (SLs)
- Operating Limits (OLs)
  - Limiting Control Settings (LCSs)
  - Limiting Conditions for Operation (LCOs)
- Surveillance Requirements (SRs)
- Administrative Controls (ACs)

The content of the TSRs is prepared in accordance with Safety Criterion 9.2-3 of the SRD.

The LCOs, which specify the lowest functional capability or performance level of equipment required for safe operation of the facility, are based on the following:

1 Process variables, design features, and operating restrictions that are the initial conditions for accident analysis, and
2 Structures, systems, and components that function to prevent or mitigate accidents must achieve compliance with public and worker radiological and chemical exposure standards of SRD Safety Criteria 2.0-1 and 2.0-2.

TSR Bases are provided as an appendix to the TSRs that describes the technical justification for the individual technical safety requirements (excluding administrative controls). This Bases appendix provides a brief summary statement of the technical justification for the SLs, OLs, and associated SRs. The Bases appendix describes how the numeric values, the conditions, the surveillances, and the Action Statements fulfill the safety requirements that are derived from the safety basis documentation. The primary purpose for describing the basis of each requirement is to assess that future changes to these requirements will not affect their original intent or purpose. The Bases Appendix references the more specific, detailed basis for the TSRs, as presented in the FSAR accident analysis and safety basis sections. Within the context of RL/REG-97-13, the TSR Bases are not considered as part of the TSRs. The Bases may be changed without approval of DOE, provided that a change to the Bases does not result in an USQ, if a Production Operations Authorization has been issued.

An additional TSR appendix may be provided to describe passive design features of the facility, which, if altered or modified, would have a significant affect on safe operation. If design features are described in the FSAR, this appendix may not be required.

3.3.1.5 Quality Assurance Program (QAP)

The QA Program is organized to meet the requirements of 10 CFR 830 Subpart A, principles stipulated in *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for RPP Waste Treatment Plant Contractor*, DOE/RL-96-0006 (DOE/RL 2001), and the specific contract requirements for QA. The WTP Project QAP document (24590-WTP-QAM-QA-01-001) was restructured to reflect BNI QA program policy, as well as use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE Order 414.1A (DOE 1999). The restructured QAP document was issued as the WTP Project *Quality Assurance Manual* (QAM) (BNI 2001). This QAM serves as the Authorization Basis document for implementation of the Project QA program. The QAP, as described in the QAM, provides assurance that the design, procurement, construction, testing, inspection, operation, deactivation, waste form qualification, modification, and maintenance activities conducted at the facility conform to regulatory and contractual requirements and reflect best industry practices. To support meeting project radiological, nuclear, and process safety requirements, the QAP complies with elements of NQA-1 (ASME 1989), as defined in the QAM.

The provisions of the Quality Assurance Requirements and Description document DOE/RW/0333P will be applied to QL-1 and QL-2 items and activities associated with HLW services from design through production and acceptance.

The objectives of the Project QAP are to:

a) establish the project organizational structure, management controls, functional responsibilities, levels of authority, and interfaces for managing, performing, and assessing the work; and
b) ensure confidence in the safe completion of project work in full compliance with radiological, nuclear, and process safety requirements, waste product acceptance quality requirements, and mission objectives.

Adherence to the DOE-approved QAP also ensures the following.

1) DOE mission and objectives related to Project are effectively accomplished.
2) Products and services are safe, reliable, and meet or exceed the requirements and expectations of the user.
3) Hazards to the public and workers are minimized.

The extent to which quality requirements are applied to the Project is based on a graded approach, reflecting the safety implications of the activity. Quality-related activities performed by organizations providing equipment, services, or support to the Project are conducted in accordance with the requirements documented in the approved QAP.

Additional information on the QAP is provided in ISMP Section 3.5, "Quality Assurance Program (QAP)". Additional information on the audit and management assessment aspect of the QAP is provided in ISMP Section 5.4, "Compliance Audits", and Chapter 10.0, "Assessments".

3.3.1.6 Radiation Protection Program (RPP)

The occupational RPP documents the program standards, requirements, administrative controls, responsibilities, and authorities associated with the scope of WTP radiological activities. The RPP is the program required by 10 CFR 835, "Occupational Radiation Protection". The RPP provides the regulatory technical basis that ensures the radiological safety of facility workers, collocated workers, facility visitors, and the onsite members of the public. Additional information on the RPP is provided in ISMP Section 2.3, "Compliance with 10 CFR 835, Occupational Radiation Protection".

3.3.1.7 Emergency Plan

The Emergency Plan, describing the provisions for responses to operational emergencies, documents the Emergency Management Program. All aspects of the Project Emergency Management Program (EMP) as required by DOE and applicable federal, state, and local requirements are addressed. The EMP, an element of an integrated and comprehensive DOE Emergency Management System (EMS) (DOE 1995a), is designed to address emergency planning, preparedness, response, recovery, and readiness assurance activities. The DOE system considers emergency conditions that might place individuals at risk; which goes beyond radiological hazards. In addition, the relationships of the EMP to existing DOE Headquarters, DOE Richland Operations Office, and Hanford Site Contractors' programs, are documented in the Project Emergency Plan. A discussion of critical interfaces and the division of responsibility among these different agencies is included in the Emergency Plan. The elements of the Emergency Plan are designed to ensure that the Project, as part of the overall DOE EMS, is prepared to respond promptly, efficiently, and effectively to any emergency to protect the public and workers.

The Emergency Plan ensures that emergency response requirements are considered throughout the planning and design process. Emergency drills and exercises are performed to evaluate the emergency plans and WTP staff response to offnormal conditions. The exercise program includes coordination with Hanford Site, state, and local emergency response organizations. The Project will participate in Hanford Site exercises and drills for other facilities as invited.

The Emergency Plan is submitted to support the request for an operating authorization. Chapter 9.0, "Emergency Management", of the PSAR will address emergency preparedness as required to support the construction authorization request. Procedures developed by the WTP construction manager implement state and federal emergency preparedness requirements for hazardous situations that may arise during construction.

Additional information on the Emergency Plan is provided in ISMP Section 3.10, "Emergency Preparedness".

3.3.1.8 Other Information

Other documents generated by the regulator or BNI may become part of the authorization basis for the Project. This includes correspondence concerning the safety aspects of the facility design, construction, operation, and plans for deactivation. Those portions specified in Appendix E of the Hazard Analysis

Report (HAR) that constitute bounding or significant hazards or hazardous situations are considered to be part of the authorization basis.

3.3.2 Control of the Authorization Basis

The authorization basis for WTP is considered as an element of the technical baseline for the facility. Changes to the technical baseline are managed by a configuration management program. For further information concerning configuration management see ISMP Sections 1.3.16 and 5.3, "Configuration Management".

3.3.3 Changes to the Authorization Basis

Changes to the authorization basis include changes to the facility design and administrative controls (e.g., procedures, programs, plans, or management processes) that are described in the authorization basis or are relied on to ensure conformance to the authorization basis. Changes to the authorization basis are managed by a configuration management program discussed in ISMP Sections 1.3.16 and 5.3, "Configuration Management". As described in these sections, the change management program includes the use of qualified personnel, procedures developed and approved under the Project procedure process, and implementation under the approved QAP.

By 10 CFR 830.121(b)(3), a contractor may make changes to the approved QAP so long as the QAP, as changed, will continue to satisfy the requirements of 10 CFR 830 Subpart A. Annual submittal of the QAM to DOE for approval must include a justification of why the revised QAM continues to satisfy the requirements of 10 CFR 830 Subpart A.

As allowed by 10 CFR 835.101(h) BNI may make changes to the approved RPP so long as the change does not decrease the effectiveness of the RPP and the RPP, as changed, continues to meet the requirements of 10 CFR 835. Proposed changes that decrease the effectiveness of the RPP are not implemented without submittal to and approval by DOE. Updates to the RPP are required if a change or addition is made to the RPP. Updates of the RPP are considered approved 180 days after submittal unless rejected by the regulator.

In accordance with *DOE Position on Contractor Initiated Changes to the Authorization Basis*, RL/REG-97-13 (DOE/RL 2002), BNI may make changes to the facility or administrative controls if a review of the Authorization Basis is performed and either:

a) The review demonstrates that a proposed change is consistent with the existing Authorization Basis, or

b) The Authorization Basis is revised or amended prior to the implementation of the proposed change, or

c) The contractor may authorize changes to the facility that deviate from the facility description in the authorization basis if the associated changes are implemented in accordance with a BNI safety management process that is consistent with section 3.3.3.3.

3.3.3.1 Authorization Basis Revisions

a. BNI may make revisions to the authorization basis, associated with changes to the facility, ~~other than to the QAP and RPP as discussed above,~~ without prior approval of the DOE provided that the following safety evaluation and documentation requirements are met prior to implementation of the revision:

1. A safety evaluation is performed that demonstrates that the revision:
   i. Does not involve deletion or modification of a standard previously identified or established in the approved SRD.
   ii. Does not involve a modification of an approved Technical Safety Requirement (only after production operations authorization agreement approval).
   iii. Does not create a new Design Basis Event (DBE).
   iv. Does not result in more than a minimal increase in the frequency or consequence of an analyzed DBE as described in the Safety Analysis Report.
   v. Does not result in more than a minimal decrease in the safety functions of important-to-safety SSCs or change how a Safety Design Class SSC meets its respective safety function.

~~Safety functions for Safety Design Class and Safety Design Significant SSCs typically are described in Chapter 4 of the Safety Analysis Report, as are descriptions of how the SSC meets its respective safety function.~~

~~2. A written safety evaluation is performed that demonstrates that the revisions to the authorization basis:~~

   ~~i.~~vi. Will continue to comply with all applicable laws and regulations, conform to top-level safety standards, conform to the requirements of the SRD, and provide adequate safety.
   ~~ii.~~vii. Will continue to conform to the contract requirements associated with the authorization basis document(s) affected by the revision.
   ~~iii.~~viii. Will not result in inconsistencies with other ~~commitments~~ requirements and descriptions contained in portions of the authorization basis or an authorization agreement not being revised.

Safety functions for Safety Design Class and Safety Design Significant SSCs typically are described in Chapter 4 of the facility-specific volumes of the Safety Analysis Report, as are descriptions of how the SSC meets its respective safety function.

The format, content, and level of detail associated with an acceptable "safety evaluation" is highly dependent on the nature of the proposed revision to the authorization basis, but in all cases, the safety evaluation must provide the rationale that demonstrates 1.i through 1.viii above are met. Rather than establishing comprehensive guidance on appropriate evaluation format, content, and level of detail, the ~~position~~ implementing procedure for Authorization Basis maintenance identifies the most fundamental basis that can applied to evaluating proposed revisions. There is a wide range of acceptable safety evaluation approaches. Also, the appropriate degree of rigor and documentation associated with the safety evaluation should be tailored to the specific authorization basis revision.

For changes made to the Authorization Basis associated with changes to the facility, all documents affected by the change except for the Preliminary Safety Analysis Report (PSAR) or Limited Construction Authorization Request (LCAR) must be revised at the time the change is implemented. The PSAR or LCAR must be revised by March 30 for changes during the previous calendar year.

~~3.~~2. The following documentation and reporting requirements are met:

i. All changes, authorization basis revisions, and associated safety evaluations performed in accordance with paragraph~~s~~ 1 ~~and 2~~ above will be documented.

ii. Documentation will be retained and readily available for DOE review.

iii. Safety evaluations should be documented in sufficient detail such that a knowledgeable individual reviewing the evaluation can identify the technical issues considered during the evaluation and the basis for the determinations.

iv. The DOE will be notified of revisions to the authorization basis within 30 days of ~~completing~~ implementing such revisions. This notification must contain a brief description of the authorization basis change, the specific references to the Authorization Basis documents, including facility documents that have been revised, and a summary of the safety evaluation. The safety evaluation shall include a brief description of the basis for concluding that each of the requirements of 3.3.3.1.a.1 have been met. The DOE may require any changes to be rescinded if it determines, within 60 days of notification, that the change is not consistent with applicable contractual and regulatory requirements. An Authorization Basis Amendment Request (ABAR) containing the change must be submitted by March 30 for changes made during the previous calendar year.

b. BNI may make revisions to the authorization basis associated with changes to the administrative controls~~, other than to the QAP and RPP as discussed above,~~ without prior DOE approval, provided that the following safety evaluation and documentation requirements are met prior to implementation of the revision.

1. A safety evaluation is performed which demonstrates that the revision:

i. Does not involve the deletion or modification of a standard previously identified or established in the approved SRD.

ii. Does not involve the modification of an approved TSR. (only after production operations authorization agreement approval)

~~iii. Does not result in a reduction in commitment described in the authorization basis.~~

~~iv. Does not result in a reduction in effectiveness of any program, procedure, or plan described in the authorization basis.~~

~~2. A written safety evaluation is performed that demonstrates that the revisions to the authorization basis:~~

iii. ~~i~~Will continue to comply with all applicable laws and regulations, conform to top-level safety standards, conform to the requirements of the SRD, and provide adequate safety.

~~ii.~~iv. Will continue to conform to the contract requirements associated with the authorization basis documents affected by the revision.

~~iii.~~v. Will not result in inconsistencies with other ~~commitments~~ requirements and descriptions contained in portions of the authorization basis or an authorization agreement not being revised.

For changes made to the Authorization Basis associated with changes to administrative controls, all documents affected by the change except for the PSAR or LCAR must be revised at the time the change is implemented. The PSAR or LCAR must be revised by March 30 for changes made during the previous calendar year.

3. The following documentation and reporting requirements are met:
   - i. All changes, authorization basis revisions, and associated safety evaluations performed in conformance with paragraphs 1 and 2 above shall be documented.
   - ii. Documentation shall be retained and readily available for DOE review.
   - iii. Safety evaluations should be documented in sufficient detail such that a knowledgeable individual reviewing the safety evaluation can identify the technical issues considered during the safety evaluation, and the basis for the determinations.
   - iv. DOE shall be notified of revisions to the actual authorization basis documents within 30 days of implementingcompleting such revisions. This notification must contain a brief description of the Authorization Basis change, the specific references to the Authorization Basis documents, including administrative controls documents, that have been revised, and a summary of the safety evaluation. The safety evaluation shall include a brief description of the basis for concluding that each of the requirements of 3.3.3.1.b.1 have been met. The DOE may require any changes to be rescinded if it determines, within 60 days of notification, that the change is not consistent with applicable contractual and regulatory requirements. An ABAR containing the change must be submitted by March 30 for changes made during the previous calendar year.

c. The Contractor may not make revisions to the SRD Safety Criteria or Implementing Codes and Standards without prior OSR approval.

3.3.3.2 Authorization Basis Amendments

An authorization basis revision that does not meet the conditions for BNI approval in subsection 3.3.3.1 requires DOE approval. Such changes may be implemented following approval by the DOE of a request to amend the authorization basis. A request to amend the authorization basis includes:

1) A description of the proposed revision
2) The reason for the proposed revision
3) A description of the proposed implementation schedule for the revision and associated change(s)
4) A copy of the authorization basis document or appropriate excerpt showing the proposed revision(s)
5) The safety evaluation for the proposed revision, as described in subsection 3.3.3.1 paragraphs a.12 and b.12
6) If the revision involves the deletion or modification of a standard previously identified in the approved SRD, certification that the revised SRD will continue to identify a set of standards that will provide adequate safety, comply with all applicable laws and regulations, and conform to the top-level safety standards.

As noted in 3.3.3.1, subparagraph a.12, the format, content and level of detail associated with an acceptable safety evaluation is highly dependent on the nature of the proposed revision to the authorization basis. If a proposed SRD change potentially results in less protection of workers, the public, or the environment against hazards associated with the operation of the facility, the safety evaluation for this change should follow the process outlined in DOE/RL-96-0003, DOE/RL-96-0004, and DOE/RL-96-0006.

3.3.3.3 Decisions to Deviate from the Authorization Basis

During the design and construction phase prior to the Start of Cold-Testing for Authorization Basis changes requiring DOE approval, BNI may implement changes to the facility that deviate from the facility description in the Authorization Basis without prior DOE approval, provided that:

a. Prior to implementing a change that deviates from the Authorization Basis, BNI will perform a safety evaluation that determines that:
   1. The change conforms with applicable laws and regulations, conforms with top-level safety standards, and maintains the SRD Safety Criteria.
   2. The specific changes will not cause or threaten imminent danger to the workers, the public, or the environment from radiological, nuclear, or chemical hazards.

b. Documentation of BNI's decision to deviate from the Authorization Basis will be completed prior to implementing the change and will include the following:
   1. Identification of the specific changes to be implemented.
   2. Identification of the specific deviation(s) from the Authorization Basis.
   3. The safety evaluation described in subparagraph a above.
   4. The signature of the manager(s) having the authority to approve changes that deviate from the Authorization Basis and the date such changes were approved.

   Such documentation and a current status report of all deviations will be readily retrievable and made available to the DOE upon request.

c. Time Limits and Notification
   1. During the construction phase, if prior approval by the DOE of the authorization basis amendment associated with the BNI-approved decision to deviate is required, BNI will notify the DOE ~~(or his/her designee)~~:
      i. either verbally or in writing within 24 hours of the decision to deviate from the Authorization Basis (as recorded in subparagraph b above), and
      ii. in writing within 72 hours of the decision to deviate from the Authorization Basis (as recorded in subparagraph b above). This notification will include a copy of the documentation of the decision to deviate from the Authorization Basis.
   ~~2. If prior approval by the DOE is not required, BNI will revise the Authorization Basis within 30 days following the decision to deviate from the Authorization Basis and notify the DOE within 30 days of completing such revision.~~
   ~~3.~~2. ~~If prior approval by the DOE is required,~~ BNI will submit a request to amend the Authorization Basis to the DOE within 30 days following the decision to deviate from the Authorization Basis.
   ~~4.~~3. If provision~~s~~ 2 ~~or 3 are~~is not met, or if approval of the amendment request is not obtained within 90 days of the decision to deviate from the Authorization Basis:
      i. All physical work associated with implementing the change that deviates from the Authorization Basis will stop, and
      ii. Corrective action will be initiated immediately to promptly correct the deviations documented under subparagraph b.

d. Tracking and Resolution of Deviations from the Authorization Basis
   1. Changes implemented that deviate from the Authorization Basis will be specifically documented and tracked as deviations using appropriate quality procedures and documentation.
   2. All revisions to the Authorization Basis associated with approved Authorization Basis deviations will be completed, documented under subparagraph b, and will be resolved prior to Start of Cold-Testing.

3.4 Safety/Quality Culture

The BNI team understands the importance of a strong safety and quality culture in achieving excellence. To achieve a culture in which individuals involved in safety-related activities accept responsibility for the safety and quality through all phases of the Project, BNI establishes the following policy:

1) Outlining expectations and performance standards
2) Communicating those expectations
3) Implementing procedures that facilitate achieving expectations
4) Performing assessments to measure the compliance with and the appropriateness of BNI safety goals.

To achieve safety and quality throughout design, construction, and operation of the facility, BNI establishes measurable goals in the areas of industrial health and safety of workers, radiological and chemical exposure limits for the public and workers, and environmental release limits. The team then establishes policies that require the communication of the goals to employees and contractors. Communication techniques include posters, meetings, newsletters, recognition of outstanding performance, and incorporation of the goals into performance plans for groups and individuals. Another important aspect of communication is training. Employees are provided information regarding the inherent hazards of the work and tools effective in controlling the hazards or responding to hazardous situations encountered during the work processes. Managers and supervisors are expected to be familiar with the work processes and to understand the potential hazards and hazardous situations.

Other policies that establish standards of conduct and job site work rules are communicated to employees. The policies empower WTP employees to stop the activity in which they are involved if the work procedure or process is not clear or the activity appears unsafe. The policies also direct that performance reviews emphasize the requirements for safety and quality.

The safe completion of a quality job requires planning that takes into consideration aspects such as adequate work packages, appropriate level of instructions, evaluation of the impact of the task on other SSCs or processes, and an evaluation of the completed activity. Procedures governing these activities specify that trained and qualified personnel are required to participate in planning process. This includes craft and operations personnel supporting technical and administrative workers.

To ensure that safety and quality procedures are being followed and that the implemented procedures are adequate to facilitate achieving the expectations, assessments of work activities performed and the results of compliance with goals are conducted. Where practices are identified that improve safety and quality, those practices are incorporated into operations. Any required corrective actions identified are tracked to completion. Results of these assessments are provided to managers and workers.

As the project moves through design and operations to deactivation, the BNI team revises the goals and procedures to reflect the activities required for each phase.

3.5 Quality Assurance Program (QAP)

The Project QAP for all activities meets the criteria of 10 CFR 830.120, “Quality Assurance Requirements”. Implementation of 10 CFR 830.120 is addressed in ISMP Section 2.2, “Compliance with 10 CFR 830.120, “Quality Assurance Requirements”.

Integration of the QAP into the Project safety approach began with the PHA, SRD, and HAR developed by specific procedures in accordance with the requirements of the QAP. This included the establishment of personnel training and qualification requirements, confirmation that personnel met the training and qualification requirements, application of technical review, and documentation of results. The performance of the accident analysis and the comparison of the results of the analysis to the radiological and chemical exposure standards is also performed in accordance with the requirements of the QAP. This includes training and qualification requirements; computer code verification; independent review of input assumptions, analytical methods, and calculations; maintenance of a calculation log; and documentation of the results.

The application of the QAP to design, procurement, construction, testing, inspection, modification, and maintenance of SSCs credited with public and worker safety is discussed in the QAP. The manner in which requirements of the QAP are imposed on subcontractors is discussed in ISMP Section 5.2, “Control of Subcontractors”.

Personnel training and qualification and procedure development credited for public and worker safety during facility operation are developed in accordance with the requirements of the QAP. The QAP is applied to the Emergency Management Program in the areas of training and qualification of emergency response team members, assessment of the program effectiveness, and records documentation. Additional details on these aspects of the emergency response program are provided in ISAR Chapter 9.0, “Emergency Management”.

Project compliance with DOE/RW-0333P*, Quality Assurance Requirements and Descriptions for the Civilian Radioactive Waste Management Program (QARD)* (DOE 1995b) is addressed in ISMP Section 3.3.1.5 “Quality Assurance Program (QAP)”. The provisions of the Quality Assurance Requirements and Description document DOE/RW/0333P will be applied as described in the QAP.

ISMP Section 5.3, “Configuration Management”, Section 5.4, “Compliance Audits”, and Section 8.0, “Document Control and Maintenance” provide additional information on the application of the QAP to the Project safety approach.

3.6 Facility Design for Postulated Events

This section describes the facility design for normal operation, anticipated operational occurrences, and accident conditions.

3.6.1 Normal Operations

The facility design provides for control of radiological exposure to the public and worker such that the exposures are within the standards provided in Table 1-2 for normal events. In addition, the design satisfies the Operations Risk Goal of *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006 (DOE-RL 1996b) and of SRD Volume II, Safety Criterion 1.0-4. Those SSCs required for achieving compliance with the public and worker exposure standards for normal operation are designated as Important-to-Safety Safety Design Significant as discussed in ISMP Section 1.3.10, "Classification of Structures, Systems, and Components".

The process follows a logical approach, beginning with defining the basis of design and developing the overall process flowsheet. System-specific flow diagrams, such as ventilation flow diagrams, are also developed if required. The next stage is the production of operation and maintenance philosophy documents for each area of the facility, tied together by an overall control philosophy document. These documents define the design principles for each area and allow specific equipment selection or design to commence. These principles are based on existing successful operation of structures, systems, and components. However, where a new process or system that has the potential to provide a cost-effective and safe alternative is identified, a research and development program is initiated to support the design process.

Flow diagrams and documents are subject to review during their development, addressing different aspects of the design. The Technical Organization ensures a consistent design approach is taken across the project and that all of the project requirements are being addressed. The PHA team, which includes representatives from operations, reliability, and relevant technical disciplines, addresses each component of the design from a safety and operability aspect.

This process is used at the WTP to ensure that safe, efficient operation is built in at the design stage. Application of this process is demonstrated in various philosophy documents and plant layouts that describe features to be used in the WTP. The following is a list of these features:

1) Fluidic devices (pumps and valves) that contain no moving parts are used to transport and divert highly radioactive liquids. These items require no maintenance
2) Fully welded pipework systems minimize the risk of leakage
3) Automated sampling and transport systems allow efficient process operations while minimizing radiation exposure to workers
4) Canister HEPA (high efficiency particulate air) filters ease handling and installation operations.

The type of control identified through the design process for the WTP also leads to the reduction of the risk to public and workers while allowing efficient process operation. The distributed control system allows the facility to be operated under normal conditions from a central control room, thus reducing radiological exposure to personnel. Hardwired backup systems are used for some safety systems that are totally independent from the operational control system.

The close relationship between Hanford tank farms operations and the WTP may require additional administrative controls and documentation in support of AP-106 operations (e.g., master pump shutdown). Such concerns are addressed and resolved at a site-wide level through interface control meetings.

3.6.2 Anticipated Operational Occurrences

The WTP will have anticipated operational occurrences that are not considered part of the normal process operation. Certain features are built into the design to minimize the risk to personnel, the impact to the process operation, and to enable equipment to be maintained in a safe manner during normal operation and anticipated operational occurrence. Examples of these features include the following:

1) Flasking systems that allow maintainable plant items to be removed from the cell environment and taken to specifically designed maintenance areas
2) Cell bulge systems that enable equipment to be safely maintained without needing to enter the high radiation level cell confinement
3) Standby filtration systems that allows filters to be changed offline
4) Distributed control system that contains a dedicated mode that is interlocked to prevent the maintenance of an item until it is fully isolated.

3.6.3 Accidents

During postulated accidents, the WTP is designed to maintain confinement of radioactive materials, thus preventing a significant release from the facility.

During facility design evolution, hazardous situations identified by the PHA and the accident consequence analysis are compared to the radiological and chemical exposure standards provided in SRD Safety Criteria 2.0-1 and 2.0-2. Hazardous situations considered include both internal and external events. If the radiological or chemical exposure standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed. Preference is given to engineered features over administrative controls.

Hazardous situations considered include both internal and external events. The HAR Section 5.0, “Hazard Evaluation by Process Step”, discusses the internal events and HAR Section 2.1, “Site Description”, discusses external events. The ISAR Chapter 4.0, “Integrated Safety Analysis”, presents additional consideration given to internal and external events.

The engineered features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention and mitigation of accidents. Recognized and accepted consensus codes and standards are used. Features credited for satisfying the public and worker radiological and chemical exposure standards of SRD Safety Criteria 2.0-1 and 2.0-2 are classified as Safety Design Class. Details on the classification process and the quality assurance provisions provided for each classification are provided in ISMP Section 1.3.10, “Classification of Structures, Systems, and Components”, and Section 1.3.11, “Quality Levels”. Additional information on the design of SSCs credited for worker and public protection is provided in ISMP Sections 3.1, “Defense-in-Depth”, 3.7, “Proven Engineering Practices”, and 3.11, “Safety Systems Design”.

A specific list of SSCs credited for worker and public protection is provided in ISAR Section 4.8, "Controls for the Prevention and Mitigation of Accidents". These SSCs are identified in the master equipment list, which is maintained by the Configuration Management Program as discussed in ISMP Section 5.3, "Configuration Management".

3.7 Proven Engineering Practices

The WTP design incorporates the use of proven technologies so that lessons learned from the use of the technology is incorporated into the operation of the facility. For the novel uses of existing technologies (such as the use of specific ion exchange resins), the PHA ensures that the safety aspects are examined in a structured research and development program to be assured that hazard potentials are reduced as far as practicable or that protection put in place is commensurate with the assessed magnitude of the hazard.

Facility processes are based on selected technologies that minimize the risk of radiological and chemical exposure. For example, sampling and maintenance activities do not require breach of confinement; hands-on maintainable items within active areas are accessible via shielded access areas that have decontamination facilities installed; and samples with high activity levels are dispensed and transported remotely.

New and novel uses of existing technologies and processes are employed to enhance the process while maintaining safe operation. These uses (e.g., selection of ion exchange resins and the melter feed processes) are examined through a program of research and development. Such development work includes operating a pilot (cold operation) melter and associated feed and mechanical handling systems. This prototype is used to examine and prove novel processes, test the design and maintainability of components, and provide operator training in operational and maintenance activities. To support the use of new and novel uses of existing technologies and processes and new equipment, it may be necessary to develop ad hoc standards. The use of ad hoc standards is discussed in SRD Volume I, Section 3.4.2, "Identification of Consensus Codes and Standards".

The WTP design incorporates passive and active engineered features that prevent and mitigate the potential for radiological and chemical exposures to the public, worker, and the environment. In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls. Preference is also given to passive engineered features over active engineered features. The designation of safety features is made during the hazard evaluation and accident analysis processes.

Examples of passive and active features are described in the following sections.

3.7.1 Passive Features

Facility processes are confined by at least two barriers. Facility and process equipment provides the first barrier and a cell or similar enclosure provides the second. This secondary confinement barrier has appropriate levels of shielding to ensure that radiological exposure does not exceed standards. Confinement and shielding design are established, as are the codes and standards that are used. Aspects of confinement design ensure that failure of one barrier does not lead to failure of the other (i.e., confinement is diverse). For example, should a process vessel or pipework leak (loss of primary confinement), the liquor drains to the cell sump where it can be recovered. The cell is lined to prevent liquor leakage. The potential for failure of a process vessel or piping is reduced by the selection materials resistant to erosion and corrosion and the use of direct inspection or erosion/corrosion coupons as discussed in Section 3.13, "Reliability, Availability, Maintainability, and Inspectability (RAMI)".

3.7.2 Active Features

The facility ventilation systems are designed to minimize the potential for radiological and chemical release into or out of the facility. The air flow into the facility is drawn through areas designated as having low or no potential for radiological or chemical release, through areas of successively higher potential. Except for the facility ventilation systems serving areas evaluated as having marginal potential for radiological contamination, this air is then filtered before release. Ventilation systems are exhausted to the atmosphere via monitored stacks. The principles behind the design and the systems employed are tried and tested components. Additionally, important to safety ventilation systems contain redundant equipment (fans, filters, electrical supply) to protect against single active failures.

The selection of facility equipment required to perform a safety function is based on proven design. The safety performance function requires that suitable testing and maintenance regimes are in place to ensure reliability. For example, where programmable logic controllers are used, specific attention is given to their unique requirements relative to software verification and protection against electromagnetic interference (See SRD Safety Criterion 4.3-1).

Protection systems are an integral part of defense-in-depth as described in ISMP Section 3.1, "Defense-in-Depth".

Preference is given in the facility design to components failing in their safe position on loss of motive power. During the design process, the failure modes of safety features are determined and specified. Simple and proven items of equipment (e.g., valves and pumps) are used, the (required) failure modes of which are well understood and categorized.

3.8 Criticality Safety

A criticality event within a nuclear chemical facility can have severe consequences; therefore, the preferred approach is to preclude the possibility of the hazard by the use of design features. Where this cannot be achieved (because of the presence of a large mass of fissile material within the process) or is impracticable, stringent criticality controls are required. Handling large amounts of fissile material (as in plutonium finishing), criticality control is achieved through a combination of geometry, inventory control, concentration (for solutions), moderation, and suitable instrumentation backed up by administrative controls. The need for these controls is established during the design phase by considering worst-case scenarios and applying conservative assumptions. Worst-case scenarios are modeled using validated computer codes to determine system reactivities and the degree of criticality control required.

The modeling and worst-case scenarios include considerations for uncertainties in the data and calculation methods, uncertainties in the immediate environment under accident conditions, and the presence of water moderation and reflections unless the presence of water is shown to not be credible. The analysis will show that the multiplication factor, k_{eff}, will not exceed 0.95 at a 95% confidence level for credible normal, off-normal, and accident conditions. Exceeding a multiplication factor of 0.95 is prevented by either the control of two independent process parameters, or a system of multiple controls on a single process parameter. This is application of the double contingency principle.

This methodology has also been applied to the WTP process. The amount of fissile material present in the contract feed has been conservatively estimated, then modeled under process conditions using conservative assumptions. The application of this methodology indicates there is insufficient concentration of fissile material to give rise to a significant potential for criticality within the WTP. The results of this preliminary analysis are provided in ISAR Chapter 6.0, “Nuclear Criticality Safety”. If any significant potential for criticality becomes apparent, appropriate controls will be implemented commensurate with the assessed potential. Additional detail regarding criticality prevention are provided in ISAR Chapter 6.0, “Nuclear Criticality Safety”.

The WTP criticality program includes the following:

1) Establishment and maintenance of controls needed to ensure that material specification for proposed feed to the facility are fully compatible with the process and are within the fissile material content bounds of the criticality assessments
2) Performance of nuclear criticality safety assessments when and where appropriate to ensure that changes do not occur that impact assumptions made in criticality evaluations
3) Maintaining appropriate access to trained nuclear criticality experts.

The need for criticality alarms is determined by evaluation to the requirements of Safety Criterion 3.3-6 of SRD Volume II. Alarms, if required by this criterion, are installed in accordance with Safety Criteria 3.3-7 and 3.3-8.

3.9 Radiation Protection Practices

The radiation protection design practice for normal operations at the Project consist of two main elements, radiation protection design and as low as is reasonably achievable (ALARA) design. These design practices ensure that the WTP can be operated in a manner that maintains normal occupational exposures and emissions of radioactive effluents within limits and ALARA. The radiation design process also considers features to facilitate deactivation and decommissioning of the facility and will be applied to the deactivation planning near the end of waste processing operations.

3.9.1 Radiation Protection Design

Radiation protection design addresses material confinement, shielding and access control features, and monitoring. Each of these is addressed in the following sections.

3.9.1.1 Radioactive Material Confinement

Confinement systems present barriers to the uncontrolled release of radioactive material and against the spread of contamination through the WTP. For the facility, the process vessels and piping and the process vessel ventilation system provide the primary confinement barrier. The process cell structures and associated ventilation system provide the secondary confinement barrier. The operating area structures and associated ventilation systems provide a tertiary confinement barrier. Ventilation flow is from areas of lower potential contamination to areas of higher potential contamination. The effluents are treated as necessary to control exposures to collocated workers and members of the public during normal operations and under accident conditions.

Throughout the WTP confinement barrier, boundaries are identified and design criteria established for these boundaries and for the associated ventilation systems. Design documents covering the confinement systems are reviewed to ensure the design criteria are adequately implemented.

The confinement systems under normal operations are assessed based on upper-bound conditions identified in the PHA. The projected annual radiological exposure from normal operations is compared against the criteria provided in SRD Volume II, Chapter 2.0, “Radiological and Process Standards”, and facility features are modified and added to the facility as necessary to meet the criteria (BNFL 1997d).

3.9.1.2 Radiation Shielding and Access Control Features

The WTP is divided into radiation zones. The zoning reflects the intensity of the radiation sources in the area, if any, and the anticipated personnel access requirements. Maximum allowable exposure rates in accessible areas are defined to ensure that personnel exposure standards are not exceeded. Shielding requirements are then established as necessary to ensure that the exposure rates in the radiation zones are maintained under all anticipated operating conditions and that commitments to ALARA are satisfied. Shielding and access control features are provided in accordance with 10 CFR 835 and additional criteria provided in SRD Volume II, Chapter 2.0, “Radiological and Process Standards”, and Chapter 5.0 “Radiation Protection” (BNFL 1997d).

Radiation protection features such as facility zoning, minimum shielding requirements, and access control features will be documented on applicable facility layout drawings and other design documents. These documents are reviewed to ensure that the requirements are met. Details, such as penetrations are analyzed to ensure that potential streaming paths are identified and properly shielded.

3.9.1.3 Radiation Monitoring

Fixed area radiation monitoring is provided in areas where the area exposure rates may change suddenly. These sudden changes may be a result of process operation or maintenance activities. Continuous air monitors are provided in accessible locations where concentrations of airborne radionuclides may vary. Air sampling capability is also provided. Effluent sampling is provided as necessary to demonstrate compliance with regulations. The radiation monitoring locations will be shown on drawings developed during detailed design.

3.9.2 ALARA Design

Project procedures are established to implement an ALARA program. These procedures include guidance on ALARA design considerations appropriate to the facility and delineate the ALARA design responsibilities of individuals on the project. The ALARA guidance is derived from federal and commercial nuclear operating experience as well as from industry standards such as NRC 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 1978) and DOE G 441.1-2, *Occupational ALARA Program Guide*. The ALARA guidance addresses considerations for reducing exposures within the WTP from operations and from final decommissioning activities. It also addresses considerations for reducing effluents from the WTP.

ALARA design criteria and ALARA design considerations are provided to project staff in controlled documents. These criteria and considerations are arranged by topic area (for example, General Criteria, Dose Criteria, Environmental Criteria, Facility Arrangement Considerations, Shielding Considerations, System Design Considerations, etc.). Design engineers are responsible for implementing and documenting ALARA design criteria and ALARA design considerations in their work. Supervisors are responsible for ensuring that individuals in the group are trained in ALARA criteria and considerations, and for reviewing designs against those criteria and consideration. The WTP ALARA program also requires an ALARA review of proposed changes to the facility.

Periodic interdisciplinary project ALARA reviews are conducted to ensure that ALARA concepts are being integrated into the design and to discuss implementation of the ALARA design goal and the rationale for exceptions from specific ALARA design considerations.

In addition, collective exposure estimates assess projected exposures to provide insight into the sources of exposure and indicate areas that may require additional attention. The estimates are compared to those from similar operating facilities.

Radioactive systems at the WTP are designed to minimize the potential for leaks of radioactive material. Radioactive leaks are collected and segregated from non-radioactive waste streams. To the extent possible, radioactive leaks are returned to the process stream.

Melter offgas streams are treated to scrub out radioactive particulates before passing through filter media. The scrub streams are returned to the process stream.

The interfaces between non-radioactive service systems (e.g., cooling water) and radioactive systems are designed so that any leakage is from the clean side to the radioactive side of the interface.

The confinement system design and access control features described above serve to minimize the spread of radioactive contamination in the WTP. During operation, movement of clean materials into potentially contaminated areas is minimized to aid in contamination control, minimize replacement and survey costs, and minimize radioactive waste volumes and costs. Tools in contaminated areas are controlled and reused to the extent possible.

3.10 Emergency Preparedness

The Project implements and maintains an emergency management program to respond promptly, efficiently, and effectively to emergencies involving WTP, activities, or operations. The applicable requirements of federal, state, and local agencies are integrated into a single comprehensive program. The magnitude and scope of the emergency management program are determined by the final assessment of the hazards and hazardous situations to be completed in Part B.

The Project emergency management program is being designed to function within the existing Hanford emergency management community. Community planning partners are the DOE; DOE contractors; the Energy Northwest; U.S. Ecology; the State of Washington; and Benton, Franklin, and Grant Counties. The Project emergency management program is being developed and will be implemented to be consistent with the *Hanford Emergency Response Plan* (DOE-RL 1994), to ensure a timely and integrated response and to eliminate duplication of effort within the planning community. Agreements will be established to enable the Project to use existing Hanford response capabilities (e.g., fire, medical, hazardous materials spill response, consequence assessment, law enforcement, and communications). The facility design facilitates access and intervention by the Hanford Site fire department (e.g., the ability to connect to the interior standpipe system). The WTP Emergency Management Administrator participates in and supports Hanford Site and local area emergency planning organizations, including the Hanford Emergency Planning Council and the local Emergency Planning Committee.

The Project emergency management program is being developed for compliance with the requirements of 40 CFR 355, "Emergency Planning and Notification", 29 CFR 1910.38, "Employee Emergency Plans and Fire Prevention Plans", and WAC 173-303-350, "Contingency plan and emergency procedures".

The emergency management plan incorporates into one document an overview of the emergency management program for the Project. The plan provides a description of how the Project implements the provisions of all applicable requirements. WTP specific emergency implementing procedures are developed to implement the requirements of the plan.

Additional information on the Project Emergency Management Plan is presented in ISAR Chapter 9.0, "Emergency Management".

Table 3-11 Outline and Content of Emergency Response Plan (this table has been deleted)

3.11 Safety Systems Design

For facilities designed and built by the WTP contractor, a proven method for identifying the requirements of operational and engineered protective measures is undertaken, the results of which are applied during the entire project design phase. The WTP contractor approach to facility design applies a suite of company targets to facilitate compliance with WTP contractor standards and compliance with applicable radiological exposure standards. Where practical, passive features are used rather than active features. Potential faults are minimized by a design that moves the facility towards a safe state in response to failures, or by incorporating permanently available, passive features that render the facility safe following a failure. In some cases, however, it may be necessary to incorporate active engineered features into the design of a facility that act in response to the fault to render the facility safe.

The following hierarchy of safety measures is incorporated into the WTP design.

1) Operational Preventive Measure (OPM) is a corrective action taken by an operator to terminate the development of a fault sequence. Examples include operator responses to system parameters, sampling and chemical analyses, control system indications or alarms, and procedural instructions. An OPM is considered the first line of protection against a hazard under normal facility operating conditions. Should the OPMs fail, protective systems and devices are designed to automatically operate.
2) Engineered Protection Systems operate automatically to prevent a hazard from occurring, and generally use hardwired trips, mechanical devices, or programmable electronic systems (such as programmable logic controllers) commensurate with the potential risk of the hazardous situation. If protective measures fail, a hazardous situation may occur, the consequences of which can be reduced by the action of mitigating systems.
3) Mitigating Systems attenuate the consequence of a hazardous situation once it has occurred. They include ventilation systems, radiological alarm systems, and evacuation systems.

Application of the design standards results in a facility in which systems operate safely, with operators monitoring the systems so that actions can be taken to terminate the development of a fault sequence. However, no credit is taken for that operator response, so the facility is designed with engineered features that will function automatically to prevent the development of hazardous situations. If system operations, operator actions, and engineered features fail to preclude the event, mitigating systems are designed to attenuate the consequences of the event.

Another important aspect in safety system design is the evaluation of the conditions in which the systems are expected to operate. The design will incorporate the expected environmental conditions into the specifications for the SSCs that must function to prevent hazardous situations or mitigate the consequences of accidents. Requirements regarding the environmental qualification of Safety Design Class systems and components, including considerations for aging, are provided in SRD Volume II as Safety Criterion 4.4-2. While suppliers of Safety Design Significant systems and components are not specifically required to provide test results relative to aging, the procurement specifications for these systems and components will specify the environmental conditions (e.g., temperature, humidity, and radiation field) to be expected during normal operation and the accident duration for which the system component must function. Specifying Safety Design Significant systems and components in this manner provides reasonable assurance to DOE that they will perform their safety function when required.

The safety system design process for the WTP uses a project-wide approach for the classification of the SSCs based on their importance to accident prevention and mitigation. This approach ensures that specifications for SSCs are commensurate with the importance of the functions that need to be performed.

Safety Design Class SSCs are those necessary to ensure that the radiation and chemical exposure standards for members of the public or workers are not exceeded as a result of accidents. The Safety Design Class designation is also applied to those SSCs necessary to prevent criticality events. The highest levels of design, quality assurance, and operational requirements (e.g., periodic testing and preventative maintenance) are applied to Safety Design Class SSCs.

Safety Design Significant SSCs are those needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation. SSCs are also designated as Safety Design Significant if they place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction. High levels of design, quality assurance, and operational requirements are applied to Safety Design Significant SSCs.

Additional information on the SSC classification process is provided in ISMP Section 1.3.10, "Classification of Structures, Systems, and Components".

3.12 Human Factors

In the design of the WTP Project, careful attention is paid to the interfaces between the operating personnel and the facility to ensure that good human factors and ergonomics practices are followed. This results in a facility that is user-friendly to minimize errors of omission and commission and to enable the operator to respond effectively to those situations in which human response is beneficial or required. Attention is given to the design and content of controls and displays (both hardware and software-generated)to ensure that clear and unambiguous indications of equipment status are readily available and understood without interpretation. Reviews of controls and displays ensure that compatibility with human psychology and physical characteristics is achieved and enable the required human tasks to be performed reliably and efficiently.

The human factors specialist evaluates proposed workstations and tasking, assesses physical components (e.g., dimensions, color coding, labeling, etc.) of the workplace, and supports the development of training for operators. The goal is to eliminate or reduce the potential for human error. The specialist has experience in a wide variety of nuclear, other process control, and manufacturing facilities upon which to draw. During plant design, the human factors specialist, in conjunction with experience operators and maintainers, identifies opportunities for design improvement and provides recommendations to project designers and engineers. The specialist also supports task analysis activities performed by project training to ensure the tools, equipment, and procedures are suitable for human use and reflect opportunity for the operators to perform their jobs and the associated elements error-free.

The design effort commences with the general layout of the facilities and continues through the detailed design stage. Human factors input to the project parallel the design efforts as they progress. Appropriate instruments and displays in the control rooms and at local control stations are particularly important to allow operators to detect and correct abnormal conditions. Alarm display systems, control screen layouts, and workspace design (including access, clearances, habitability, etc.) are also important to ensure that routine and special maintenance can be completed safely.

The aforementioned human factors considerations support the basis for interactions and integration with other aspects of project design, which include human factors support to: engineering, training, the development of operating instructions and procedures, and any implications for safety management. The intent is to ensure that the training of operations personnel and other staff is compatible with the proposed facility operating regime and, likewise, that the operating procedures are developed to ensure full compatibility with the design of the tasks and the design of the equipment. Operating instructions are validated for reliable interpretation and implementation by the users.

Implementation of the above-described human factors considerations are carried out via the guidance contained in the American National Standard IEEE Std 1023-88 (IEEE 1988). This standard may be tailored as guidance to WTP activities as they proceed through the design and commissioning/operational phases. The implementation of human factors considerations is done systematically and includes oversight reviews by the human factors specialist at appropriate points. Other human factors related standards or guidance are used, if needed, for topics not sufficiently covered by IEEE Std 1023-88 or where that coverage is not sufficiently explicit. If needed, the project's standard selection process, as outlined in the *Safety Requirements Document Volume II*, Appendix A, will be followed to formally select additional implementing standards for human factors requirements.

3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)

To ensure that the facility meets operational requirements, it is necessary to address issues associated with reliability, availability, maintainability, and inspectability.

Reliability is used as a measure of the ability of an item or system to complete a task, and it is normally expressed as a probability of failure. Reliability is designed in through the use of appropriate design techniques and control of the mode of operation and the environment. Design techniques to be used vary because they are dependent on the specific item or system and the task to be performed. Their purpose is to optimize reliability by the following:

1) Use of proven materials and components
2) Design simplicity
3) Testability
4) Control of manufacturing standards
5) Control of operational mode (e.g., prevention of misuse and overloads)
6) Control of environment (e.g., protection against corrosion and vibration).

Consistent with the process for tailoring hazard controls using the potential radiological and chemical consequences of individual events, reliability is assigned to SSCs based upon the importance of the SSC to the prevention or mitigation of accidents. The significance of accident prevention and mitigation is determined by the severity of the accident to workers or the public. To implement this tailoring in a clear, consistent, and defensible manner, an Implementing Standard for Safety Standards and Requirements Identification was developed. This Implementing Standard includes a Severity Level ranking system which provides the hazard assessment and control teams with a defined way to categorize the potential severity of those events that can result in radiological or hazardous exposure to the workers or the public. The Implementing Standard provides the means by which the hazard assessment and control teams establish target reliabilities for SSCs.

Availability is a measure of the degree to which an item or system is in an operable condition. It is expressed quantitatively as the ratio of the mean time between failures to the sum of the mean time between failures and the mean time to repair. System availability is calculated to determine the potential for downtime. In this way, systems are identified that contribute to decreased availability. Required availability is achieved by specifying additional systems or increasing reliability of existing systems.

Maintainability is a measure of the ability to restore a failed item or system to an operable condition in a specified time. Maintainability is designed into the facility and processes through use of appropriate design techniques, (e.g., the use of specially designed, remotely removable, and replaceable pumps and valves in process systems, and the placement of active pumps or valves within shielded accessible areas equipped with appropriate decontamination facilities that allow hands-on maintenance activities) and logistic support (e.g., scheduling and procedures). Benefits of these design techniques are that they simplify maintenance operations in high radiation areas and remove high maintenance equipment from high radiation areas.

Testability of Safety Design Class systems and components is facilitated by such features as redundancy that allow for a system or component to be removed from service for maintenance or testing without loss of safety protection.

Inspectability is the measure of the ease with which items or systems can be inspected for preventative maintenance or assessment of condition. Inspectability is used to monitor facility items in order to maintain their reliability. Inspectability of facility items can be designed in by the use of shielded access areas (as above, to reduce radiation exposure) for active equipment or the provision of monitoring equipment (e.g., material coupons for determining vessel corrosion rates, and in-cell cameras).

During the design phase, the WTP and processes are evaluated for reliability, availability, maintainability, and inspectability. BNI uses a number of validated modeling techniques (computer codes, mathematical modeling, failure modes, and effects analysis) for determining reliability and availability of the facility and processes. These are used to identify those facility and process areas that are sensitive with respect to influencing overall facility and process performance. Optimum reliability is established by the use of appropriate standards and quality control. The determination of maintenance and inspection needs is based on facility and process reliability requirements. It is a mixture of process optimization, provision of appropriate design features to aid preventative and scheduled maintenance and inspection, and the development of maintenance and inspection programs (administrative and procedural controls) whose objectives among other things, are to facilitate these activities. Reliability targets are assigned to SSCs only when a quantitative value has been credited for the reliability of an SSC in safety analysis.

A hypothetical example of the application of RAMI to the WTP is the cooling water supply system to the technetium/cesium product storage tank. Cooling water is supplied to the this vessel to keep the contents from boiling thereby preventing the release of radionuclides and steam to the ventilation system. Failure of the cooling water system supply could lead to a hazardous situation or, at the least, operability concerns. The system comprises a closed-cycle primary system supplying chilled water to cooling coils within the vessel. Chilled water is supplied via a secondary chilled water circuit and heat exchanger. It should be noted that physical considerations indicate that the tank contents may reach their boiling temperature, but the predicted time required is on the order of several days. A conservative estimate of the minimum time to boiling assumes there is no heat transfer from the tank (ISAR Section 4.7.2.4, “Technetium/Cesium Product Storage Tank”).

This supply system is analyzed using a commercially available computer program. The system is first broken down into major components (e.g., pumps and valves); for each component reliability data are obtained and an acceptable repair time specified. The computer model calculates total availability of the system throughout the "operating life" of many years. The overall reliability of the system is then determined by application of fault tree analysis. Failure rates for postulated faults are determined and sensitive items of the system with respect to failures are identified.

No maintainability of the in-cell components (primary circuit) is required, as the design takes this into account (e.g., all welded pipework and enhanced testing). Inspection of the primary circuit takes place either indirectly through the use of coupons within the circuit to assess corrosion rates of the pipework and cooling coils or directly through visual (closed circuit television) means.

3.14 Commissioning and Operation

A structured test program ensures that SSCs function correctly against their specific performance requirements, including safety functions. The test program depends on the facility design being systemized, which allows each individual system to be fully tested in isolation before being integrated with the others leading towards full facility operation. Design documentation, such as process and system descriptions, are used as a resource to develop the startup testing program. Full facility operation is dependent on the successful demonstration of the process performed by the facility. Facility operation is not initiated until the systems testing adequately demonstrates their performance objectives in support of the process. Fault detection sooner rather than later is the philosophy to ensure cost-effective design, manufacture, and fabrication, leading to a structured design and testing methodology with the emphasis on systems analysis early in the design process. The WTP is systemized for design and procurement, allowing the BNI design and testing philosophy to be applied consistently with the Tank Farm facility.

The WTP includes chemical process and mechanical handling operations, performed by a number of mechanical, electrical, instrument, and control systems contained within a suitable civil structure. Each system is tested to demonstrate performance, as scheduled by a test plan, and is only integrated with other systems when test acceptance criteria have been met.

During testing, diagnostic data are collected, and the initial operating parameters recorded. Operating points are adjusted to conform to the design basis of the system or component. Deficiencies detected in testing are tracked to ensure their resolution.

The method of testing is predetermined to be either analysis, demonstration, or examination, depending on the function performed and the type of SSC. Testing begins at the component level. Only components that have met qualification requirements are integrated into their respective system. Each system is tested, as appropriate, with particular attention given to the system interface(s) with its associated system(s). These interfaces are simulated for the purposes of testing.

Manufactured systems and components are typically tested at their point of fabrication, and held there until proven acceptable for delivery to the construction site. All installed systems are subject to installation and startup tests, to ensure that they perform as they did at their point of manufacture, and that they have not been damaged during transit. These tests include energizing equipment and checking mechanical operation, instrument calibration, electrical cable continuity, and pipe and structural integrity.

A phased testing program is implemented for the WTP, with the testing schedule established by the availability of systems and their dependence on associated systems. Specific tests are implemented for each system including testing of the supporting or supported systems. Interface testing is of prime importance to the success of testing in this phased manner because the consequences of failure affects the overall schedule. System integration only occurs when each end of an interface has been adequately tested to give confidence that integration will succeed.

When systems have sufficiently demonstrated their ability to function, process operation may begin. A series of system performance demonstrations (SPD) are typically performed to commission new facilities, and the number of SPDs depends on the function of the facility and the materials handled. For the WTP, the following four levels of SPD are demonstrated:

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

All SPD levels are not applied for all systems and components. For example, the first level would not be applied to the melters or vent systems.

Because the fourth-level SPD is the first time that the facility becomes radioactive, faults identified during previous testing can be corrected without any decontamination costs or radiological hazards. On successful completion of the fourth-level SPD, the facility is ready for normal operations.

The involvement of operations personnel throughout the design process and the involvement of design engineering personnel through the beginning of operations when the facility is turned over to operations are key elements in the design and testing philosophy. The development of facility control system simulators in advance of facility testing also strengthens the ability and confidence in the performance of the facility control systems and operator interfaces.

Such simulators have several purposes: they allow testing of the control systems software offline, without risk to personnel or the facility; they permit proving of the testing, commissioning, and operational procedures and documentation; and they facilitate training of operational and maintenance personnel so they may support testing. Integration of design and operating personnel during testing is important to the successful turnover of the facility for operations because it ensures a relatively smooth transition. These activities ensure that the facility is able to demonstrate operational readiness independently of the testing schedule and in advance of hot testing activities.

3.15 Training and Qualification

Training plays an important role in the safe operation of the WTP by ensuring that personnel have sufficient knowledge to safely fulfill the roles and responsibilities of their assigned jobs. Operator training for normal operation takes benefit of facility design information, results from the startup test program, operation of similar facilities, and operation of Project demonstration facilities. Training for accident conditions is based, in part, on the safety analyses performed for the WTP including the hazard analysis and accident consequence analyses.

The training objectives include the following:

1) Improving technical ability (understanding of processes)
2) Enhancing of personal skills (communication, worker-management)
3) Increasing awareness of the workplace and signs of potential hazardous situations
4) Educating personnel in the importance of acting with regard to their own safety and the safety of others
5) Establishing a safety culture that assigns safety responsibility to the individual.

A training plan, described in ISAR Section 3.4, "Training and Qualification", incorporates the above objectives. The plan notes the following requirements that constitute a thorough approach to personnel training and qualification for the WTP.

1) Recognition of the different types of training that is required. For example achievement of a necessary level of job competence, knowledge of the requirements of applicable laws and regulations pertaining to the handling of radioactive and chemical materials, specialist training for maintenance activities, and detailed knowledge of process operations.
2) Assessment of training needs. Training is most effective when matched to the needs of the individual. This can happen with two-way communication between the training section and the individual. Each person is assessed on training needs, in conjunction with their line management and training personnel. These needs vary from individual to individual and are dependent on job type.
3) Clear definition of responsibility for training. The plan outlines which functional office within the Project is responsible for training and how this responsibility for training was assigned. Personnel are encouraged to take an active interest in their own training and development and are able to discuss with their line management how their needs can best be met.
4) The establishment of learning objectives. These objectives are derived from analyses that describe the desired performance after training.
5) Training requirements evolve as the facility and its safety program evolves. As the facility and process develop from design to testing and operations, and lessons learned from other facilities become available, training information and requirements change. For example, facility operators may need training in a new type of process developed as a result of a facility modification during operations. The training program is flexible to reflect changing requirements. However, training is continuous to reflect these changing requirements and to ensure that job proficiency is maintained; it is not driven solely by changes to administrative or engineered controls.
6) Training evaluation. A feedback process is established to ensure current training needs are being met by assessing the following:
    a) The training being given is appropriate for the task and effective (i.e., individuals learn from the training)
    b) Personnel performance in the job setting
    c) Requirements for new or updated training are being met.
7) Auditability. The training program and individual development are visible. The maintenance of training log books and regular appraisal of an individuals training needs are important in

demonstrating that the WTP personnel are always correctly trained in the current procedures. The training program is evaluated by oral testing, written exams, or assessment of the work product.

Training and qualification credited for public and worker safety are in accordance with the requirements of the QAM. The program for establishing the qualification requirements for WTP personnel is summarized in ISMP Section 6.1.3, "Personnel Qualification and Resources". Details on the training and qualification programs are described in ISAR Section 3.4, "Training and Qualification".

3.16 Internal Safety Oversight

Internal safety oversight for the Project involves several oversight functions to ensure safety of the public and workers and to preclude environmental degradation. These internal safety oversight functions include corporate safety assessments, management assessments, independent assessments and audits, safety committees, incident investigations, maintenance of the authorization basis, and the USQ process. In ISMP Section 5.4, "Compliance Audits", and Chapter 10.0, "Assessments", other facets of internal safety oversight are covered. Several administrative functions provide information on the adequacy of the oversight functions and also provide information used to define the scope of future internal safety oversight functions. This information includes: performance monitoring; performance indicators; lessons learned and industry experience; and feedback and trending.

The staff possess the unique skills to perform internal safety oversight. Some of the skills applied are as follows:

1) Conducting performance-based assessments that emphasize work activity in progress
2) Reporting deficient conditions to line management
3) Following up on corrective actions to prevent a recurrence of the deficiency
4) Applying performance trending to determine existence of programmatic issues and plan for future oversight areas
5) Understanding the requirements of the Price Anderson Amendments Act and 10 CFR 820, "Procedural Rules for DOE Nuclear Activities"
6) Assisting line management to establish a positive safety culture
7) Incorporating applicable lessons learned from previous WTP incidents and industry experience at other DOE sites and the commercial power industry to the project oversight program
8) Maintaining a continuing interaction with the WTP regulator on the status and direction of project oversight activities.

Internal oversight may include participation of staff external to BNI. The external members are selected based on their experience and qualifications to provide different perspectives or expertise in specific functional areas.

3.16.1 Safety Committees

The Project Safety Committee (PSC) structure provides the overview, review, and approval functions for nuclear, radiological, and process safety, occupational safety, and environmental protection matters. The WTP Contractor corporate safety oversight addresses corporate safety policies and matters as they relate to the Project. The WTP PSC addresses WTP-specific safety policies and regulatory requirements. This two-tier structure affords open communications and sharing of relevant information between the corporate staff and the Project.

During the design and construction phase, the WTP Contractor corporate safety oversight and the WTP PSC focus on nuclear, radiological, and process safety (as related to the development of the facility design and operations) and on worker safety (as related to construction activities). As the construction phase nears completion, the safety committees' focus shifts to commissioning activities and preparations by the various Project organizations to ensure the effectiveness of their nuclear and worker safety programs during operation. During operation, the committees focus on operations, management, performance of personnel, equipment, and systems, and incidence reporting. Near the end of waste processing operations, radiological control and worker safety during deactivation also are addressed.

As part of safety communication throughout the Project, workers will be invited to participate in the safety committee meetings (e.g., during regular updates on worker safety performance, review of proposed corrective actions for incidents involving worker activities). Facility workers also serve as active members on other WTP safety committees.

3.16.1.1 WTP Contractor Corporate Safety Oversight

The WTP Contractor corporate organization provides ongoing oversight and review of Project matters that affect radiological, nuclear, and process safety. This corporate oversight is provided to the WTP Project Manager by senior level management of the WTP Project contractor corporate organization. To provide this support, corporate management periodically makes recommendations based on review of items such as:

1) Safety programs that implement WTP policy and regulatory requirements applicable to the Project
2) Recommendation of the approval to proceed with hot operations
3) The significance of new regulations related to radiological, nuclear, and process safety, as applied to Project programs, procedures, and policies
4) Unusual occurrence reports
5) Reports and meeting minutes issued by the Project Safety Committee
6) Project reports on the effectiveness of Project safety programs and associated management controls.

Corporate management also initiates special independent assessments or audits, as necessary, to obtain additional information concerning the effectiveness of radiological, nuclear, and process safety programs or management controls at the Project.

3.16.1.2 Project Safety Committee

The PSC provides advice to the Project Manager on matters related to safety. PSC members are specified from facility management and staff. Specialists in specific fields and external subject matter experts may also be specified, as required. The members are specified from several different organizations and backgrounds to ensure that advice on safety matters is representative of an integrated evaluation of the matters under consideration.

The PSC Chairperson coordinates and facilitates the committee decision making process to achieve consensus on decisions and recommends approval by the Project Manager or designee.

The PSC reviews the management and the performance of the WTP nuclear, radiological, process, and occupational safety and environmental protection activities, including the following:

1) Results from the Safety Improvement Program
2) Identification, resolution, and implementation of recommendations and corrective actions resulting from nonconforming items or activities, incident investigations, audits and assessments, inspections and reviews, or emergency exercises
3) Unusual and off-normal incident reports, including TSR violations
4) Reports covering such topics as proposed WTP modifications, emergency exercises, and the implementation of findings from management assessments
5) Performance indicators and trends of the WTP for worker, public, and environmental safety activities
6) Results of training programs for safety-related activities
7) Operating problems
8) Effectiveness of the safety/engineering interface with respect to the incorporation of safety and environmental requirement in the design.

The PSC is also responsible for reviewing and recommending approval to the Project Manager or his designee, for safety-related documents, such as the following:

1) Proposed changes to the authorization basis
2) Positive USQ determinations prior to submittal to the regulator
3) Procedure development processes and selected facility procedures
4) Proposed Important-to-Safety design changes
5) Responses to Notices of Violations from the regulator
6) Authorization requests and other regulatory submittals
7) State of Washington permits and license applications
8) WTP pre-operational testing programs including summaries of test procedures and test results

The PSC reviews audit and assessment reports and recommends actions.

The PSC may make use of subcommittees, as appropriate, to provide oversight to specific functional areas or complete specific tasks or evaluations.

3.16.2 Safety Improvement Program

A safety improvement program is developed and implemented by the PSC. The key theme in the safety improvement program is that it is owned by all WTP personnel with the demonstrable commitment and leadership of senior WTP management.

The safety improvement program is coordinated, monitored, and implemented by the following:

1) The establishment of the PSC to oversee safety performance
2) The establishment of safety improvement groups to identify and implement improvement initiatives within their work area
3) The senior management support and demonstrated commitment to the PSC by attendance at committee meetings
4) The reviews of safety performance and implementation of safety improvement action plans about four times per year via an appropriately constituted review group established by the PSC. Representatives are selected based on the scope of the review, personnel expertise required for the review, and personnel qualifications.

3.16.3 Incident Investigations

Incident investigations involve the identification, categorization, notification, reporting, and processing of information related to incidents, emergency events, and accidents associated with the WTP. Incident reports are sent to the DOE Occurrence Reporting and Processing System. Although the incident reporting process is usually initiated with operation of a nuclear facility, the process is developed and implemented for the WTP construction and testing activities in preparation for operation.

The incident investigation and reporting procedures, and the training to these procedures, ensure that the WTP regulator, the DOE Program Office, and WTP management are kept informed on a timely basis, of events and conditions during construction, testing, and operational activities that could adversely affect quality assurance, security, environment, operations, or the health and safety of the public and workers. Incident reports are evaluated for a potential noncompliance to a nuclear safety requirement reportable by the requirements of 10 CFR 820 “Procedural Rules for DOE Nuclear Activities”.

For an incident that indicates a potential inadequacy of previous safety analyses as defined in an approved safety analysis report or that indicates a possible reduction in safety margins as defined in the TSRs, actions are taken to place or maintain the facility in a safe state and a safety evaluation is performed. The completed safety evaluation is submitted to the regulator before removing any operational restrictions initiated in response to the incident.

Additional detail on incident investigations is included in ISMP Section 5.6.7, “Investigation of Incidents” and ISAR Section 3.7, “Incident Investigations”.

3.16.4 Unreviewed Safety Questions

USQ reviews are performed after Production Operations Authorization has been issued. A proposed change, test, or experiment involves an Unreviewed Safety Question (USQ) if:

1) The probability of occurrence or the radiological or chemical consequences of an accident or malfunction of equipment important to safety, previously evaluated in the authorization basis is increased, or
2) A possibility for an accident or equipment malfunction of a different type than any evaluated previously in the facility safety analyses is created, or
3) Any margin of safety is reduced.

Proposed temporary or permanent changes to administrative and engineered controls are reviewed by qualified USQ evaluators to determine if they would involve a USQ. An activity will not be undertaken without DOE review and approval if the initiation of the activity would itself involve an unreviewed safety question. If the proposed change does involve a USQ, one of the following three options are pursued.

1) The proposed activity is abandoned.
2) The proposed activity is modified to remove the USQ.
3) The proposed activity is submitted to the regulator for review and approval prior to initiating the activity, if initiation of the activity would itself involve a USQ, or implementing the proposed change.

When the WTP Contractor identifies information that indicates a potential inadequacy of previous safety analyses or a possible reduction in the margin of safety, the Contractor:

1) Notifies the DOE of the situation upon discovery of the information;
2) Performs an Unreviewed Safety Question determination safety evaluation;
3) Takes action to place the facility in a safe condition until the safety evaluation is completed; and
4) Submits the completed safety evaluation prior to removing any operational restrictions.

The following organizations have key roles in the WTP USQ process.

1) The ES&H Organization is responsible for developing the USQ procedure, developing the training and qualification requirements for USQ evaluators, and maintaining the list of qualified evaluators.
2) The Facility Manager approves the USQ procedure and the training and qualification requirements for USQ evaluators.
3) The Configuration Management Organization will support the project functional organization in establishing procedures requiring the performance of USQ evaluations of proposed changes, tests, and experiments.
4) The PSC approves USQ determinations prior to their submittal to the regulator.

3.16.5 Performance Monitoring

Performance monitoring is used at the WTP to verify that ES&H and other WTP programs, plans, and procedures exist; are in place; are adequate; are functioning as designed; and are in compliance with applicable regulatory or permit requirements. Performance monitoring for radiological, nuclear, and process safety is conducted by WTP quality assurance, process safety, health physics, nuclear safety, and regulatory staff. Performance monitoring includes, but is not limited to, reviewing records, plans, and procedures; visually observing operations/activities; and interviewing key personnel. Findings are provided in written reports with recommendations for improvements as applicable. During design and construction, the findings are provided to the Project Manager and during pre-operational testing, operation, and deactivation, the findings are provided to the Facility Managers.

Performance monitoring is conducted to ensure high standards of performance in the following areas:

1) WTP site radiological monitoring program
2) Radiological safety program
3) Personnel training program
4) Employee concerns program
5) Hazardous material inventory and waste tracking systems
6) Facility safety requirements
7) Conduct of operations and maintenance (beginning with hot commissioning)
8) Housekeeping (during construction, commissioning, and operations)
9) Employee compliance to established safety and quality criteria (See ISMP Section 3.4, “Safety/Quality Culture”)
10) Quality Assurance Program.

3.16.6 Performance Indicators

Performance indicators for safety and environmental protection objectives are established for the Project. Performance is monitored on a periodic basis to determine progress of the Project in achieving these indicators. Examples of performance indicators are as follows:

1) A change in the number of lost-time accidents and recordable injuries
2) Radiological exposures of facility personnel
3) Radiation workers exceeding a specified annual exposure level
4) Operation outside the established limits for discharge and disposal of waste
5) Entry into TSR actions statements for reasons other than TSR-required surveillance
6) Violations of TSRs
7) Findings of audits and assessments

8) Unusual occurrences
9) Maintenance backlog
10) Effectiveness of the maintenance program (e.g., time to repair, control room annunciators, and equipment out of service)
11) Fire impairments.

3.16.7 Lessons Learned

The lessons learned program, established and maintained by the ES&H Organization, includes the identification, documentation, validation, and dissemination of lessons learned information for the Project. Industry experience that draws on lessons learned, events, deficiencies, and other similar information from other operating sites for the purpose of enhancing the safety of the facility will be considered during each phase of the project.

This information is used in the revision of applicable procedures, development of training curricula, and in the modification of training materials. Personnel potentially affected by lessons-learned material can participate in this training process by providing feedback on information distributed and identifying information for potential inclusion in the process.

The WTP Project has prepared a procedure to support the development and implementation of Lessons Learned Program. Development of a Lessons Learned Program establishes a consistent manner in which information is captured or developed and disseminated throughout all phases of the WTP Project to ensure ongoing improvement of WTP safety and reliability. Development and implementation of such a program is required per DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, as well as by the ISMP and QAM Authorization Basis documents. Lessons Learned incorporates the Integrated Safety Management System Core Function of Feedback and Continuous Improvement.

To define the WTP project approach for addressing Lessons Learned in the Engineering design process, an Engineering Department Lessons Learned System was developed. This Lessons Learned System applies to Engineering department personnel, but does not replace the project-wide Lessons Learned program procedure. The requirements of that "umbrella" procedure for project-wide lessons learned are also met in the Engineering Lessons Learned System.

The objectives of the WTP Engineering Lessons Learned System are to:

- Contribute WTP Lessons Learned to the BSII Engineering Department Lessons Learned Database.
- Identify best practices by providing feedback on work process improvements and innovative approaches.
- Identify recurring or significant problems.
- Provide useful information about suppliers.

The Engineering Lessons Learned System involves identification, assessment, dissemination, and appropriate incorporation of Lessons Learned into "Best Practices" and, ultimately, into the Engineering standards, guides, and procedures.

3.16.8 Feedback and Trending

As described above, incidents occurring in the WTP are used as lessons learned to feed relevant information back to appropriate WTP staff members and the training programs to assist in precluding recurrence. The lessons learned are applied in a broad manner within the WTP, rather than focused only on the specific administrative or engineered control involved in the incident. Significant lessons learned are provided to the Project Manager during design and construction and to the Facility Manager during commissioning, operation, and deactivation.

Trending within various performance areas, such as operations, training, and maintenance, is used to verify that continuous improvement is being achieved in the Project. In the event that repeat events, findings, or other deficiencies are indicated, follow-up actions are initiated to identify additional corrective actions needed to preclude further recurrence. These additional corrective actions are tracked to completion and their adequacy to correct adverse trends is verified. Adverse trends are also evaluated to determine the existence of a programmatic failure of nuclear safety requirements subject to reporting in accordance with 10 CFR 820, “Procedural Rules for DOE Nuclear Activities”.

13.0 References

62 FR 8693, "Record of Decision for the Tank Waste Remediation System, Hanford Site, Richland, Washington", U.S. Department of Energy, *Federal Register*, Vol. 62, pp. 8693-8704.

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 830.120, "Quality Assurance Requirements", *Code of Federal Regulations*, as amended.

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

10 CFR 1021.216, "Procurement, Financial Assistance, and Joint Ventures", *Code of Federal Regulations*, as amended.

29 CFR 1910, "Occupational Safety and Health Standards", *Code of Federal Regulations*, as amended.

40 CFR 68, "Chemical Accident Prevention Provisions", *Code of Federal Regulations*, as amended.

AIChE 1992, *Guidelines for Hazards Evaluation Procedures, Second Edition with Worked Examples*, Center for Chemical Process Safety, American Institute of Chemical Engineers, New York, New York.

AIHA 1988, *Emergency Response Planning Guidelines*, American Industrial Hygiene Association, Akron, Ohio.

ASME 1989, *Quality Assurance Requirements for Nuclear Facility Applications*, ASME NQA-1-1989 Edition, American Society of Mechanical Engineers, Fairfield, New Jersey.

BNFL 1997a, *Quality Assurance Program*, BNFL-5193-QAP-01, BNFL Inc., Richland Washington.

BNFL 1997b*, Hazard Analysis Report,* BNFL-5193-HAR-01, BNFL Inc., Richland, Washington

BNFL 1997c, *Initial Safety Analysis Report*, BNFL-5193-ISA-01, BNFL Inc, Richland, Washington.

BNFL 1997d, *Safety Requirements Document*, BNFL-5193-SRD-01, BNFL Inc., Richland, Washington. (Revision 2 issued December 1998).

BNFL 1997e, *Radiological and Nuclear Dose Standards for Facility and Co-Located Worker*, BNFL Inc., Richland, Washington.

BNFL 1998a, *Deactivation Plan*, BNFL-5193-DP-01, Draft, BNFL Inc., Richland, Washington.

BNFL 1998b, *Integrated Master Plan*, BNFL-5193-IMP-01, Revision 1, BNFL Inc., Richland, Washington.

BNFL 1998c, *Quality Assurance Program and Implementation Plan*, BNFL-5193-QAP-01, BNFL Inc., Richland, Washington.

BNI 2001, *Quality Assurance Manual*, 24590-WTP-QAM-QA-01-001, Bechtel National, Inc., Richland, Washington.

BNI 2001a, *Quality Assurance Provisions Document*, 24590-WTP-QPD-QA-01-001, Bechtel National, Inc., Richland, Washington.

BNI 2001b, *Safety Requirements Document, Volume I*, 24590-WTP-SRD-01-001-01, Bechtel National, Inc., Richland, Washington.

BNI 2001c, *Safety Requirements Document, Volume II*, 24590-WTP-SRD-01-001-02, Bechtel National, Inc., Richland, Washington.

BNI 2001d, *Initial Safety Analysis Report, Volume I*, 24590-WTP-ISAR-01-001-01, Bechtel National, Inc., Richland, Washington.

BNI 2001e, *Initial Safety Analysis Report, Volume II*, 24590-WTP-ISAR-01-001-02, Bechtel National, Inc., Richland, Washington.

BNI 2001f, *RPP-WTP Configuration Management Plan*, 24590-WTP-PL-MG-01-002, Bechtel National, Inc., Richland, Washington.

DOE 1994, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, DOE-HDBK-3010-94, U.S. Department of Energy, Washington, D.C.

DOE 1995a, *Comprehensive Emergency Management System*, DOE O 151.1, U.S. Department of Energy, Washington, D.C.

DOE 1999, *Quality Assurance*, DOE Order 414.1A, September 29, 1999, US Department of Energy, Washington, DC.

DOE 1999a, *Contractors Requirements Document*, Attachment 1 to DOE Order 414.1A, *Quality Assurance*, September 29, 1999, US Department of Energy, Washington, DC.

DOE 2000, *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program (QARD)*, DOE/RW-0333P, Rev 10, April 28, 2000, U.S. Department of Energy, Washington, D.C.

DOE-ORP 2000, DOE Contract DE-AC27-01RV14136, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE-RL 1994, *Hanford Emergency Response Plan*, DOE/RL 94-02, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

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

DOE-RL 1996c, *TWRS Privatization*, DOE Contract DE-AC06-RL-12208, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

DOE-RL 1998a, *Corrective Action/Enforcement Action Program Description*, Revision 0, RL/REG-98-06, US Department of Energy, Richland, Washington.

DOE-RL 1998b, *Inspection Program Description for the Regulatory Oversight of TWRS Privatization Contractors*, Revision 0, RL/REG-98-05, US Department of Energy, Richland, Washington.

DOE-RL ~~2000~~2002, *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basis*, Revision ~~7~~9, RL/REG-97-13, US Department of Energy, Office of Safety Regulation of the Contractor, Richland, Washington.

DOE-RL 2001, *Review Guidance for the Construction Authorization Request (CAR)*, Revision 3, RL/REG-99-05, US Department of Energy, Richland, Washington.

EPA 1991, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*, US Environmental Protection Agency, Washington, D.C.

Gibbs, D C, 2000, "Approval of BNFL-5193-QAP-01, Rev 4c, 'Quality Assurance Program and Implementation Plan' (QAPIP)", 00-RU-0063, (letter to Mr. M J Bullock, BNFL Inc., January 7, 2000), U S Department of Energy, Richland Operations Office, Richland, Washington.

HRC 1976, *Investigation of Incident in Ion Exchange Resin*, HRC Report 3719, Hazards Research Corporation, Denville, New Jersey.

ICBO 1994, *Uniform Building Code*, International Conference of Building Officials, Whittier, California.

National Environmental Policy Act, 42 USC 4321 et seq., as amended.

NCRP 1963, *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure*, Handbook 69, Addendum 1, Recommendations of the National Committee on Radiation Protection, National Bureau of Standards, Washington, D.C.

NRC 1977, *Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable*, Regulatory Guide 8.10, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1978, *Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is be As Low as is Reasonably Achievable*, Regulatory Guide 8.8, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1982, *Accident Generated Particulate Materials and Their Characteristics -- A Review of Background Information*, NUREG/CR-2651, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1988, *Nuclear Fuel Cycle Accident Analysis Handbook*, NUREG-1320, in revision, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1994, *Integrated Safety Analysis Guidance Document*, NUREG-1513, draft, distributed August 8, 1994, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1995a, *Standard Format and Content for the Health and Safety Sections of License Applications for Fuel Cycle Facilities*, Regulatory Guide 3.52, Revision 2, draft, U.S. Nuclear Regulatory Commission, Washington, D.C.

NRC 1995b, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, draft NUREG-1520, U.S. Nuclear Regulatory Commission, Washington, D.C.

Resource Conservation and Recovery Act of 1976, 42 USC 2795 et seq., as amended.

Sheridan, T. R., 1997, “TWRS Regulatory Unit Approval of the BNFL, Inc. ‘Tank Waste Remediation System Privatization Project Quality Assurance Program’”, BNFL-5193-QAP-01, Revision 2, February 7, 1997”, 97-RU-0042, (letter to Mr. Maurice J. Bullock, BNFL, February 12), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

State Environmental Policy Act, Chapter 43.21C, Revised Code of Washington.

WAC 173-303, “Dangerous Waste Regulations”, *Washington Administrative Code*, as amended.

WAC 173-400, “Washington State Air Pollution Control Regulations”, *Washington Administrative Code*, as amended.

WAC 173-460, “Controls for New Sources of Toxic Air Pollutants”, *Washington Administrative Code*, as amended.