



02-0000740

**The Under Secretary of Energy**  
Washington, DC 20585

March 4, 2002

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DNF SAFETY BOARD

The Honorable John T. Conway  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue, N.W., Suite 700  
Washington, DC 20004

Dear Mr. Chairman:

The following is provided in response to your October 15, 2001, letter, concerning integrated safety management issues for the Department of Energy (DOE) Oak Ridge Operations Office (OR) and its Environmental Management (EM) contractor, Bechtel Jacobs Company (BJC). The Department regrets the lateness of our response.

The Department recognizes and takes full ownership for its safety management issues and as its highest priority, has been focused on establishing a basis for continued operations required to maintain limited activities in a safe condition and for implementation of compensatory measures and controls. The Department recognizes that some of the improvements required are associated with adopting a new, more rigorous culture related to nuclear safety and contractor management and, as such, will take longer than has been anticipated. This response identifies recent actions taken by DOE to improve the nuclear safety posture under the Oak Ridge Operations Office and the Bechtel Jacobs Company. This response does not, however, include a comprehensive corrective action plan. Because of recent management reassignments and anticipated program restructuring, new expectations are being established that will impact the final corrective action plan. Additionally, I believe the assessment of root causes has not been fully addressed to my satisfaction. Rather than further delay a response to the Board, this letter should be viewed as an interim status report with the commitment to provide the Board with periodic briefings and/or status reports to assist your understanding and evaluation of our progress.

Following are some of the key actions taken since the receipt of your letter:

1. On October 15, 2001, the DOE Assistant Secretary for Environmental Management (EM) rescinded all delegations of authority, previously delegated to the Oak Ridge Operations Office. EM issued new authorities on November 20, 2001, retaining the approval for the authorization basis for all Category 3 and higher nuclear facilities within the EM program.

2. The OR Manager formally revoked Integrated Safety Management (ISM) system verifications for both OR and BJC on November 1, 2001. The Department is identifying ISM deficiencies and flaws in the process used during the initial certification and assessing root causes for this area. DOE believes strongly that continued work is needed to support long-term and lasting gains. Consequently, our integrated corrective action plan will identify near and longer term improvement actions. But clearly, the OR/BJC feedback and continuous improvement mechanisms were not operative and headquarters/field managers did not effectively assess leading indicators. In addition, Oak Ridge's limited use of external reviewers may have contributed to a lack of objectivity during the previous ISM implementation
3. An independent DOE headquarters review, led by Mr. Dae Chung of the Department's National Nuclear Security Administration (NNSA), completed an assessment of Safety Basis Authorization and Approval Basis for Oak Ridge Operations Office and the Bechtel Jacobs Company in January 2002. This review was comprehensive and identified many deficiencies in the area of nuclear safety management processes. This report is included herein and we offer to brief the Board on its results.
4. Regarding the adequacy of the safety bases for nuclear facilities under the Oak Ridge Operations Office, in early analysis DOE acknowledges that a fully compliant Authorization Bases (AB) program for OR and its contractors against 10CFR830 is at least 12 months away. Consequently, we must rely upon compensatory measures to support continued safe nuclear operations. To support such a position the Department recently completed a management review of safety requirements, existing safety documentation, while also assessing a review of the adequacy of those controls for individual facility operated under the BJC contract, including those at Paducah and Portsmouth. As a result many activities were suspended or curtailed and compensatory measures and controls were implemented. Currently, a team of highly qualified nuclear safety experts is conducting safety-basis walk-downs and presenting their results to a Senior OR review panel for validation of conclusions. The panel has either accepted the existing implementation and controls or recommended additional compensatory measures where appropriate. The results from this effort will form the basis for the OR Manager to accept a defined minimum safe posture for the BJC Category 2 and 3 nuclear facilities. A final report is being prepared and will be forwarded to the Board by March 15, 2002.

5. On February 14, 2002, the Assistant Manager for EM approved the Technical Safety Requirements (TSR) for the East Tennessee Technology Park – Radiation Criticality Accident Alarm System. This approval resolved the criticality alarm system deficiencies and also provided a one-time extension to the Limiting Conditions of Operations for Building K-29. Both of these approvals were provided contingent upon completion of the contractor's implementation plans and the DOE verification prior to resumption of operations.
  
6. The Oak Ridge Operations Office and BJC are completing a comprehensive review of the Work Smart Standards set for the BJC contract against the 109 orders of interest. The result of this review is the identification of 25 directives that are applicable to the work scope currently performed by BJC, but were not previously and directly included in the contract. Of these 25 directives, the requirements for 14 directives are included through contract equivalencies, such as prime contract clauses and/or ISMS descriptions in the BJC contract. Because these requirements are being substantively met, OR plans to modify the BJC contract using a Type 1 change control process or directed change. Of the remaining directives, OR requested incorporation of four directives into the BJC contract on January 28, 2002, [DOE 5480.19, 5480.20A, 420.1 Change 3 (Section 4.2 Fire Protection) and DOE STD 1120.98]. A letter from BJC with a revised WSS set incorporating these four directives was submitted on February 28, 2002. The review also identified one directive, 10 CFR 830 Part B, that is required by regulation and for which BJC has submitted an implementation plan to OR. Finally, six directives contain requirements that are not included in the current BJC contract (DOE Orders 425.1, 433.1, 460.1, 460.2, 5400.1, 420.1, and 5480.4). A rough order magnitude cost assessment has been prepared for implementation. The analysis and cost associated with implementation of these six directives is expected to represent a Type II change revision or bilateral agreement with the contractor and will be evaluated using ORO O 250, Chapter V. If a Type II revision process is required DOE and BJC line managers, subject matter experts and workers will evaluate the issues and recommend contract modifications.

In addition to the above, the Office of Environmental Management performed an independent evaluation of the adequacy of the BJC contract to properly manage performance for the given statement of work. Mr. Michael Weis, EM, performed this review during February 2002 and found the contract to be adequate, but offered a number of recommendations related to contract management practice improvements. His report is being completed and will be

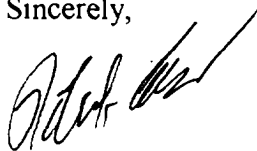
made available to the Board by March 15, 2002. The Office of Environmental Management will perform a verification of the OR/BJC WSS set review when the final report is issued.

7. The Department agrees with the Board that our technical competencies to support management of nuclear operations for both our federal and contractor ranks need strengthening. The Oak Ridge Operations Office is reviewing its responsibilities in its Functions Responsibilities and Authorities Manual against required technical competencies to identify gaps. The Oak Ridge Operations Office expects to mitigate these deficiencies in technical competency through details of Federal and contractor individuals as well as staff augmentation. As a compensatory measure both OR and BJC are adding qualified, but temporary, personnel from sites such as Savannah River and Rocky Flats to support ongoing operations and corrective actions. The OR Manager appointed a Senior Facility Representative for major facilities to provide additional technical support to the OR Assistant Manager for Environmental Management. The Bechtel Jacobs Company augmented its contract team with several qualified safety basis professionals from BJC subcontractors, other Bechtel or Jacobs' sites, and from their respective corporate offices. Additionally, progress is being made toward obtaining additional full-time resources for both OR and BJC. For example, OR hired a nuclear criticality safety engineer, who began work in February 2002 and BJC hired a senior nuclear safety specialist with both DOE and Nuclear Regulatory Commission experience who also reported in February 2002.

We continue to assess the effectiveness of our management and our technical competencies, both within the Federal and contractor ranks. Recognizing that measurable and fundamental change is necessary, the Department expects to announce modifications in the reporting relationships between headquarters and the field as well as changes in our respective management teams. We will continue to keep you informed of our progress in addressing the concerns at Oak Ridge Operations Office and Bechtel Jacobs Company. The Oak Ridge Operations Office will forward an integrated corrective action plan to the Board by April 19, 2002.

We are prepared to brief the Board at your convenience on our progress to date. If you have further questions, please contact me on 202-586-7700.

Sincerely,



Robert G. Card

Enclosure

SEPARATION

PAGE

United States Government

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Department of Energy  
National Nuclear Security Administration

# memorandum

DATE: February 1, 2002

REPLY TO  
ATTN OF: NA-53:DChung:3-3968SUBJECT: DEPARTMENT OF ENERGY-HEADQUARTERS ASSESSMENT OF BECHTEL  
JACOBS COMPANY AND OAK RIDGE OPERATIONS OFFICE SAFETY BASIS  
AUTHORIZATION AND APPROVAL PROCESSESTO: Milton D. Johnson, Acting Principal Deputy Director  
Office of Science, SC-3REF: Memorandum, "Assessment of Bechtel Jacobs Company (BJC) and Oak Ridge Operations  
Office Safety Basis Authorization and Approval Process," from Milton D. Johnson to  
Ralph E. Erickson, November 19, 2001.

Per your request in the reference, the subject independent assessment has been completed. The assessment was conducted in accordance with the assessment plan and criteria forwarded to your office and the Oak Ridge Operations Office (ORO) prior to commencing the site visit. As such, the assessment focused primarily on the following aspects-of nuclear facility safety management:

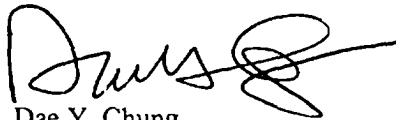
- Adequacy of the safety basis and safety posture for BJC nuclear facilities;
- Establishment and flow-down of nuclear safety roles, responsibilities, requirements, and technical directions;
- Technical competencies of managers and staff; and
- Safety basis management processes and procedures.

The final report containing a summary of the conclusions, findings, observations, and recommendations is attached (an advanced copy was submitted electronically to your office earlier).

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I wish to acknowledge all the hard work performed by each of the team members, as well as diligent support from many dedicated ORO and BJC personnel throughout the assessment period.

Sincerely,

A handwritten signature in black ink, appearing to read 'Dae Y. Chung', with a long horizontal flourish extending to the right.

Dae Y. Chung  
Assessment Team Leader

Attachment

cc:

J. H. Roberson, EM-1  
S. L. Johnson, EM-1  
P. M. Golan, EM-5  
G. L. Dever, Manager, ORO  
R. E. Erickson, NA-50

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**DOE Headquarters Independent Safety  
Basis Assessment**

**Of**

**Bechtel Jacobs Company LLC and  
DOE Oak Ridge Operations Office**



**Final Report**

**January 31, 2002**

Commissioned by the Office of Science

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## List of Acronyms

AMAU	Assistant Manager for Assets Utilization
AMEM	Assistant Manager for Environmental Management
AMESH	Assistant Manager for Environment, Safety, Health & Emergency Management
AML	Assistant Manager for Laboratories
ANSI	American National Standards Institute
ARF	Airborne Release Fraction
ASA	Auditable Safety Analysis
ATL	Advanced Technologies and Laboratories International, Inc.
BIO	Basis for Interim Operations
BJC	Bechtel Jacobs Company LLC
CAAS	Criticality Accident Alarm System
CFR	Code of Federal Regulations
DID	Defense in Depth
DMSA	DOE Material Storage Area
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EH	Office of Environment, Safety, and Health (Headquarters)
EM	Environmental Management
EM-1	Assistant Secretary for Environmental Management
ETTP	East Tennessee Technology Park
EU	Enriched Uranium
FHA	Fire Hazard Analysis
FSAR	Final Safety Analysis Report
HDBK	Handbook
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISMS	Integrated Safety Management System
JCO	Justification for Continued Operation
LCO	Limiting Conditions of Operation
LEU	Low Enriched Uranium
LLLW	Liquid Low Level Waste
LPF	Leak Path Factor
MAR	Material at Risk
MOP	Manager of Projects
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
NSD	Nuclear Safety Division
NTS	Noncompliance Tracking System
O	Order
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office
OSR	Operational Safety Requirements
Paducah	Paducah Site
Portsmouth	Portsmouth Site

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PHA	Preliminary Hazard Analysis
RCRA	Resource Conservation and Recovery Act
RF	Respirable Fraction
SAR	Safety Analysis Report
SB	Safety Basis
SBAT	Safety Basis Assessment Team
SC	Office of Science
SER	Safety Evaluation Report
SME	Subject Matter Expert
SMP	Safety Management Program
SSC	Structure, System, and Component
STD	Standard
TQ	Threshold Quantity
TSR	Technical Safety Requirements
U	Uranium
USEC	United States Enrichment Corporation
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WSS	Work Smart Standards
Y-12	Y-12 National Security Complex

## **Executive Summary**

At the request of the Acting Principal Deputy Director for the Department of Energy's (DOE) Office of Science, an independent assessment was conducted of the Oak Ridge Operations Office (ORO) and Bechtel Jacobs Company LLC (BJC). The assessment was in direct response to concerns raised by the Defense Nuclear Facilities Safety Board (DNFSB) in its letter dated October 15, 2001, which focused on the following aspects of nuclear safety management responsibilities:

- Safety assurance at nuclear facilities managed by the Office of Environmental Management;
- The adequacy of safety basis documents;
- Establishment and flowdown of nuclear safety roles, responsibilities, and requirements;
- Technical competencies of managers and staff; and
- Safety basis management processes and procedures.

The assessment team was led by Mr. Dae Chung of the National Nuclear Security Administration and included an experienced team of nuclear safety analysts, engineering and safety specialists, and technical managers of nuclear safety programs. The team was on site during December 2001 and January 2002 and reviewed safety basis documents for all 29 clusters of ORO Environmental Management Hazard Category 2 and 3 nuclear facilities, as well as a sampling of radiological facilities. Nuclear safety procedures and other related documents, such as the Work Smart Standards, were also reviewed, and interviews were conducted with the DNFSB site representative and numerous other BJC and ORO managers and personnel.

A systemic breakdown was found in fundamental nuclear safety management systems and processes within both ORO and BJC. These problems have persisted for years, in spite of an Integrated Safety Management System verification and other external assessments that have raised many of the same concerns. This inattention to nuclear safety management has resulted in widespread deficiencies in safety basis documents, as well as insufficient capabilities or mechanisms within ORO to help assure nuclear safety is being adequately managed.

The principal contributing factor leading to the systemic failure was a lack of management priority and accountability for nuclear safety from ORO and BJC. This is evidenced by the exclusion of applicable nuclear safety requirements in the BJC contract, the lack of clear nuclear safety policies and expectations, and inadequate resources within both organizations. A root cause of this factor may have been a long-standing presumption that the ORO Environmental Management nuclear facilities are "low risk" and, therefore, the traditional nuclear safety requirements are not imperative for operating these facilities safely.

Despite the above systemic concerns, the team observed that the vast majority of the BJC nuclear facilities, while containing significant radionuclide inventory, have a general lack of stored energy sources, and the prevailing material form is contained or fixed in nature (i.e., not easily dispersible). Added to this fact, the team observed that (1) operations personnel at the working level are generally aware of hazards and controls, (2) BJC has focused on safety programs related to radiation hazards and occupational safety, and (3) awareness of the nuclear criticality hazards has increased and the need for having a corporate-driven program was elevated to the highest level during the past year as a result of the Office of Environment, Safety, and Health assessment, which generated 40 corrective actions. Considering these factors and based on the SBAT's limited facility tours and observations, it was

determined that there is no imminent risk to the public or workers from readily releasable nuclear materials. This determination is also contingent on implementation of certain compensatory measures (see Section 6.0 for specific recommendations) and provided that there is no change to the current mission activities conducted within the BJC facilities.

However, the team also concluded that the nature of environmental management operations involves a certain amount of uncertainty and potential for encountering uncharacterized hazards. This necessitates that nuclear facility operations have a sound safety basis and commitment to implement key safety management programs (e.g., fire protection, training, and emergency management) that support nuclear operations. Some of these programs have not been established at the BJC corporate level. A summary of these and other concerns raised by the assessment team and communicated in this report is presented below. For more specific discussions on the findings and recommendations, see Section 6.

#### **Assurance of Safety at the BJC Nuclear Facilities**

- A breakdown in the safety basis management systems and processes resulted in overall technical deficiencies in the development, review and maintenance of safety basis documents.
- Systemic weakness in safety management programs exists at the BJC corporate level for the five sites (e.g., there is no corporate fire protection program) and, therefore, some compensatory measures are warranted (see Section 6.0).
- The ORO Nuclear Criticality Safety Program still does not meet the intent of DOE Policy 450.5, *Line Environment, Safety, and Health Oversight*. ORO does not have an approved formal program in place, and the corrective actions for the open safety issues identified in May 2000 relative to this program have not been closed.

#### **Flowdown of Safety Basis Roles, Responsibilities, and Requirements**

- ORO and BJC managers have not been held accountable for their lack of performance in exercising their nuclear safety roles and responsibilities.
- Inadequate consideration was given to the adequacy of management systems, processes, and technical capabilities when the authority for safety basis review and approval was delegated to ORO and then further delegated to the Assistant Manager for Environmental Management.
- No independent assessment role has been practiced. Therefore, the ORO Manager lacked having an "honest" safety broker who was capable of identifying that there was an ongoing problem.
- The Work Smart Standards included in the BJC contract did not fully invoke applicable nuclear safety requirements and standards.

#### **Safety Basis Management Processes and Systems**

- No functioning ORO corrective action tracking system is in place to ensure closeout of Integrated Safety Management System verification or other assessment findings.
- No functioning systems are in place within BJC or ORO for safety basis document control, receipt, or tracking.
- ORO wide procedures for review and approval of safety basis documents are not in place.
- A breakdown in communication between ORO line management and the nuclear safety organization significantly hindered progress in reviewing safety basis documents.
- Facility Representatives do not formally or routinely communicate nuclear safety basis issues to ORO management.

### **Technical Competencies and Training**

- ORO and BJC have not established minimum nuclear safety competencies for program, project, and facility managers. This has resulted in a broad lack of knowledge and understanding of DOE SB expectations/requirements and ability to prepare appropriate SB documents.
- Very little safety basis-related training has been given to ORO and BJC personnel.
- Many safety basis documents are being prepared by subcontractors with little oversight from BJC. Based on interviews and review of documents prepared since the BJC contract was awarded, it is clear that minimum training qualifications and experience need to be extended to subcontractors.

### **Adequacy of Safety Basis Documents**

- In general, the safety basis documents did not adequately identify safety controls, either engineered or administrative.
- Technical deficiencies exist in the hazard categorization of nuclear and radiological facilities; therefore, some radiological facilities could be nuclear facilities and some Hazard Category 3 facilities may be Hazard Category 2.
- Primary safety basis documents (i.e., Safety Analysis Reports [SARs] and Bases for Interim Operation [BIOs]) do not adequately reflect current activities and missions, since annual updates have not been performed.
- Technical deficiencies exist in the hazards and accident analyses. (see Section 5.5.3)
- Safety significant structures, systems and components are not always identified in safety basis documents. Where safety systems are relied upon, they were not derived from the safety basis documents, nor are they forced to be maintained through the Technical Safety Requirements (TSR) or Operational Safety Requirements (OSR).
- Most of the BJC SARs and BIOs do not adequately describe the criticality safety program, nor do have requisite commitments in the TSRs and OSRs.

ORO and BJC have taken some positive, near-term measures to improve their nuclear safety posture. For ORO, this includes active involvement in reviewing the basis for continued operations of BJC's facilities, confirming an official list of BJC's nuclear facilities and safety basis documents, proposing a revision to ORO's roles and responsibilities, improving communication and cooperation at the working level between the ORO organizations, and initial planning for addressing staffing deficiencies. BJC has initiated a flowdown assessment of safety basis documents at nuclear facilities, conducted an internal assessment of the adequacy of the Work Smart Standards, and begun planning for an evaluation of safety basis adequacy at radiological facilities.

Upgrading the safety basis program in the near term and re-evaluation of the previously submitted Title 10 Code of Federal Regulations Part 830 (10 CFR 830) compliance plan should also help resolve the TSR, OSR, and safety basis hazard and accident analysis concerns. However, ORO should ensure that appropriate safe harbor methods are employed to ensure cost-effective safety basis implementation that is consistent with the flexibilities allowed by 10 CFR 830 for environmental management activities.

## 1.0 INTRODUCTION

On October 15, 2001, the Defense Nuclear Facilities Safety Board (DNFSB) transmitted a letter (see Appendix A) to the Under Secretary of Energy, Science, and Environment that raised concerns over the safety of Department of Energy (DOE) nuclear facilities being managed by Bechtel Jacobs Company LLC (BJC), as well as the adequacy of Safety Basis (SB) systems and execution of nuclear safety responsibilities within the Oak Ridge Operations Office (ORO). The letter stated that "absent a comprehensive set of safety controls and supporting safety analyses, it is not credible to assert that the public, workers, and the environment are protected from the hazards from these facilities." In accordance with 42 U.S.C. § 2286b (d), the DNFSB requested that an independent assessment be conducted within 45 days.

Subsequent to the DNFSB letter, the Acting Principal Deputy Director for the Office of Science (SC), Milton Johnson, directed that an independent assessment be conducted of BJC and ORO. SC is the Lead Program Secretarial Office for ORO, and the Office of Environmental Management (EM) conducts activities at various sites under ORO's jurisdiction.

As referenced in an SC memorandum dated November 19, 2001 (see Appendix B), an Assessment Team was asked to complete the following:

- *"An assessment of the adequacy of the AB and safety posture for each of BJC's defense nuclear facilities. Since inadequate hazard classifications for BJC's facilities have previously been identified, and the guidance for facility classifications in U.S. Department of Energy (DOE) directives may not have been followed, the team should also address BJC's radiological facilities. The report should include a determination of the safety of ongoing operations and Justifications for Continued Operation, as appropriate (Reference: DNFSB letter of 10/15/01, second page, first bullet).*
- *An assessment of the flowdown of responsibilities for technical direction, specifically, those for authorization bases, from the DOE directives to DOE-ORO's Office of Environmental Management. This assessment should include a determination of whether ORO has the specific technical expertise in place to meet those responsibilities for review and approval of AB documents. Where that expertise does not exist, the compensatory measures to be implemented and the actions necessary to eliminate the need for those compensatory measures should be described (Reference: DNFSB letter of 10/15/01, second page, part of fourth bullet).*
- *An assessment of ORO's processes for reviewing and approving safety basis documents for ORO's facilities to ensure that acceptable controls for safe operations are defined and implemented (Reference: M. Morrow letter of 11/1/01)."*

As requested in the SC memorandum, Mr. Dae Chung from the National Nuclear Security Administration (NNSA) led an independent assessment of ORO and BJC during December 2001 and January 2002. This report describes the scope of the assessment, the overall approach used, and the results and recommendations of the team.



## 2.0 SCOPE OF ASSESSMENT

In response to the SC memorandum, the Safety Basis Assessment Team (SBAT) focused on the adequacy of BJC's SB documents for nuclear and radiological facilities, as well as the overall safety assurance at these facilities. Related to these elements, the SBAT evaluated the SB management processes established within BJC and ORO. Primary assessment areas are summarized as follows:

**Table 1. Assessment Scope**

PRIMARY AREAS OF ASSESSMENT	SUBJECTS REVIEWED
Safety Assurance at BJC's Nuclear Facilities	<ul style="list-style-type: none"> <li>➤ Awareness of hazards and controls by facility managers and operations personnel</li> <li>➤ Implementation of safety controls</li> <li>➤ Compensatory measures in place where SB documents are deficient</li> </ul>
Flowdown of SB Roles, Responsibilities, and Requirements	<ul style="list-style-type: none"> <li>➤ Delegation of SB approval authority</li> <li>➤ Communication and implementation of SB roles and responsibilities</li> <li>➤ Selection and implementation of nuclear safety requirements</li> </ul>
SB Management Systems and Processes	<ul style="list-style-type: none"> <li>➤ Line management systems, processes, and procedures for SB development, update, review, and approval</li> <li>➤ Unreviewed Safety Question (USQ) process</li> <li>➤ Staffing levels and plans</li> </ul>
Technical Competencies and Training	<ul style="list-style-type: none"> <li>➤ Technical capabilities of managers and staff</li> <li>➤ Training and qualification programs</li> </ul>
Adequacy of BJC's SB Documents	<ul style="list-style-type: none"> <li>➤ Completeness, accuracy, and currency of BJC's SB documents</li> <li>➤ Methods and approaches used for hazard categorization of nuclear and radiological facilities</li> <li>➤ Adequacy of hazard identification and accident analysis process</li> <li>➤ Selection of safety controls</li> </ul>

### 3.0 TEAM COMPOSITION AND RESPONSIBILITIES

The SBAT included a cross-section of safety management system specialists and technical specialists who have extensive experience and backgrounds in preparing and reviewing SB documents, hazard and accident analyses, criticality safety, and development of DOE nuclear safety directives and standards. Due to the nature of BJC's nuclear facility operations, the team also included several individuals with backgrounds related to nuclear facility cleanup and long-term surveillance and maintenance. A list of team members and their areas of responsibility is shown below. A short biographical sketch of each team member is provided in Appendix C.

**Table 2. Team Composition**

<b>SBAT Team Member</b>	<b>Affiliation</b>	<b>Assessment Role(s)</b>
Dae Chung	NNSA	Team Leader
Shirley Olinger	DOE Richland Operations Office	SB Management Systems, Roles and Responsibilities, Technical Competencies
Ray Schwartz	DOE SC	SB Management Systems, Roles and Responsibilities, Technical Competencies
Yusuf Noorani	DOE Office of River Protection	Facility SB Documents, Hazard and Accident Analysis, Safety Controls
Rick Haynes	DOE Savannah River Site	Facility SB Documents, Hazard and Accident Analysis, Safety Controls
Jerry McKamy	DOE Office of Environment, Safety, and Health (EH)	Criticality Safety
Jeff Woody	Link Technologies, Inc	SB Management Systems, Roles and Responsibilities, Technical Competencies, Safety Management Programs, Hazard Categorization
Louis Restrepo	Omicron, Inc	Facility SB Documents, Hazard and Accident Analysis, Safety Controls, Safety Management Programs, Facility Controls, Hazard Categorization
Terry Foppe	Foppe and Associates, Inc	Facility SB Documents, Hazard and Accident Analysis, Safety Controls, Safety Management Programs, Facility Controls, Hazard Categorization
Patrice McEahern	Strategic Management Initiatives, Inc.	Facility SB Documents, Hazard and Accident Analysis, Safety Controls, Technical Direction, Flowdown of Responsibilities

#### **4.0 ASSESSMENT APPROACH**

The SBAT conducted an on-site assessment during the week of December 10, 2001, and conducted a follow-up visit the week of January 7, 2002. The team used review criteria that were developed around the subject areas addressed in the SC memorandum dated November 19, 2001, and the DNFSB letter dated October 15, 2001. Review criteria were based on acceptable approaches and expectations contained in DOE nuclear safety standards and requirements. The detailed criteria and lines of inquiry are included in Appendix D.

During the on-site assessment, the SBAT interviewed numerous ORO and BJC managers and staff, as well as the DNFSB site representative. The team inquired about roles and responsibilities, knowledge, skills, training, and the level of involvement in reviewing, approving, preparing, or updating SB documents. The SBAT also reviewed ongoing corrective actions, including interim compensatory measures and an active SB flowdown assessment being conducted by BJC. The team attended a meeting held by the BJC SB Review Board.

The SBAT reviewed numerous documents, including relevant site manuals and procedures, nuclear safety provisions in the BJC contract, and the latest approved set of Work Smart Standards (WSS). Primary facility SB documents were reviewed for all 29 Hazard Category 2 and 3 nuclear facilities (or clusters of facilities). A sampling of USQ Determinations (USQDs) and Safety Evaluation Reports (SERs) were also reviewed. Because of the large number of radiological facilities (over 250) and concerns over the accuracy of some hazard categorizations, SB documents were also reviewed for a small set of radiological facilities.

The SBAT toured 15 nuclear facilities at the Oak Ridge National Laboratory (ORNL), the East Tennessee Technology Park (ETTP), the Y-12 National Security Complex (Y-12), and the Paducah Site (Paducah). These facilities were chosen based on a subjective determination of several factors that included perceived risk, current inventory and form of radiological/hazardous materials, known safety issues, and the level of human activity within the facility (e.g., inactive, surveillance versus waste management, or cleanup). During tours, the team questioned facility personnel on their knowledge of the hazards and controls; sampled and reviewed procedures; observed work practices; and compared actual facility configuration, material inventories, and controls to those stated in the approved SB documents. Table 3 provides an overview of the facilities evaluated and toured.

Table 3. BJC Nuclear and Radiological Facilities Reviewed

Site	BJC Nuclear/Radiological Facilities Reviewed	Hazard Category	Toured
ETTP	K-1066 (B, E, J, K, L) UF <sub>6</sub> Cylinder Yards	2	✓
	K-1066-F Cylinder Yard	2	✓
	K-25 Building	2	✓
	K-27 Building	2	
	K-29 Building	2	
	K-33 Low Level Waste Storage Pad	2	
	K-1065-A, -B, -C, -D, and -E Waste Management Storage Buildings	Rad	
	K-1066-H	Rad	
ORNL	Bulk Shielding Reactor Facility Complex (3010)	2	
	Federal Facilities Agreement and GAAT Tanks (Various Locations)	3	
	Fission Product Development Laboratory (3517)	2	✓
	Gunite and Associated Tanks	3	
	High Radiation Level Analytical Facility (3019B)	2	✓
	Interim Waste Storage Facility (7886)	3	
	Isotopes Development Laboratory (3038)	2	✓
	Liquid Low Level Waste (LLLW) Management System, including Tank W-1A	2	✓
	Molten Salt Reactor Experiment (7503)	2	✓
	Oak Ridge Research Reactor (3042)	3	
	Pits, Trenches, and Augered Holes (Various Locations)	3	
	Radioactive Solid Waste Storage Facilities (Various Buildings)	3	
	Radioactive Solid Waste Storage/Staging Pads (7822J, 7842A)	3	
	Remote-Handled Transuranic Storage Facility (7855)	3	✓
	Retrievable Waste Storage Well Facilities (Various Buildings)	3	
	Solid Waste Compactor Facility (7831)	3	
	Tower Shielding Facility (7700A, 7700B)	2	✓
	Transuranic Waste Storage Facilities (7826, 7834)	2	
	Waste Examination and Assay Facility (7824, 7824A)	2	
	Waste Storage Facility (7883)	3	✓
	Shielded Transfer Tanks (next to Building 7819)	Rad	
	Low Level Waste Pit 3, Hillside SW of Pit 1	Rad	
Mixed Hazardous Waste Storage Facility Building 7507W	Rad		
Well Drillers' Steam Cleaning Facility	Rad		
Paducah	C-746-Q, C-410 and DOE Retained Areas, DOE Material Storage Areas (DMSAs), UF <sub>6</sub> Cylinder Storage Yards	2 and Rad	✓
Portsmouth Site (Portsmouth)	X-7725, X-7745R, X-744G, X-705E, X-345, X-326, X-745C, X-745E, X-333	2	
Y-12	Uranium (U) Oxide Storage Vaults 9825-1/2, and Shed (9809-1)	2	✓
	Old Salvage Yard (9983-74)	3	
	U Chip Oxidation Facility, Building 9401-5	Rad	
	Building 9720-31 Resource Conservation and Recovery Act (RCRA) Motel	Rad	

## 5.0 FINDINGS AND OBSERVATIONS

This section presents the findings and observations from the SBAT's assessment activities described in Section 4.0. The overall safety posture associated with nuclear facility operations is first discussed in Section 5.1, followed by the results of the management assessment, which is presented in Sections 5.2-5.4. Results of specific technical reviews of SB documents and associated programs and procedures being used at the five sites managed by BJC are presented in Section 5.5.

### 5.1 Safety Assurance at the BJC Nuclear Facilities

The SBAT reviewed SB documents, interviewed facility and project managers, toured facilities, and observed ongoing corrective actions in order to assess the overall safety assurance provided at BJC's nuclear facilities. Based on these activities and the facilities that were toured, the team concluded that there is no imminent risk to the public and workers associated with releasable nuclear materials. However, this conclusion is contingent upon implementation of certain compensatory measures discussed in Section 6. This finding must also be tempered with the recognition that BJC's EM activities, by nature, involve a reasonable potential that uncharacterized legacy hazards may be encountered during the course of project activities. The risk of a nuclear criticality or worker exposure to radionuclides or hazardous chemicals still exists. Therefore, EM activities must continue to rely on established facility SBs in which the hazards are evaluated and the controls are derived, as well as supporting nuclear Safety Management Programs (SMPs) (e.g., maintenance, criticality safety, fire protection, emergency management, inventory control, etc.).

The team's conclusion on safety assurance is not founded on the existence of established BJC facility SBs or the presence of DOE/BJC nuclear safety systems, programs, and procedures. As discussed in subsequent sections, many of these components are either deficient or not in place. Rather, the team's conclusion is based on the recognition that the vast majority of the BJC nuclear facilities, while containing significant radionuclide inventory, have a general lack of stored energy sources and the prevailing material form is fixed in nature (i.e., not easily dispersible). In addition, the team observed that (1) operations personnel at the working level are generally aware of the hazards and controls, (2) BJC has focused on safety programs related to radiation hazards and occupational safety, such that relevant performance indicators are established at the BJC corporate level, and (3) awareness of the nuclear criticality hazards has increased and the need for having a corporate-driven program was elevated to the highest level during the past year as a result of the EH headquarters assessment that generated 40 corrective actions.

Also contributing to the SBAT's conclusion on safety assurance is the observation of the following positive actions taken in response to conditions identified in the DNFSB letter of October 15, 2001:

- On October 18, 2001, the Assistant Secretary for Environmental Management (EM-1) rescinded all previous delegations of EM-1 authority for approval of SB documents.
- In late October 2001, BJC self-imposed limitations on operations based on a qualitative assessment (reference: letter from P. F. Clay, BJC, to R. R. Nelson, ORO) of all Hazard Category 2 and 3 nuclear facilities under its contract with ORO. This assessment resulted in suspension of 13 activities pending further review and justification for resumption.
- A BJC self-assessment, *Root Cause Analysis for Noncompliance Report NTS-ORO-BJC-BJCPM-2001-0004, Inadequacy in Safety Authorization Basis Management, Root Cause Analysis and*

Corrective Action Plan, dated November 2, 2001, identifies many causal factors that have application at most of the BJC facilities.

- On November 1, 2001, all fissile material-handling operations at ETTP were suspended pending the resolution of issues identified with the Technical Safety Requirements (TSR) for the Radiation/Criticality Accident Alarm System (R/CAAS).
- In November 2001, BJC initiated a safety basis flowdown assessment for 29 nuclear Hazard Category 2 and 3 facilities, which includes BJC nuclear safety personnel, some DOE Facility Representatives, and subcontracted nuclear facilities safety experts. Technical adequacy of SB documentation, flowdown of requirements into procedures, and assessment of implementation of controls in the field are being evaluated.

## 5.2 Flowdown of Safety Basis Roles, Responsibilities, and Requirements

The SBAT observed a lack of many fundamental SB management systems, processes, and procedures within both ORO and BJC. The root cause for this condition appears to be a lack of management priority and accountability for nuclear safety, particularly with respect to EM operations. As a result, many SB roles and responsibilities are not well established or exercised. Also, nuclear safety performance expectations are not tied to current DOE requirements and do not flow down to BJC and its subcontractors. These concerns are further elaborated in the sections below.

### 5.2.1 Delegation of Approval Authority

ORO is responsible for managing multiple nuclear facilities that are funded primarily by SC and EM headquarters. The Office of Nuclear Energy manages two major nuclear facilities in Oak Ridge (i.e., the High Flux Isotope Reactor and the Radiochemical Engineering Development Center). Both SC and EM headquarters have delegated their authority for approving nuclear facility SBs to the ORO Manager. The ORO Manager has further delegated the SC headquarters approval authority to the Assistant Manager for Laboratories (AML) and EM approval authority to both the Assistant Manager for Environmental Management (AMEM) and the Assistance Manager for Assets Utilization (AMAU).

The AMAU was previously given responsibility for certain EM facilities being decommissioned at ETTP (i.e., Buildings K-29, K-31, and K-33), and the AMEM had authority over the remaining EM nuclear facilities located at ETTP, ORNL, Y-12, Paducah, and Portsmouth. The AMEM further delegated approval authority for radiological, non-nuclear, and industrial facilities to BJC. On October 18, 2001, EM headquarters retracted all of these delegations because of concerns raised by the DNFSB in its October 15, 2001, letter. The approval authority currently resides with EM-1, except for other industrial, low hazard, non-nuclear, and below Hazard Category 3, which have been re-delegated.

In each case where approval authority was delegated, there was no indication that consideration was given to the adequacy of management systems, procedures, or technical resources needed to accomplish required reviews and approvals. Further, no management accountability expectations or mechanisms were established to ensure that approval authorities were adequately exercised. Delegation letters from EM headquarters and within ORO provided no basis for granting approval authority, nor did the recipient organizations attempt to communicate their capabilities. The AMEM has never had the staffing, technical competencies, or management systems and procedures necessary to effectively exercise its nuclear safety management responsibilities.

To date, ORO has not requested that EM-1 re-delegate approval authority to the Operations Office, except for other industrial, low hazard, non-nuclear, and below Hazard Category 3, which have been re-delegated. In addition, ORO has not prepared a corrective action plan to demonstrate the compensatory measures or planned improvements necessary to regain approval authority.

### 5.2.2 Roles and Responsibilities

ORO communicates roles and responsibilities for review, approval, and oversight of nuclear SBs through a series of site-specific manuals and directives (e.g., *ORO Manual of Safety Management Functions, Responsibilities, and Authorities* and *ORO Organization Manual*). As reflected in these directives, the line management organizations (i.e., the AMEM, AMAU, and AML) have primary nuclear safety responsibility but rely on the Assistant Manager for Environment, Safety, Health & Emergency Management (AMESH) to provide the necessary nuclear safety expertise and resources.

The AMESH's responsibility to support the line organizations is performed only when requested. This role conflicts with another AMESH responsibility, which is to provide independent technical and analytical evaluation of SB documents. Neither responsibility has been exercised effectively, primarily because of a lack of available qualified SB experts and organizational issues. As a result, the AMEM has been reluctant to rely on the AMESH, and a breakdown in communication has occurred between these organizations.

Review, approval, and oversight of nuclear facility SB documents are, therefore, not often accomplished in a timely manner (see the Section 5.5 discussion of the SER process). It has also led the AMEM to use unqualified in-house personnel or contractors, when desired, to conduct SB reviews. The AMESH is not required to concur on SB reviews conducted by line organizations, and the AMEM is not obligated to accept the results of SB reviews conducted by the AMESH. This practice has resulted in the AMEM's approval of some SB documents without due consideration to the AMESH reviewers' comments or without a qualified technical review (e.g., see the Appendix E summaries for Paducah C-410 and Building 3019B).

The lack of an independent SB assessment function has further permitted these problems to continue without attention. While ORO's procedures give this responsibility to the AMESH, it is essentially not recognized in practice. Independent assessments are performed only when permission is granted by the line organizations, and nuclear facility SB has not been included among the programs previously assessed.

The DOE Facility Representative Program is the last line of defense for independently assessing nuclear safety performance and issues. The Facility Representatives report to the line Assistant Managers and are responsible for providing day-to-day operational oversight of the contractor's activities, conducting routine assessments on safety management systems and programs, and reporting potential or existing safety problems to line management. These activities have been conducted very informally and have not focused on nuclear safety or SB issues. In the past two and a half years since BJC was awarded the management and integration contract, few written assessment reports have been submitted by the Facility Representatives (e.g., see Appendix E for the Paducah assessments of the UF<sub>6</sub> TSR boundary fence and criticality alarms). Without this function or the AMESH's independent assessment activities, the ORO Manager does not have an "honest broker" for nuclear safety concerns and issues.

### 5.2.3 Selection of Work Smart Standards

Appendix E of the BJC management and integration contract contains the "Baseline List of Applicable Directives" that governs all BJC's work activities. Mandated by the "list" is a set of WSS that was originally developed by Lockheed Martin Energy Systems and subsequently incorporated into the BJC contract. A total of 13 revisions have been issued to the original WSS.

Although BJC is responsible for 29 Hazard Category 2 and 3 nuclear facilities, the WSS does not fully invoke several DOE nuclear safety directives and standards. Of primary concern, DOE 5480.23, *Nuclear Safety Analysis Reports*, was never included as a requirement. One implication from this condition is that no annual updates are required for SB documents. This has contributed to outdated SB documents that do not reflect current organizations, facility configurations, hazardous material inventories, and current controls.

Some nuclear safety directives were adopted, but these were only for nuclear facilities classified as Hazard Category 2. These include DOE Standard (STD) 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*; DOE 5480.21, *Unreviewed Safety Questions*; and DOE 5480.22, *Technical Safety Requirements*. While these directives are applicable to Hazard Category 3 nuclear facilities, they are not required by the WSS. The issuance of Title 10 Code of Federal Regulations (CFR) 830, Subpart B, has now mandated equivalent requirements. Other important nuclear safety-related requirements are treated in the BJC WSS as follows:

- Only portions of DOE Order (O) 420.1, *Facility Safety*, related to criticality safety are required. Those sections related to fire protection are not included, thus eliminating the requirement to perform a Fire Hazards Analysis (FHA). The absence of FHAs was found at several nuclear facilities under BJC's management. A revision to the WSS is being proposed to add DOE O 420.1A fire protection requirements. However, the revision is still in draft form and has been under BJC review for approximately nine months.
- DOE 5480.20A, *Personnel Selection, Training, and Qualification for Nuclear Facilities*, is not included in the WSS. This directive provides important expectations for training and qualification for managers and staff with nuclear safety responsibilities.
- DOE 4330.1B, *Maintenance Management*, is only incorporated as guidance. This is an important safety program that provides a driver for maintaining systems and equipment that may be relied on to perform a safety function within a nuclear facility.
- DOE-STD-1120-98 and DOE-STD-3011 are not addressed in the WSS, even though they are 10 CFR 830 "safe harbor" methods for meeting documented safety analysis requirements for decommissioning or environmental restoration projects. Several BJC projects could benefit from this standard, which permits an alternative, cost-effective SB approach.

The rationale for omitting nuclear safety requirements is not given in WSS documents, since the process as outlined in DOE Manual 450.3-1, *The Department of Energy Closure Process for Necessary and Sufficient Sets of Standards*, does not require a formal justification when requirements and standards are not selected. However, WSS participants indicated a general approach to rely on the principles of DOE Policy 450.4, *Safety Management System Policy*, and allow contractors some flexibility by citing relevant DOE directives as Implementation Guides, which are not mandatory in the BJC contract.



The original WSS process conducted in 1997 involved nuclear safety subject matter experts (SMEs). However, some participant's opinions may not have been given adequate consideration. In spite of the original WSS document's claim that "no minority opinions" were identified by any team members, the conduct of operations SME raised objections over the omission of DOE 5480.19, *Conduct of Operations*. The concern was shared by all of the ORO Facility Representatives but not by the official WSS team members. The SME contributors did not have a vote in approving the WSS, and only official team members could submit a minority opinion report. Therefore, the SME's concerns were not "officially" documented on record or addressed.

#### **5.2.4 Management Priority and Accountability**

Several factors have led the team to conclude that there has been an overall lack of management priority and accountability within both the ORO and BJC organizations. As indicated in previous sections, nuclear safety roles and responsibilities have not been exercised effectively, DOE requirements were not mandated in the BJC contract, and authority was delegated without regard to existing capabilities. In addition, Section 5.3 discusses the absence of many fundamental nuclear safety management systems and processes. These conditions have persisted for years, and until recently, they have not received a high priority.

A contributing factor to these issues may be a long-standing practice to rely on key individuals rather than on a standards-based system driven by requirements and supported by established systems and procedures. Thus, the BJC contract does not have a sufficient basis upon which to enforce performance related to the nuclear SBs, and ORO does not have a structured process by which accountability mechanisms are enforced and important nuclear safety issues are raised to the ORO Manager.

There is some evidence that ORO and BJC are beginning to respond to these problems. The corrective and investigative actions mentioned in Section 5.3.1 are a good start. However, to ensure success, nuclear safety must be a high priority and ORO's expectations of BJC, as well as of the ORO managers, must be made clear. In addition, nuclear safety performance must be enforced, and managers should be held accountable through contracting mechanisms and the performance appraisal process.

### **5.3 Safety Basis Management Systems and Processes**

Processes, systems, and procedures used by ORO and BJC to prepare, review, approve, and monitor nuclear facility SBs, as well as to track SB assessment findings and corrective actions, have been conducted very informally, if at all. Most apparent is that until recently (December 11, 2001), a DOE-approved list of the nuclear facilities being managed under the BJC contract did not exist. Several "uncontrolled" facility lists were available, but they were inconsistent, incomplete, and not approved by DOE. This condition persisted in spite of the previous Integrated Safety Management System (ISMS) Phase I/II Verification (February 2000), which recommended that a list of the most current, approved revisions of SB documents be prepared, maintained, and made available as a controlled SB/authorization agreement list. Similar concerns were also expressed in the DNFSB letter to the Under Secretary of Energy, Science, and Environment dated October 15, 2001.

#### **5.3.1 Review and Approval of BJC Facility Safety Basis Documents**

No ORO procedure exists for how to review and approve SB documents. While the AMESH has an internal procedure, it is not used by the AMEM. In addition, it does not address important elements of the SER process, such as qualifications for team leaders and participants, review criteria, and comment

resolution. As a result, many SERs do not provide a technical basis for adequacy and are not consistent with the acceptance criteria in DOE-STD-1104, *Review and Approval of DOE Nonreactor Nuclear Facility Safety Analysis Reports*. Many SERs sampled by the team did not evaluate the adequacy of the information presented (e.g., hazard and accident analysis, adequacy of controls, etc.), address the risk acceptance of the operations, nor specify any conditions for approval.

The lack of an ORO process means that review and approval is heavily dependent on informal agreements and a good working relationship between ORO's line organizations (i.e., AMEM, AMAU, and AML) and the AMESH. However, a breakdown in communications between these organizations has hampered SER progress and is still considered a significant barrier to reducing the backlog of unreviewed SB documents. At the time of this assessment, there was a backlog of over 40 SB documents awaiting DOE review, some of which have been in the pipeline for several years, including a Justification for Continued Operation (JCO) for the Y-12 Oxide Storage Vault. BJC operates to and performs USQD reviews against these draft documents rather than the last approved document.

This problem has been further exacerbated because there is no ORO system or procedures for resolving disputes, which leaves it to individual managers to resolve differences of opinion. This has been ineffective and has led to approval of SB documents with outstanding comments, as well as SB documents that remain unapproved for long periods of time. Managers have not been held accountable for the breakdown in communication or the failure to exercise their roles and responsibilities.

The SER process does not always engage reviewers early during SB document preparation. In fact, for many EM facilities, the AMESH is typically not given access to facility personnel and SB documents until after they are submitted by BJC for approval. This practice is inconsistent with DOE-STD-1104 and adds further time delay to the SB review and approval process. Exceptions were noted for some projects and facilities managed under the AML and AMAU programs.

BJC and ORO have initiated self-assessments as a result of the recent SB issues. For example, ORO audited the USQD process in February and March 2001. A self-assessment, *Root Cause Analysis for Noncompliance Report NTS-ORO-BJC-BJCPM-2001-0004, Inadequacy in Safety Authorization Basis Management, Root Cause Analysis and Corrective Action Plan*, dated November 2, 2001, identifies many causal factors that have application at most of the BJC facilities. Another self-assessment issued November 5, 2001, *Facility Safety Basis Assessment (ECS/NS-02-002)* evaluated the BJC SB program for compliance with 10 CFR 830, Subpart B. Findings and observations were issued and are being addressed. This is a step in the right direction to reassess the BJC SB program and 10 CFR 830 compliance plan.

Also related to the SB process, BJC requested Westinghouse Safety Management Solutions to prepare a compliance task plan for 10 CFR 830, Subpart B, that defines the strategy for upgrading the Paducah SB. A review of the draft shows that the plan is a start in the right direction to get concurrence from the BJC Manager of Projects (MOP) and BJC SB program. At some point, this plan should receive concurrence by the ORO AMEM and AMESH. Although it does not define the hazards and accident analysis approach and control set selection strategy, it does lay out the major tasks and milestones to effectively upgrade the SB.

### 5.3.2 Unreviewed Safety Question Process

BJC personnel who perform USQDs are required to meet minimum qualifications and must be certified every two years in accordance with the BJC-NS-1001 procedure. However, all subcontractors who

conduct USQDs are not required follow this procedure. In fact, four different procedures are being used by subcontractors at the five sites under BJC's jurisdiction. None of these procedures have been reviewed and approved by DOE. BJC plans to modify its subcontracts and recently issued a Directive (BJC-GM-525, dated December 14, 2001) to require the use of the BJC procedure as a temporary measure until the BJC procedure is approved by DOE and the subcontractor procedures are assessed as adequately implementing the BJC procedure.

The SBAT noted a BJC practice of reviewing proposed activities or facility modifications against SB documents submitted for review but not yet approved, as well as operating to a set negative USQDs that have not been evaluated by DOE (typically done through the annual update). This suggests that the implemented SB no longer reflects the SB as approved by DOE. In other words, the facility and the activities performed are not generally reflected in the documents approved by DOE.

#### **5.4 Technical Competencies and Training**

A lack of technically qualified staff has hindered several ORO organizations in meeting their nuclear SB responsibilities. The AMEM currently has no individuals with the requisite qualifications necessary to conduct technical reviews of nuclear SB documents. SB-related technical qualifications, skills, knowledge, and training have not been required for program and project manager positions, nor have they been incorporated into individual development plans. ORO has recently initiated some positive steps, including the posting of an excepted service position for a senior-level manager with nuclear safety experience and establishment of a coordinator to manage SB activities, including posting two excepted service positions for senior-level managers with nuclear safety experience. Further, a compensatory measure was also taken by providing some fundamental SB training to many ORO EM managers and staff.

A technical qualification program has been developed for nuclear safety personnel working in the AMESH organization's Nuclear Safety Division (NSD). Based on interviews and the quality and quantity of review comments provided on SBs, NSD has a few staff who are technically competent and knowledgeable of DOE SB requirements, standards and practices. However, only two individuals currently meet all required competencies. This is due in part because of attrition within the organization and a severe lack of available staff. Because of ORO-wide hiring limitations and staffing reductions brought on by budget cuts, NSD has lost positions along with people. The near-term compensatory measure has been to rely on support service contractors. However, there has been little funding available for this work. No immediate corrective actions have been identified, and this issue still remains as a significant impediment to correcting the SB deficiencies.

BJC has also been deficient in establishing minimum qualification requirements for project managers, nuclear safety managers, and personnel in nuclear facility management positions. Similarly, no qualification requirements are passed down to subcontractors. This is partially because DOE 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*, was never included in the BJC WSS. BJC has now committed to comply with this requirement and develop qualification standards for nuclear safety personnel.

Based on interviews of BJC and subcontract personnel and review of recently prepared SB documents (e.g., the November 2001 version of the R/CAAS TSR) since the BJC contract was awarded, it is the conclusion of the SBAT that there is a broad lack of technical knowledge and understanding of DOE SB expectations/requirements and the ability to prepare sound and approvable SB documents in a timely and cost-effective manner.

Both BJC and the ORO AMESH have implemented DOE standards for training and qualification of nuclear criticality safety engineers. DOE established a nuclear criticality safety technical qualification standard for DOE criticality safety engineers and issued a standard, DOE-STD-1135-99, for contractor criticality safety engineers as part of its implementation plan for DNFSB Recommendation 97-2. The AMESH has one qualified criticality safety engineer. The AMEM has none. The AMESH is in the process of hiring an additional qualified criticality safety engineer in response to the EH headquarters criticality safety assessment issued in June 2001. BJC developed a formal training and qualification program for criticality safety engineers that was reviewed and approved by the AMESH. All BJC criticality safety engineers at ETTP, including subcontracted criticality safety staff, have been qualified for their jobs in accordance with DOE-STD-1135-99.

## 5.5 Adequacy of Safety Basis Documents

Approximately 29 nuclear facilities (or groupings of like facilities) and their corresponding SB documentation were reviewed, along with the standalone TSR for the R/CAAS (K/P-6807, Revision 5, dated September 2000) and selected SB documents for radiological facilities.

The review covered the following:

- Evaluated the SB for facility conformance to current DOE guidance (e.g., DOE-STD-3009 and DOE-STD-3011);
- Evaluated each facility and its operations to determine if any “immediate safety problems” existed; and
- Reviewed the strength and weaknesses of the process used to prepare, review, and maintain the facility SB documentation.

The review focused on an assessment of the approval status of the SB; the adequacy of the SB documents in reflecting or capturing current operations; adequacy of the hazard categorization, hazard identification, and hazard analysis; selection and implementation of controls; and overall identification of SB document weaknesses or deficiencies with respect to the SB documentation preparation, review, and maintenance.

### 5.5.1 Facility and Mission Description

Overall, many SB documents reviewed were outdated and did not reflect the current facility mission, configuration, or operating organizations. Many SB documents have not been updated since BJC became the management and integration contractor and still contain references to Lockheed Martin Energy Systems organizations. While negative USQDs have been prepared that reflect updated facility information, primary SB documents have still not been updated. This is primarily because the BJC contract does not contain DOE 5480.23, *Nuclear Safety Analysis Reports*; therefore, no requirement exists for annual updates.

In some cases, the SB is confusing. The team could not always identify by reviewing the hazards and accident analysis what activities were being authorized. In some circumstances, the documentation needs to better reflect the status of the facility in the life cycle (e.g., in surveillance and maintenance mode or entering decommissioning).

### 5.5.2 Hazard Categorization

BJC has procedure BJC/OR-952, *Hazard Identification and Facility Classification*, to provide guidance on implementing hazard categorizations per DOE-STD-1027. The guidance provided in the document for facility categorization is generally based on DOE-STD-1027. However, there are several concerns with the methodology that bring into question the accuracy of the final hazard categorizations for both nuclear and radiological facilities.

The hazard categorization methodology results by default in a final hazard categorization, thus bypassing the initial hazard categorization required by DOE-STD-1027. In general, the initial hazard categorization for a facility or activity should be based on gross inventory. If the initial hazard category is Hazard Category 3 or higher, DOE must concur with the technical justification and the final hazard categorization.

DOE-STD-1027 allows the use of alternate Airborne Release Fractions (ARFs) and Respirable Fractions (RFs) to reduce the final hazard categorization from Hazard Category 2 to Hazard Category 3 when the dispersive energy sources present and the form of the materials involved warrant such consideration. The application must demonstrate that the postulated scenarios will preclude the Material At Risk (MAR) from changing to forms that resemble those used in the derivation of the Threshold Quantities (TQs) in DOE-STD-1027. However, BJC is incorrectly applying ARF and RF adjustments to Hazard Category 3 TQs to calculate a Radiological Facility designation (see Appendix F for more discussion). Similarly, segmentation assumptions must be shown to hold true under all design basis accidents.

The BJC alternate ARFs and RFs are preselected independent of the accident category or scenarios being postulated in the SB documents, thus leading to ARFs and RFs that, in many cases, are not bounding for the postulated design basis accidents. In many cases, the ARFs and RFs used in the SB documents are not considered to be the bounding values provided by DOE-Handbook (HDBK) 3010, nor do they consider the potential for changes in material form or confinement configuration in determining the applicable ARF and RF. For example, the ARF and RF for combustible waste burning in a drum is different than the ARF and RF that would result if some of the waste was ejected from the drum due to an overpressurization caused by the fire.

In other circumstances, ARFs and RFs are assumed in the hazard categorization with little or no justification. For example, an RF of 1% is used in some documents for solid wastes with no discussion of its validity. The technical basis for the adjusted ARFs and RFs was originally documented in a Lockheed Martin Energy System calculation (DAC-AC2827-SSE-001, *Recommended Effective Release Fractions for use in Calculating Revised Category 2 Threshold Quantities for ORNL WMRAD Facilities*, dated July 1996). The issues associated with selection of ARFs and RFs carry through the accident analyses as well.

In conclusion, the hazard categorization of both nuclear and radiological facilities is questionable given the above issues. Furthermore, formal reclassification of nuclear facilities (i.e., initially identified as nuclear facilities) to lower classification or radiological status requires DOE review and approval of not only the hazard categorization methodology but also its application to the facilities that were reclassified. The team was not presented with any documentation to indicate that ORO approved the existing hazard categorization of radiological facilities or the reclassification of nuclear facilities to radiological status.

### 5.5.3 Hazard Identification and Analysis

Review of multiple nuclear facilities SB documents indicated that, for the most part, the major hazards and energy sources are being identified; however, some documents do not present the maximum allowable quantities of material in the facility or the specific material forms. Most of the BJC facilities are in the surveillance and maintenance mode (i.e., shutdown facilities in various stages of deactivation to stabilize the residual hazards) or the initial stages of decommissioning. Other than the potential for a nuclear criticality, the SBs portray relatively low hazards, primarily due to the passive nature of many of the facilities and the lack of energy sources. This has led to the misperception that BJC's activities do not involve significant nuclear hazards.

The accident analysis for Hazard Category 2 facilities in the SB documents is, in many cases, overly simplistic (with the exception of the UF<sub>6</sub> Cylinder Storage Yards Final Safety Analysis Report [FSAR]). The accident analysis suffers from a lack of specificity regarding the safety designation of controls and their functional and performance requirements. In some cases, the hazard analysis misses potential accident scenarios and associated controls. As an example, for the remote-handled transuranic waste operations, overexposure of workers due to mishandling or lack of shielding (e.g., due to streaming) is missing from the hazard analysis. More important, however, is the fact that potential safety significant controls, such as shielding and containerization and/or use of remote equipment, have not been identified in the SB documentation, including the TSR.

Another scenario not evaluated is gas generation in sealed drums (e.g., hydrogen) leading to possible explosions or drum ruptures from overpressurization. Most drums do not have High Efficiency Particulate Air (HEPA)-vented lids or use retaining clips. Findings at Hanford and Savannah River Site indicate this is an appreciable area of concern, especially when coupled with potential internal corrosion of the drums while in storage. The SB documents did not provide sufficient information regarding the hazard, but processes like ion exchange are described that have gas generation hazards, such as resin degradation with gas evolution (both inorganic and organic resins) and filter cake radiolysis. This could also be a problem for the U drums, radioactively contaminated waste drums, and fission product containers and waste drums. The failure to evaluate potential drum explosions that could cause fatalities, serious injuries, or significant chemical exposures and the failure to identify their preventive and mitigative controls, some of which may warrant a TSR, is one of the unresolved SER issues regarding the Paducah and Portsmouth FSARs, and it is also applicable to many other BJC facilities. As a compensatory measure, the SBAT is recommending that this hazard be evaluated for all facilities as soon as reasonably possible and that engineering controls (e.g., use of vent clips or HEPA-filtered lids) should be required for applicable drums.

Natural phenomena (i.e., earthquake, high wind, lightning strike, and flooding), external events, explosions, container breach, forklift punctures, and internal fires are often eliminated from further consideration and are not carried forward into the accident analysis by assuming preventative controls are in place or the likelihood of an event is beyond extremely unlikely. This is contrary to the unmitigated analysis concept in DOE-STD-3009. In many cases, there is no discussion of the likelihood of a criticality in facilities in which a criticality is of concern. Often the hazard and accident analyses come to the conclusion that criticality is incredible without proper identification of the controls that make such likelihood acceptably low. The Safety Analysis Reports (SARs), in general, do not contain enough information to determine if the criticality accident risks have been adequately mitigated. The SB documents need, as a minimum, a contingency evaluation or reference that a criticality scenario is adequately controlled and mitigated. Awareness of criticality hazards and controls has been elevated

during the last year as a result of defining and implementing 40 corrective actions (which are about 80% completed) from the EH headquarters assessment.

FHAs were found to be missing, out of date, or inconsistent with the SB documents (e.g., with respect to the combustible loading limits, maximum potential fires, status of fire suppression systems, etc.). The FHAs have not been integrated into the SB documents as required by DOE O 420.1. The Building 3517 Fission Product Development Laboratory fire analysis disagrees with the Basis for Interim Operation (BIO) conclusion regarding the credibility of fires, which raises the issue of a potential inadequacy in the safety analysis.

The use of alternate ARFs and RFs as part of the hazard analysis process may have led to underestimating the potential unmitigated consequences to the public for many of the postulated accident scenarios. The default ARFs and RFs used in the consequence evaluations in the hazard analysis seem to be related to either a generic fire or generic spill, and they vary only by material form and not the specific stresses associated with the scenario being evaluated. This issue was previously discussed for hazard categorizations.

In some SB documents, a nonconservative Leak Path Factor (LPF) of 0.55 (based on the Hanford Test) is used in the consequence analysis. DOE-STD-3009 requires presentation of unmitigated accident scenarios based on an LPF of 1.0, and mitigated evaluations could use lower LPFs if they could be defended.

The accident scenario consequence definitions used in several of the SB documents (e.g., Table 3-3 in the Building 7883 SAR) identify consequence bins for on site and the public. For example, public consequences are segregated into man-made and natural phenomena, with different dose range criteria, even though they are in the same consequence category. While life cycle considerations may support acceptance of the natural phenomena hazard risk (e.g., upgrade is not warranted), the arguments for acceptance of additional risk should be presented for DOE's approval.

The hazard analysis section of the SB documentation could better present the logical progression of the hazards, the risk posed by the current operations, appropriate control selection, and the basis for acceptability of the SB document. The SB documentation for radiological facilities is often in an Auditable Safety Analysis (ASA). Some of these ASAs are large documents that may not be commensurate with the level of the hazards.

#### **5.5.4 Selection of Controls**

In general, the SB documents did not adequately identify safety controls, either engineered or administrative. The few controls that were identified as safety controls were typically administrative controls. There are no safety class Structures, Systems, and Components (SSCs) identified in any of the SBs. There are few safety significant SSCs identified. The hazard/ accident analysis credits, explicitly or implicitly, the controls that reduce the likelihood, the consequences, or the hazard categorization for the facility. These controls are not identified as safety controls (e.g., safety significant SSCs, defense-in-depth) in the SB documentation or considered for TSR coverage. (e.g., cask, Type A or B containers, sprinkler systems, combustible loading controls, etc.). In many cases, although the facility structure has clearly been identified as being able to meet PC-2 requirements, the hazard/accident analysis often assumes that the facility will collapse and result in a release of radioactive material. Because of this assumption, the SB documents often conclude that the structure does not need to be designated as a

safety significant SSC, rather than considering the DOE-STD-3009 Defense In Depth (DID) criterion for prevention of significant releases.

Other examples of potential safety significant SSCs are shown in the following list. Some of these would be TSR design features, but others may warrant Limiting Conditions of Operation (LCOs) based on the hazards or accident analysis.

- Crediting a solid masonry wall and special welded container to preclude a fire in the Building 3038 Isotopes Development Laboratory
- Fire alarm and/or automatic wet-pipe fire sprinkler system for waste facilities (e.g., Building 7824 Waste Examination and Assay Facility, Paducah Building C-746-Q)
- The portable Criticality Accident Alarm System (CAAS) for protection of personnel near Building 3019B
- HEPA filters for the Federal Facilities Agreement Tanks Remediation Project and the Building 3517 Fission Product Development Laboratory
- Ventilation for the Y-12 Oxide Storage Vaults and sampling for hydrogen gas generation
- The soil overburden and asphalt and/or concrete cap for the ORNL Pits, Trenches, and Augered Holes

In cases where some systems, structures and components (SSCs) were identified as safety controls, the TSRs did not adequately provide their operability requirements or technical bases from which they are derived. The SBs heavily relied on SMPs that are supposedly implemented through the ISMS, but the SMPs identified in the TSRs do not provide specific attributes for each committed program. As an example of an administrative safety control, the documents reviewed do not always provide clear inventory or material-at-risk limits and how they are to be implemented. Another example would be the nuclear criticality program. Most of the BJC SB documents do not adequately describe the criticality safety program. Most documents simply refer to a criticality program but do not describe the attributes of the program or how it implements the American National Standards Institute (ANSI) standards. Typically, the SB documents only refer to a criticality safety program (without elaboration), the need for a CAAS, and the need to train operators and handlers on criticality safety.

### **5.5.5 Implementation of Controls**

As stated in the previous section, the SB documents, including the TSRs, do not specifically identify all the important controls. Even in cases in which administrative controls are identified in the TSRs, these controls lack specificity to allow a clear understanding of the requirement. In many cases, LCOs and surveillance requirements are vague, unclear, misleading, and could easily lead to misinterpretation (and thus a potential TSR violation) or, more importantly, the lack of assurance that the safety function will be provided when needed. Design features or other engineering features that may have been identified as safety significant SSCs do not always show up in procedures; thus, it is not clear that their functional requirements or performance criteria will be met or maintained. The team found that many of the identified controls are being implemented at the working level, even though they are not driven by the SB documents. However, the importance of some of these controls should be elevated to TSR status and



should be derived from the hazards and accident analysis to provide adequate technical basis and proper implementation.

There is a lack of formality and emphasis on SMPs by BJC and ORO. The programs are not well developed in the SB documentation, and several programs appear to have a lack of resources. Many of the SB documents cite the previous Lockheed Martin Energy Systems programs and include the previous program in the chapter descriptions of the SMPs. BJC and ORO addressed this in the authorization agreements, where they stated that the BJC SMPs shall be implemented in place of previously approved Lockheed Martin Energy Systems programs. This creates confusion because the BJC programs changed significantly during implementation of the WSS. More importantly, the team could not clearly identify that the BJC SMPs exist at the corporate level with consistent expectations for implementation at the five separate sites. Instead, the SMPs at four of the five sites are primarily owned by the other sites' prime contractors, and BJC has a Memorandum of Understanding or work authorizations with those prime contractors to utilize their services (e.g., fire department response, fire protection engineering support, etc.). However, there have been situations where the BJC MOPs did not fund SMP support. At ETTP, BJC is responsible for all of the SMPs and provides services to the other contractors (e.g., BNFL Inc.) if they fund it. Fire protection and criticality safety programs play a prominent role in the safety strategy at Oak Ridge; therefore, these programs were specifically included in this assessment. Specific comments related to Paducah and Building K-25 at ETTP are included in Appendix F.

An example of the lack of SMP support is the fire protection program. There is no corporate SMP (e.g., a BJC fire protection program manual). However, there is a procedure (BJC-FP-2001, *Fire Protection Program Description*, dated July 2000) that defines the responsibilities of BJC and its subcontractors. The decision to create a corporate-level Fire Protection Program Compliance Officer to oversee the five sites was a result of the ISMS verification. BJC has responsibility for the ETTP Fire Protection Program, and it is funded by the ETTP MOP. At all the other sites, they utilize the prime contractor's program if it is funded by the MOP. The MOP and the ORO AMEM can override the SMP SME's recommendations without written disposition of the concerns. In March 2001, BJC and ORO convened a WSS team to address the deficiencies in the WSS standards that has resulted in a draft proposal to incorporate most of the DOE O 420.1A and National Fire Protection Association (NFPA) 801 requirements, and this is almost ready for BJC submittal to ORO.

The ORO Nuclear Criticality Safety Program still does not meet the intent of DOE Policy 450.5, *Line Environment, Safety, and Health Oversight*. ORO has not corrected the deficiencies in the program that were self-identified in May 2000 as a result of a self-assessment performed at the direction of the Deputy Secretary. The ORO Nuclear Criticality Safety Program under the AMESH remains understaffed, although action has been initiated to hire an additional nuclear criticality safety SME. ORO has not implemented a formal program that meets the intent of DOE Policy 450.5. A draft program and policy document was issued just at the end of the team's site visit. Therefore, at the time of the on-site review, the ORO Nuclear Criticality Safety Program was not capable of performing effective oversight of the contractor at the diverse facilities managed by ORO. The draft program and policy documents appear to be a positive step, but some elements need revision to meet the intent of the criteria provided by the Deputy Secretary in November 1999. It remains to be seen what the final program will look like, since neither the AMESH, AMEM, nor AML have concurred on the draft.

The team found that some core SMPs, such as radiation protection, industrial safety, and industrial hygiene, are being effectively implemented.

## 6.0 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The following presents the SBAT's overall findings and associated recommendations that should be considered as part of ORO's and BJC's corrective actions. Each major finding is a roll-up of SBAT concerns and observations. Recommendations are linked to each of the major findings under the following categories: (1) Safety Assurance at BJC Nuclear Facilities; (2) SB Management; or (3) Adequacy of SB Documents. In addition, individual findings and observations are presented in Appendix E and F for each facility reviewed.

Those items discussed under the "Safety Assurance" category are considered the most urgent and necessary for maintaining the team's conclusion that there is no imminent risk to workers, the public, or the environment. Immediate corrective actions and compensatory measures should be established based on the team's recommendations in this category. Recommendations in the other two categories are also important in order to correct many of the root causes that have led to problems with safety basis programs, management systems and documents. Within each category, findings and recommendations are presented in the order of perceived relative importance.

### 6.1 Safety Assurance at BJC Nuclear Facilities

The SBAT recognizes the relative low risk of many operations conducted by BJC, as well as BJC's improvements in criticality safety and the attention given to SMPs focused on worker safety, such as radiation protection and occupational safety and health. However, the nature of EM operations and the associated potential for unknown radiological or chemical hazards still demand a structured management approach that includes a sound SB and commitment to maintain and implement key nuclear SMPs (i.e., maintenance, fire protection, inventory control, emergency management, etc.).

**Finding #SA1: Systemic weakness in SMPs exists at the BJC corporate level for the five sites (e.g., there is no corporate fire protection program) and therefore, some compensatory measures are warranted. [See Section 5.1, 5.5.5]**

#### *Recommendations:*

- SA1a. Impose compensatory measures on the SMPs as provided in Table 4, with higher priority placed on fire protection and inventory control. (Note: Other SMPs are expected to be in place; however, the SMPs identified above are considered essential to ensure safe operations to prevent or mitigate significant radiological or toxicological accidents.)
- SA1b. Besides the SMPs identified in Table 4, the implementation of an effective operational safety program that includes industrial safety and hygiene and conduct of operations needs to be maintained. Review the adequacy and effectiveness of procedures and training on handling and storage of hazardous materials, such as pressure vessels, activities with large quantities of hazardous materials and asphyxiants, and those high-hazard activities that could cause worker fatalities (e.g., UF<sub>6</sub> cylinder handling--see the facility write-up in Appendix E).
- SA1c. The SB flowdown assessment should incorporate/expand the criteria on the adequacy of controls and implementation of SMPs.

SA1d. BJC's SB confirmation effort should be expedited for all Hazard Category 2 facilities and restricted operations. This needs to include a process to rapidly resolve findings and manage observations or recommendations.

**Finding #SA2: The failure to (a) evaluate potential drum explosions that could cause fatalities, serious injuries, or significant chemical exposures and (b) identify their preventive and mitigative controls, some of which may warrant a TSR, is one of the unresolved SER issues regarding the Paducah and Portsmouth FSARs, and it is also applicable to many other BJC facilities. [See Section 5.5.3]**

*Recommendation:*

SA2a. As an immediate action, the potential gas generation hazard from sealed containers (e.g., from U, fission products, and waste drums) should be evaluated as soon as reasonably possible, and engineering controls (e.g., use of vent clips or HEPA-filtered lids) should be installed where the potential is likely to occur.

**Finding #SA3: Numerous weaknesses were identified in BJC's SB documents, as well as supporting management systems, programs, and procedures. [Note: This is related to various findings throughout Section 5.]**

*Recommendation:*

SA3a. It is recommended that a new Price-Anderson Amendments Act Noncompliance Tracking System (NTS) report or a revision to the existing one on the U Oxide Storage Vault be issued to acknowledge the broader nature of the SB deficiencies, including the USQD problems noted as a result of not having up-to-date SBs. The team recognizes that the root cause analysis performed for the existing NTS report did identify a broad spectrum of causal factors that would apply to many other nuclear facilities. The NTS corrective actions, among other recommendations, must address how BJC is going to perform USQDs in the interim.

## 6.2 Safety Basis Management

In general, the team has concluded that a principal contributing factor to the widespread deficiencies in SB documents and the absence of fundamental SB management systems and processes is an overall lack of management priority and accountability for nuclear safety within ORO and BJC.

This condition must be addressed in order to build a solid foundation upon which future progress and improvements can be accomplished. Nuclear safety roles and responsibilities, policies, and corporate-level expectations must be clear and should flow down through all organizational levels, including subcontractors. ORO and BJC managers must be cognizant and committed to meeting the Department's established nuclear safety requirements. Managers must be held accountable for their nuclear safety roles and responsibilities. And finally, DOE and contractor personnel must possess the necessary nuclear safety skills and competencies to perform their duties.

**Finding #MG1: Inadequate consideration was given to the management systems, processes, and technical capabilities in place when the authority for SB review and approval was delegated to ORO and then further delegated to the AMEM. [See Section 5.2.1]**

*Recommendations:*

- MG1a. ORO should develop an "integrated" corrective plan that responds to SB-related findings and concerns generated from the DNFSB, this Headquarters Independent SB Assessment, and other internal self-assessments. The plan should formulate a path forward and include corrective actions, as well as a schedule for completion.
- MG1b. Approval authority for EM activities should be maintained at headquarters until ORO demonstrates that the necessary nuclear safety management systems and personnel are in place and planned corrective actions are implemented or, at a minimum, that interim compensatory measures are sufficient to warrant re-delegation.
- MG1c. ORO should coordinate with EM headquarters regarding the backlog of SB documents awaiting review and arrange a strategy for their disposition. This includes setting priorities and ensuring that review and approval of the most important SB documents (including associated USQDs) are immediately conducted in order to expedite decisions related to continuing operations.
- MG1d. DOE headquarters line management should oversee ORO SB activities and continually assess progress until the corrective actions are complete.

**Finding #MG2: The AMESH role of SB review and independent technical evaluation of SB documents is not being performed effectively. Contributing factors include a lack of available, qualified SB experts, an ORO process that permits the AMESH to exercise SB roles only when requested by line organizations, and a breakdown in communication between the AMESH and AMEM. [See Section 5.2.2]**

*Recommendations:*

- MG2a. The AMESH's roles and responsibilities need to be strengthened to include concurrence on all SERs for Hazard Category 2 and 3 nuclear facilities and moderate/high non-nuclear hazards, as well as on initial and final hazard categorization for all nuclear facilities (including categorizations for nuclear facilities being downgraded to radiological).
- MG2b. The AMESH should be given authority to exercise its role of independent assessment of SB programs and documents when deemed appropriate by the AMESH and senior ORO management, rather than just when requested by line organizations.
- MG2c. ORO should conduct a staffing analysis and ensure that sufficient numbers of qualified safety personnel are made available for preparation, review, and approval of SB documents. In addition, ORO should ensure that near-term compensatory measures are in place to address staffing deficiencies.

**Finding #MG3: Processes, systems, and procedures used by ORO and BJC to prepare, review, approve, and monitor nuclear facility SBs, as well as to track SB assessment findings and corrective actions, have been conducted very informally, if at all. [See Section 5.3.]**

*Recommendations:*

- MG3a. ORO should adopt an SB review and approval procedure that applies to all ORO line and safety organizations. The procedure should ensure that SERs are prepared in accordance with DOE-STD-1104 for all new SBs or tailored as appropriate to approve TSR page changes, discovery USQs, or JCOs.
- MG3b. ORO should develop a dispute resolution process that involves senior ORO management when necessary to address any unresolved SB review comments.
- MG3c. ORO should formalize tracking of corrective actions and elevate this responsibility to a centralized ORO function. Further, ORO should ensure that SB findings from previous assessments are resolved.
- MG3d. BJC should establish corporate expectations on "core" SMPs (e.g., fire protection, maintenance, training, etc.).

**Finding #MG4: ORO and BJC managers have not been held accountable for their lack of performance in exercising their nuclear safety roles, responsibilities, and authorities. [See Section 5.2.4]**

*Recommendations:*

- MG4a. Ensure that mechanisms are in place for holding BJC and ORO managers accountable for meeting their nuclear safety roles and responsibilities. This includes establishment of individual performance goals and evaluations and continued emphasis on nuclear safety within contract mechanisms such as fee evaluations.
- MG4b. Accountability mechanisms should flow down to subcontractors, including a requirement that subcontractors meet BJC's corporate expectations.

**Finding #MG5: Several factors have led the team to conclude that there has been an overall lack of management priority given to nuclear safety within both the ORO and BJC organizations. [See Section 5.2.4]**

*Recommendations:*

- MG5a. ORO should ensure that the root causes that led to the suspension of certain operations, the DNFSB findings, and the withdrawal of the ORO SB approval authority are either eliminated or addressed.
- MG5b. ORO should develop the necessary management systems to control and track SB documents, as needed to help manage the current backlog, and ensure that management is aware of the priority given to SB documents awaiting review.

MG5c. BJC should ensure that all SB documents for the five sites (ETTP, ORNL, Y-12, Paducah, and Portsmouth) are collected and placed under centralized document control.

**Finding #MG6: The WSS included in the BJC contract did not fully invoke applicable nuclear safety requirements and standards. [See Section 5.2.3]**

*Recommendations:*

MG6a. The current ORO effort to re-evaluate the WSS against DOE nuclear safety requirements should be completed, and the WSS set should be modified to ensure that DOE requirements related to Hazard Category 2 and 3 facilities are adopted, as applicable.

MG6b. Future WSS proceedings should involve necessary nuclear safety expertise and give adequate consideration to the minority opinions of all participants, including SMEs.

**Finding #MG7: No independent SB assessment role has been practiced. DOE Facility Representatives do not formally or routinely communicate nuclear SB issues to ORO management. Therefore, the ORO Manager never had an "honest" safety broker who was capable of identifying that there was an ongoing problem. [See Section 5.2.2]**

*Recommendations:*

MG7a. DOE Facility Representatives should formalize their assessment process related to SB, including documentation of concerns and findings and communication to the ORO Manager.

MG7b. See MG2b regarding AMESH role.

**Finding #MG8: ORO and BJC have not established minimum nuclear safety competencies for program, project, and facility managers. [See Section 5.4]**

*Recommendations:*

MG8a. See recommendation MG3a related to ORO. BJC should conduct a staffing analysis and ensure that sufficient numbers of qualified safety personnel are made available for preparation, review, and approval of SB documents. In addition, BJC should ensure that near-term compensatory measures are in place to address staffing deficiencies.

MG8b. Based on interviews and review of documents prepared since the BJC contract was awarded, it is clear that minimum training qualifications and experience need to be extended to subcontractors.

MG8c. BJC should ensure that DOE 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*, is included in the BJC WSS.

MG8d. BJC should ensure that revised procedures on technical qualifications are flowed down to subcontractors.

**Finding #MG9: Subcontractors who conduct USQDs are not required to follow the BJC-NS-1001 procedure. In fact, four different procedures are being used by subcontractors at the five sites under BJC's jurisdiction. None of these procedures have been reviewed and approved by DOE. [See Section 5.3.2]**

*Recommendation:*

MG9a. Expedite resolution of previous ORO review comments on the BJC USQD procedure (BJC-NS-1001) and approve it per 10 CFR 840.203(b). Resolve whether BJC's subcontractor USQD procedures also need DOE approval.

**Finding #MG10: Very little SB-related training has been given to ORO and BJC personnel [See Section 5.4].**

*Recommendations:*

MG10a. Both ORO and BJC should conduct an analysis of SB training needs based on specific job requirements and ensure that BJC and ORO develop minimum technical qualifications for program/project managers and nuclear safety managers and personnel that are inclusive of nuclear safety-related knowledge, skills, education, and training

**Finding #MG11: Many SB documents are being prepared by subcontractors with little oversight from BJC [See Section 5.5].**

*Recommendation:*

MG11a. BJC should ensure that adequate oversight is given to subcontractors preparing SB documents, including the flowdown and adherence to BJC's corporate SB expectations (as revised).

### **6.3 Adequacy of BJC Safety Basis Documents**

Overall, the team found many SB documents to be outdated and not reflective of the current facility missions, configurations, hazards, or operating organizations. In addition, the team was concerned with the general lack of safety controls described in SB documents. This condition could be traced to deficiencies within the WSS and, therefore, a lack of contractual requirements, as well as the overriding belief that many fundamental nuclear safety programs and requirements did not apply to the "low-risk" operations performed by BJC.

**Finding #SB1: Many SB documents do not adequately identify safety controls, either engineered or administrative. Safety significant SSCs are not always identified. Where relied on, they were not derived from the SB documents, nor are they forced to be maintained through the TSR or Operational Safety Requirements (OSR). [See Section 5.5.4]**

*Recommendations:*

SB1a. Activities relying on the new TSR controls for the Paducah Building C-410 and certain DMSAs should not be restarted until the ORO NSD issues are resolved (see the facility report in Appendix E).

SB1b. USQD evaluations should be done against both the approved SB and pending revisions until the revised documents are approved.

SB1c. See Recommendation SB2a and SB2b.

**Finding #SB2: Technical deficiencies exist in the hazards and accident analyses, including, in some cases, the exclusion of certain hazards and accident scenarios. [See Section 5.5.3]**

*Recommendations:*

SB2a. The hazard analysis section of SB documentation should present the logical progression of the hazards, the risk posed by the current operations, appropriate control selection, and the basis for acceptability of the SB document.

SB2b. As part of the 10 CFR 830 implementation plan, consider the potential cost effectiveness of evaluating certain hazards (such as natural phenomena) and perhaps external events (such as an aircraft crash) at a sitewide level for each of the five BJC sites. Individual SB documents could then reference the sitewide assessment rather than consuming significant resources to evaluate such hazards when there are no expected benefits from a control perspective (e.g., would not expect seismic upgrading for BJC's facilities). However, if there are relevant feasible controls that should be implemented to mitigate such hazards (e.g., inventory controls on dispersible radiological materials), these should be considered in the individual facility SB document.

**Finding #SB3: Many SAR and BIO documents do not adequately reflect current organizations, activities, missions, and hazards. [See Section 5.5.1]**

*Recommendations:*

SB3a. Existing approved SARs and BIOs should meet 10 CFR 830.207(b) and 830.202 (c) requirements for an annual update.

SB3b. Revise the implementation plan for updating existing SB documents (and, if necessary, request an extension for compliance with the 10 CFR 830 deadline) to address issues on the adequacy of existing SB documentation and expectations for implementing the safe harbor methods.

SB3c. ORO and BJC need to work together, with insights and guidance from the headquarters program offices, to agree on the right balance (i.e., considering cost effectiveness and safety assurance) of SB documentation and approaches that reflect the nuclear facility hazards and operations at sites under ORO's jurisdiction.

SB3d. Re-evaluate the policy with respect to safety documentation for radiological facilities (e.g., develop a format and content guide for an ASA that is something like the 10 CFR 830 nuclear health and safety plan or other documentation of the hazard categorization determination, such as a checklist or a brief report).



**Finding #SB4: The ORO Nuclear Criticality Safety Program still does not meet the intent of DOE Policy 450.5, *Line Environment, Safety, and Health Oversight*. ORO does not have an approved formal program in place, and the corrective actions for the open safety issues identified in May 2000 relative to this program have not been closed. Most of the BJC SARs and BIOs do not adequately describe the criticality safety program, nor do they have the requisite commitments in the TSRs and OSRs. [See Sections 5.5.4 and 5.5.5]**

*Recommendations:*

- SB4a. See recommendation SA1a and Table 4.
- SB4b. As new SBs are developed per 10 CFR 830, provide the expected programmatic attributes in the SMP chapter and TSRs as recommended in the safe harbors (e.g., DOE-STD-3009)
- SB4c. ORO should ensure that remaining open criticality safety items identified in the Corrective Action Tracking System (CATS) are corrected and closed out in a timely manner.

**Finding #SB5: Technical deficiencies exist in the hazard categorization of nuclear and radiological facilities; therefore, some radiological facilities could be nuclear facilities and some Hazard Category 3 facilities may be Hazard Category 2. [See Section 5.5.2]**

*Recommendation:*

- SB5a. Develop a hazard categorization review plan that includes (a) revising the procedures per DOE-STD-1027 and EH headquarters interpretation memos, (b) validating the adequacy of previous hazard category determinations (including a prioritization for questionable facilities), and (c) developing a process to manage hazard categorization discrepancy discoveries (e.g., Building C-410 radiological facility and the Y-12 Old Salvage Yard) with nuclear criticality hazards, reclassification of radiological facilities to nuclear status, or reclassification of facilities from Hazard Category 3 to Hazard Category 2, etc.

**Finding #SB6: The use of alternate ARFs and RFs as part of the hazard analysis process may have led to underestimating the potential unmitigated consequences to the public for many of the postulated accident scenarios. [See Sections 5.5.2 and 5.5.3]**

*Recommendation:*

- SB6a. As new SBs are developed per 10 CFR 830, apply the DOE-HDBK-3010 bounding ARFs and RFs unless the DOE approval authority approves alternate values based on sufficient technical justification. (Note: This also applies to the use of alternate ARFs and RFs for hazard categorizations.)

**Finding #SB7: FHAs were found to be missing, out of date, or inconsistent with the SB documents (e.g., with respect to the combustible loading limits, maximum potential fires, status of fire suppression systems, etc.). [See Sections 5.2.3 and 5.5.3]**

*Recommendation:*

SB7a. BJC and DOE should ensure that the applicable portions of DOE O 420.1 are incorporated into the WSS and that FHAs are performed at BJC nuclear facilities and integrated into the SB documents.

**Table 4. Recommended SMPs and Corresponding Compensatory Measures**

Safety Management Program	Compensatory SMP Actions
*Fire Protection	<ul style="list-style-type: none"> <li>• Establish a sitewide combustible/ignition control program (e.g., elimination of waste storage on wooden pallets, hot work control permits, etc.).</li> <li>• Perform a fire protection engineer or equivalent assessment of allowable combustible loading and combustible/ignition control verification on a prioritized basis for each facility as agreed to by ORO</li> <li>• Commit to a formal evaluation of fire protection, including the fire suppression and detection systems at BJC's facilities (and to include updating FHAs for all nuclear facilities).</li> </ul>
*Inventory Control	<ul style="list-style-type: none"> <li>• Establish a formal inventory and waste (or material) acceptance control program which ensures that all facilities and activities remain within the bounds of the SB documentation and hazard categorization.</li> </ul>
Procedure and Training	<ul style="list-style-type: none"> <li>• Update operating procedures following BJC's verification of the flowdown of controls.</li> <li>• Train personnel on the new/revised procedures.</li> <li>• Verify qualifications and training of BJC, its subcontractors, and ORO personnel responsible for preparation, review, and oversight of SB documentation.</li> </ul>
Criticality Safety	<ul style="list-style-type: none"> <li>• Complete the corrective action items in response to the headquarters criticality safety assessment.</li> <li>• Review and approval of the ETTP sitewide R/CAAS TSR is required.</li> </ul>
Maintenance and In-Service Inspection	<ul style="list-style-type: none"> <li>• Formally incorporate a surveillance and in-service inspection program for all safety significant SSCs identified in the SB documents (as amended through the flowdown verification).</li> </ul>
Emergency Response	<ul style="list-style-type: none"> <li>• Establish an effective emergency response program to ensure that personnel are trained and qualified to respond to essential alarm conditions (i.e., fire, criticality, and radioactive material release).</li> </ul>
Hazardous Material Protection	<ul style="list-style-type: none"> <li>• Develop procedures, training, and an institutional program to deal with activities or operations that meet the following:</li> <li>• Hazardous materials in quantities greater than 40 CFR 302 TQs, and</li> <li>• Reactive or explosive materials with hazard level <math>\geq 2</math> as defined by NFPA 45.B-2.3 or 49 CFR 173.2, Division 1.1, 1.2, 1.3, or explosives &gt;45g of Division 1.4 explosives in one area</li> </ul>

\*These are considered immediate actions.

**Appendix A -- DNFSB Letter to Under Secretary of  
Energy, Science, and Environment**

January 18, 2002

The Honorable Robert Gordon Card  
Under Secretary of Energy, Science, and  
Environment  
1000 Independence Avenue, SW  
Washington, DC 20585-1000

Dear Mr. Card:

On October 15, 2001, a letter from the Defense Nuclear Facilities Safety Board (Board) formally advised you of potential issues related to the health and safety of the public and workers associated with the environmental management activities of the Department of Energy's Oak Ridge Operations Office (DOE-ORO) and its prime contractor, Bechtel Jacobs Company (BJC). The Board's letter identified issues related to the establishment and application of safety bases and controls for hazardous nuclear activities, the implementation of Integrated Safety Management (ISM), the application of nuclear safety requirements, and the technical capability of the organizations involved. Given the need to reestablish control over the safety of hazardous nuclear activities, the Board requested a report within 45 days providing a determination of the safety of ongoing operations.

DOE-ORO and BJC managers recognized the significance of the safety issues involved and suspended certain hazardous nuclear activities. (Subsequent corrective actions and compensatory measures allowed many of these activities to be resumed.) DOE-ORO suspended BJC's fissile material operations because of criticality safety concerns and revoked both BJC's and its own certification of ISM implementation. In addition, DOE and BJC have begun taking preliminary action to address the need for additional safety expertise. In the interim, DOE's Office of Environmental Management has rescinded its delegation of authority for DOE-ORO to approve safety basis documents.

On December 14, 2001, DOE's Office of Science (DOE-SC) provided an interim response on your behalf to the Board's reporting requirement. That response failed to make any assertion regarding the safety of ongoing operations and indicated that a final determination will not be provided until late January 2002. The response also did not address the status of the other issues encompassed by the Board's reporting requirement or describe a path forward for resolving them, except to request more time. The Board found the response unacceptable because of this lack of detail.

The Board requested a video teleconference with senior DOE and BJC personnel from Headquarters and Oak Ridge on December 19, 2001, to discuss the issues at Oak Ridge, the Board's reporting requirement, and DOE's response. DOE-ORO and BJC managers

acknowledged that the safety issues raised by the Board were real, long-standing, and potentially serious and reiterated that the lack of adequate safety bases and controls required prompt action.

The Board is aware of and commends the steps taken recently by DOE-ORO and BJC to bring in additional experienced personnel, including those from the Bechtel National, Inc. and Jacobs Engineering Group, Inc. parent companies, to help address these issues. Progress is also being made in that technical experts from the National Nuclear Security Administration and elsewhere have begun the process of evaluating the hazards of BJC's nuclear operations and the adequacy of controls for these hazards. Nevertheless, the Board remains concerned that DOE, particularly DOE-SC, has not yet developed a coherent and prioritized plan and is not aggressively pursuing the actions necessary to establish and control the safety bases for hazardous nuclear activities, as well as to address the more fundamental problems that allowed these conditions to exist. The Board and its staff are available to assist you to ensure that these safety issues are resolved in a comprehensive and technically adequate manner with no additional undue delay.

Sincerely,

John T. Conway  
Chairman

c: The Honorable Jessie Hill Roberson  
Mr. James F. Decker  
Ms. Gertrude Leah Dever  
Mr. Mark B. Whitaker, Jr.

**Appendix B -- Office of Science Memorandum  
dated November 19, 2001**



**Department of Energy**  
Washington, DC 20585

November 19, 2001

MEMORANDUM FOR RALPH E. ERICKSON  
ACTING ASSOCIATE ADMINISTRATOR  
FOR FACILITIES AND OPERATIONS  
NATIONAL NUCLEAR SECURITY ADMINISTRATION

FROM: MILTON D. JOHNSON  
ACTING PRINCIPAL DEPUTY DIRECTOR  
OFFICE OF SCIENCE

*MDS*

SUBJECT: Assessment of Bechtel Jacobs Company and Oak Ridge  
Operations Office Safety Basis Authorization and Approval  
Process

The Office of Science (SC) requests your assistance in providing Mr. Dae Chung to organize and lead an independent assessment of Bechtel Jacobs Company (BJC) and Oak Ridge Operations Office (ORO) safety basis authorization and approval processes. This is in response to two elements that were identified in the Defense Nuclear Facilities Safety Board (DNFSB) letter of October 15, 2001 (attached). This request expands the scope of the previously planned review requested by Margaret Morrow, Oak Ridge Operations Assistant Manager, by letter of November 1, 2001, regarding a review of the ORO safety basis authorization process.

The assessment team is requested to complete the following:

- An assessment of the adequacy of the authorization basis and safety posture for each of BJC's defense nuclear facilities. Since inadequate hazard classifications for BJC facilities have previously been identified, and the guidance for facility classifications in U.S. Department of Energy (DOE) directives may not have been followed, the team should also address BJC's radiological facilities. The report should include a determination of the safety of ongoing operations and Justifications for Continued Operation, as appropriate (Reference: DNFSB letter of 10/15/01, second page, first bullet).
- An assessment of the flowdown of responsibilities for technical direction, specifically those for authorization bases, from the DOE directives to DOE-ORO's Office of Environment. This assessment should include a determination of whether DOE-ORO has the specific technical expertise in place to meet those responsibilities for review and approval of authorization basis documents. Where that expertise does not exist, the compensatory measures to be implemented and the actions necessary to eliminate the need for those compensatory measures



should be described (Reference: DNFSB letter of 10/15/01, second page, part of fourth bullet).

- An assessment of ORO's processes for reviewing and approving safety basis documents for ORO facilities to ensure that acceptable controls for safe operations are defined and implemented (Reference: M. Morrow letter of 11/1/01).

We are requesting the review be conducted starting the first week of December 2001 and the report issued by January 11, 2002. We look forward to receiving a report that contains the review plan and criteria, the findings, and the opportunities for improvements.

Dr. Charles Billups is the point of contact for my staff. He can be reached at (202) 586-7141. Margaret Morrow, ORO, will assist Mr. Chung with the logistics and administrative support to plan and carry out this review.

Attachment

cc:

D. Chung, NA-53  
L. Dever, ORO  
M. Morrow, OR  
C. Billups, SC-3

## **Appendix C -- Biographical Sketches of the Safety Basis Assessment Team Members**

## Biographical Sketches of Team Members

**Dae Y. Chung (Team Leader)** currently holds the position of Leader of the Risk and Safety Support Division within the Office of ES&H and Operations Support (NA-53), NNSA, DOE headquarters.

Mr. Chung has been with DOE for 12 years, assuming various different positions in EH, the Office of Nuclear Energy, the Office of Defense Programs, and the NNSA Facility and Operations. Prior to joining DOE, Mr. Chung spent eight years with the Nuclear Fuels Division of Westinghouse Electric Corporation in Pittsburgh, Pennsylvania. His last position at Westinghouse was as Technical Manager, where he was responsible for all aspect of core design for several utilities.

Mr. Chung has more than 20 years of combined experience in DOE and commercial nuclear industries performing, leading, and managing various engineering and regulatory activities, with emphasis on design, safety analysis, and operational safety management of DOE's defense nuclear facilities, DOE's test and research reactors, and commercial nuclear power reactors. His experience encompasses review and evaluation of safety analysis and technical (or operational) safety requirements and design requirements for a number of defense nuclear facilities at multiple DOE sites; development, review, and implementation of DOE nuclear safety policies, directives, and standards; nuclear criticality safety; safety management assessments; training; quality assurance; reactor core design; and safety analysis of commercial power reactors.

Mr. Chung's DOE safety-related experience is as follows:

- Led the development of DOE-STD-3009-94
- Led the development of DOE-STD-3007
- Managed and advised the development of DOE-STD-3011
- Led the development of DOE-HDBK-3010
- Managed and advised the development of Office of Defense Programs Document of Example TSRs
- Managed and led the DOE Accident Phenomenology and Consequence Code Project
- Initiated and led the development of the internationally sponsored Nuclear Criticality Safety Benchmark Evaluation Project
- Initiated and managed the development of DOE-STD-3013
- Participated in the initial phase of ISMS development in terms of a tailored approach to hazard analysis
- Led or participated in reviews/evaluations of various SB documents for numerous defense nuclear facilities and nuclear explosive operations
- Led or participated several different forms of on-site assessments covering a broad spectrum of safety functional areas
- Led or participated in several design reviews for new facilities and major modifications

**Terry Foppe** is a Safety Analyst with Foppe & Associates, Inc. Mr. Foppe has approximately 27 years of professional experience in safety analysis, risk assessments, fire protection engineering, and occupational safety and health. He is a Registered Professional Engineer (fire protection engineering) and Certified Safety Professional (comprehensive practice).

Mr. Foppe has provided safety analysis, hazards and accident analysis, and qualitative or quantitative risk assessments of non-reactor nuclear and hazardous chemical to the Rocky Flats Site operating contractor or the Rocky Flats Field Office for the past 19 years. These evaluations were used for development of (1) SB documents such as SARs or BIOs for plutonium handling or waste storage facilities, hazard classifications of nuclear facilities and activities, safety classifications of SSCs, TSRs, OSRs, USQDs, and JCOs; (2) National Environmental Policy Act Environmental Assessments and Environmental Impact Statements; (3) off-site Emergency Planning Hazards Assessments; (4) radiological and chemical sabotage vulnerability assessments; and (5) risk management decision-making for structural upgrades or risk acceptance.

Since 1995, Mr. Foppe has functioned as a technical support service contractor for the Rocky Flats Field Office regarding (1) reviewing and approving SB documents (e.g., SARs, BIOs, TSRs, USQDs, JCOs) and issuance of SERs for plutonium-handling facilities; waste storage/processing facilities; and deactivation, decontamination, and decommissioning of nuclear facilities, (2) developing or reviewing National Environmental Policy Act Environmental Impact Statements and Environmental Assessment risk assessments, (3) reviewing Emergency Planning Hazards Assessments and off-site emergency planning zones, (4) reviewing radiological sabotage vulnerability assessments, and (5) developing risk assessments for DNFSB Recommendations 94-1 and 94-3 related to plutonium residue stabilization and interim storage of special nuclear materials. He has also provided SB support to the Richland Operations Office.

Mr. Foppe's experience prior to the above included eight years of developing, coordinating, and implementing safety management and fire protection programs for DOE and other commercial companies to protect employees, property, the public, and the environment.

**Rick Haynes** has a bachelor's degree in chemistry and a master's degree in chemical engineering. He has more than 15 years of experience at the Savannah River Site Tritium Facilities and more than 20 years of experience in SB documentation. He was the Lead Engineer/Analyst for the original SAR (1987) for the Tritium Processing Facilities (i.e., 232-H, 234-H, and 238-H). Mr. Haynes developed the original OSR for the Tritium Facilities. He also participated in the development of the Replacement Tritium Facility (233-H) SAR (1989). Mr. Haynes was the Lead Engineer/Analyst for the Plutonium Fuel Form Facility SAR (1985), participated in the development of the SARs for the H- and F-Canyons, HB and JB-Lines (1986), and was the Lead Engineer/Analyst for the Existing Tritium Facilities BIO (1994). As a member of the DOE Savannah River Site staff, he reviewed SB documentation for the Defense Waste Processing Facility, the Tritium Facilities, F-Canyon, and FB-Line. Mr. Haynes participated in the Operational Readiness Review for the startup of the Defense Waste Processing Facility (1996). Mr. Haynes has participated in various Operational Readiness Reviews and readiness assessments for the Tritium, F- and H-Canyons and the FB-Line Facilities (1997-present). Mr. Haynes participated in the formation of the Savannah River Site DOE/contractor Authorization

Basis Steering Committee and the DOE Savannah River Nuclear Safety Committee (1997). He successfully completed the technical qualification program in the area of nuclear safety systems in March 1998. His training and experience provide a distinct basis for review of an entire SAR but are uniquely suited to review of accident and hazards analysis, including development methodology.

**Patrice McEahern** has more than 20 years of engineering and management experience, including design engineering, construction, operations, maintenance, regulatory, quality assurance, and environment, safety and health issues associated with nuclear reactor and nuclear weapons facilities. She possesses an in-depth knowledge and understanding of the nuclear safety and safety management issues at DOE facilities and operations. Ms. McEahern is recognized for her experience and expertise in developing and reviewing nuclear facility SB documentation and performing management-level assessments that focus on determining the root cause of facility and program shortcomings. Ms. McEahern possesses extensive experience in dealing with local, state, and national regulators, including the DNFSB. She also possesses expert knowledge in the area of integrated safety management. Ms. McEahern holds an active Level 3, Q security clearance with DOE. Ms. McEahern has a bachelor of science degree in engineering science from Colorado State University.

Ms. McEahern is currently Vice President of Strategic Management Initiatives, Inc., where she provides senior-level technical, managerial, and programmatic support to the Rocky Flats Site management and integrating contractor, Kaiser-Hill, LLC, on issues associated with nuclear facility SB, nuclear facility deactivation, integrated safety management, and engineering oversight. She provides support to EH and EM headquarters, as well as other DOE field elements in the development of strategies and management systems to overcome the issues associated with nuclear facilities operation and disposition, nuclear materials stabilization, accelerated mortgage and support cost reduction, nuclear waste disposition and integrated safety management.

**Dr. Jerry N. McKamy** currently holds the position of Nuclear Criticality Safety Specialist with the DOE EH Office of Special Projects and Investigations (EH-21). Dr. McKamy received his doctor of philosophy degree in experimental nuclear physics from Ohio State University (1982) and a bachelor of science degree, *summa cum laude*, in physics from the University of Texas at Arlington (1976).

Dr. McKamy's areas of expertise include nuclear criticality safety and nondestructive assay. He started his nuclear career at the Critical Mass Laboratory at Rocky Flats in 1983. From 1983 through 1987, he performed critical experiments, validated Monte Carlo criticality safety codes, and was the responsible Criticality Safety Engineer for various Rocky Flats production buildings. In 1987, Dr. McKamy joined the Safeguards Measurements Group as the Principal Engineer for neutron nondestructive assay. In 1989, as Manager of Safeguards Measurements, Dr. McKamy led the development and implementation of the Rocky Flat Nondestructive Assay Program to measure the plutonium holdup in the ventilation ducting. Late in 1990, Dr. McKamy returned to the Criticality Engineering Group at Rocky Flats as Manager. His major accomplishment as Manager of Criticality Engineering was changing to a formal, standards-based criticality safety program, which was the foundation for the successful resumption of operations in Buildings 559

and 707. In 1994, Dr. McKamy joined the consulting firm of M. H. Chew and Associates, where he primarily provided criticality safety support to the DOE Rocky Flats Field Office. In addition, he developed the criticality safety design criteria for the BNFL Team's Plutonium Stabilization and Packaging System and helped in the resolution of the Hanford TWRS Criticality Safety Question.

Since joining DOE in the fall of 1996, Dr. McKamy has provided criticality safety assistance to DOE Field Offices at Rocky Flats, Y-12, Richland, Savannah River, and Lawrence Livermore National Laboratory. The assistance provided to DOE Richland was instrumental in the successful resumption of plutonium stabilization operations at the Plutonium Finishing Plant. In addition, Dr. McKamy was a principal in drafting the DOE Implementation Plan in response to DNFSB Recommendation 97-2. He serves on the Department's Nuclear Criticality Safety Program Management Team and the Criticality Safety Support Group, and he chairs the Criticality Safety Coordinating Team. Dr. McKamy initiated and organized the Department's criticality safety self-improvement workshop, *Your Mission and Nuclear Criticality Safety*, which was held in Las Vegas in August 1999. Dr. McKamy participated in the investigation and led the team of criticality safety experts that reviewed key DOE facilities as part of the Department's criticality safety improvement initiative in the wake of the criticality accident in Tokaimura Japan.

Dr. McKamy is an active member of the Nuclear Criticality Safety Division of the American Nuclear Society. He is a member of the NCSO Executive Committee, chairs the Education Committee, and is a member of the ANSI/ANS 8.26 writing group.

**Yusuf Noorani** is a Senior Engineer and Scientist with 16 years of extensive experience in nuclear safety, licensing and permitting, environmental investigations, audits and surveillances, and data management. He is currently assigned to the DOE Office of River Protection. Mr. Noorani's responsibilities include reviewing and recommending approval of SB documents such as TSRs, SARs, BIOs, and other documented safety analyses. Mr. Noorani is also responsible for oversight of the Tank Farms USQ process and overall evaluation of SB compliance for the Hanford Tank Farms. He has led and participated in several DOE safety review teams for review of safety documents and preparation of SERs.

Prior to joining DOE, Mr. Noorani was a consultant with Duke Engineering and Services, Inc., providing engineering support to Duke Engineering and Lockheed Martin Hanford Company for development and preparation of the Hanford Tank Farms safety analyses. Mr. Noorani's previous assignments include technical review and support to DOE in project planning, control, engineering, waste management, safety analysis, and National Environmental Policy Act compliance, including preparation of Environmental Impact Statements and Environmental Assessments at Hanford.

At the DOE Idaho National Engineering and Environmental Laboratory, Mr. Noorani's experience included compilation and evaluation of waste management data in support of the Laboratory's sitewide Environmental Impact Statement and review of various safety and technical documents. He participated in a DOE safety review team in the early 1990s for review of Waste Experimental Reduction Facility safety documents. He has extensive experience in

project planning, control, management, and technical direction for Remedial Investigation/ Feasibility Studies of the DOE Superfund sites. Mr. Noorani served as an Operable Unit Manager for the Environmental Restoration Program for the Radioactive Waste Management Complex at INEL. Other previous experience includes working as an Environmental Engineer and Database Manager in the Environment, Safety, and Health Department of the DOE Weldon Spring Site Remedial Action Project in St. Louis, Missouri. Other relevant expertise includes conducting performance assessments, audits, surveillances, and Operational Readiness Reviews.

**Shirley J. Olinger** is the Assistant Manager for Safety and Engineering at DOE's Richland Operations Office. She is responsible for the SB, nuclear safety, establishing the principles of integrated safety management and quality assurance programs, performing readiness reviews, and providing technical subject matter expertise and engineering support for multiple complex facilities to ensure the safety and health of the workers and the public.

Ms. Olinger was the Acting Assistant Manager for Engineering at the Rocky Flats Field Office from 1998 to 2000, where she was responsible for the SBs, nuclear safety, engineering (including criticality and fire protection), quality assurance programs, health and safety programs, integrated environmental, the safety and health management system, readiness reviews, and contract terms and conditions. Prior to that, she held various management positions at Rocky Flats from 1990 to 1998. She has also worked at DOE headquarters with the Offices of Defense Programs and EH.

Ms. Olinger was a Nuclear Manager at Pearl Harbor Naval Shipyards from 1982 to 1987. She was responsible for oversight of overhauls, defuelings, and testing of several naval nuclear propulsion plants. From 1979 to 1982, she performed structural and civil engineering work for a private architect and engineering firm in Hawaii and for the U.S. Forest Service in Oregon. This work entailed designing and constructing bridges, roads, retaining walls, pumping stations, and sewage treatment facilities; conducting geotechnical field investigations and tests; and acting as contract officer technical representative on numerous projects.

Ms. Olinger, who is a native of Hawaii, received her bachelor's degree in civil engineering from the University of Hawaii. Half of her degree was obtained at Purdue University. She also received extensive nuclear course work from the Pearl Harbor Naval Shipyard in the Nuclear Navy Program.

**Dr. Louis Restrepo** has an extensive educational background, which includes a doctor of philosophy degree in nuclear engineering from the University of New Mexico, a master of science degree in health physics from Georgia Tech, a master's degree in program numerical analysis from John Hopkins University, a master of engineering degree in nuclear engineering from Cornell University, and a bachelor of science degree in mathematics/physics from Montclair State Collete.

Dr. Restrepo has more than 20 years of experience in nuclear safety and risk analysis, risk and cost-benefit evaluations, nuclear facility and process design, criticality, insider thread

evaluations, waste operations, operational safety (e.g., USQs, radiation protection, integrated safety management, etc.). He has prepared and supported the preparation of over 50 SB documents throughout the DOE complex (excluding reviews, USQs, etc., and including SARs, BIOs, TSRs, OSRs, TSRs (nuclear power industry), and JCOs, etc.). He has extensive experience and training in weapons safety, including weapons response evaluations (currently supporting Los Alamos National Laboratory and Device Assembly Facility).

Dr. Restrepo developed and taught numerous courses in probabilistic risk analysis, fire/explosion/source term/consequence modeling, TSRs, USQs, Technical Specifications, etc. He supported the development of the DOE-STD-3009 course, and he has upgraded the course and taught it to over 500 people throughout the DOE complex, most recently in 2001 to DOE Albuquerque and DOE Nevada. He also supported the development of several DOE STDs, Guides, HDBKs, etc., i.e., DOE-STD-3009, DOE-STD-1104, DOE-HDBK-3010 (see the contributors list on the cover), DOE O 420.1 Implementation Guide, etc.

He has reviewed dozens of nuclear SB documents, including transportation safety analyses, throughout the DOE complex on behalf of DOE. He has participated in numerous DOE and contractor's self-assessments of operational and safety programs throughout the DOE complex (e.g., SB, criticality, USQ, etc.). Dr. Restrepo has prepared several criticality safety evaluations, contingency evaluations and fault tree analyses relating to criticality potential. He has performed several criticality safety program independent reviews (e.g., Y-12, Rocky Flats, Pantex, etc.). He has prepared several criticality safety analyses, including consequence calculations and development of controls related to criticality as part of SB documentation preparation. In addition, he has supported several nuclear facility and process designs throughout the DOE complex, including the development of the DOE O 420.1 Implementation Guide.

Dr. Restrepo's employment history is as follows:

- OMICRON Safety and Risk Tech., Inc., President (1997-present)
- Sandia National Laboratories, SMTS (1990-1997)
- Rocky Flats Plant (Rockwell), Senior Principal Lead Engineer (1984-1990)
- Colorado University, Undergraduate/Graduate Teacher - Engineering Physics I/II
- Colorado School of Mines, Risk Analysis (1987-1989)
- Before 1984, supported the nuclear power industry (as a consultant) in PRA, environmental qualification, safety analysis/technical specifications instructor, etc.
- High School Teacher, Physics (1980).

**Ferdinand L. Ray Schwartz** is a Lead Engineer in the SC Office of Laboratory Operations and Environment, Safety and Health; ES&H Division (SC-83). He has held this position since 1993, with responsibilities in the areas of SARs, Price-Anderson Amendments Act, nuclear criticality safety, conduct of operations, facility representative programs, and natural phenomena hazards.

A summary of Mr. Schwartz's technical qualifications is as follows:

- 1990-1992: Chief Design Engineer, Design Division, Modular High Temperature Gas-Cooled Reactor, New Production Reactors
- 1983-1990: Three Mile Island-2 Site Office Manager, Electric Power Research Institute
- 1983: Licensing Engineer, Project Management Corp., Clinch River Breeder Reactor Project



- 1980-1983: Licensing Engineer, Duquesne Light Company, Beaver Valley Power Station Units 1 & 2
- 1978-1980: Project Engineer, reactor core design, Bettis Laboratory, West Mifflin, Pennsylvania
- 1974-1980: Bettis member of Joint Test Group for Submarines, Norfolk Naval Shipyard
- Bachelor of science degree, U.S. Military Academy, West Point, New York; 1967
- Master of engineering management degree, George Washington University, 1997
- Registered Professional Engineer (Nuclear, Pennsylvania) PE-033435-E
- Qualified Reactor Startup & Physics Acceptance Test Engineer, Bettis Laboratory (1978-1980)
- Qualified Reactor Plant Test Engineer, Bettis Laboratory (1974-1980)
- Publications: 5 Electric Power Research Institute Reports, 4 Journal Articles (technology transfer, robotics, radiation measurement)
- DOE Training in Management Oversight and Risk Tree-Based Root Cause Analysis, Personnel Management Supervision, Cost & Schedule Control System, Accident Investigation, Conduct of Operations, and Readiness Reviews
- Participated on ISMS verifications of Pacific Northwest National Laboratory and ORNL and Implementation Plan development in response to DNFSB Recommendation 95-2
- Numerous SC peer reviews for projects in design, construction, and pre-operation phase
- Participated in reviews of most SC nuclear facility SARs and several SC accelerator Safety Assessment Documents

**Jeff Woody** is Vice President and Director of Operations for Link Technologies, Inc. He holds a degree in civil/structural engineering and has more than 15 years of experience managing and consulting on DOE and Nuclear Regulatory Commission (NRC) nuclear and chemical operations and projects. His primary areas of support have included maintenance, nuclear facility decommissioning, hazard and accident analysis, safety management, and risk management.

Mr. Woody has managed or provided a lead support role on several important DOE nuclear safety related initiatives and field office projects. A sampling of these activities includes the following:

- Member of DOE Savannah River K Reactor Restart Team (Office of Defense Programs Lead for Airborne Activity Confinement System)
- Member of the Knuth Committee investigating the adequacy of HEPA filtration systems at major DOE nuclear facilities;
- Manager of the Office of Defense Programs Facility Safety Survey Program (consequence analysis at DOE Hazard Category 1 and 2 facilities)
- NRC Maintenance Team Inspector reviewing the Fitzpatrick Nuclear Power Plant
- Member of writing teams for numerous safety standards (e.g., DOE-STD-1027-92, DOE-STD-1120-98, DOE Hazardous Waste Operations HDBK, and the Beryllium Rule Implementation Guide);
- Member of the Hanford PUREX Deactivation Project Team;
- Deputy Team Leader for the Highly Enriched Uranium Vulnerability Study at the Idaho National Engineering and Environmental Laboratory.

## **Appendix D – Safety Basis Assessment Team Review Criteria**

**SBAT Review Criteria**

<b>Adequacy of BJC Safety Basis Documents</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>SB Documents are complete, accurate and up to date.</b></p> <ul style="list-style-type: none"> <li>• SB documents accurately reflect current facility configurations, mission(s), hazards, scope of operations, and pertinent on-site and off-site conditions.</li> <li>• SB documents are approved and are consistent with the latest DOE requirements, unless the basis for deviating from these requirements is fully justified.</li> <li>• Annual updates are performed in accordance with DOE 5480.23 and 10 CFR 830.</li> <li>• JCOs, SER approval conditions, or other compensatory measures that are in effect are part of the SB.</li> </ul>	<p>Review defense nuclear/radiological facility SB documents, including SERs.</p> <p>Review dates of approval and modifications.</p> <p>Conduct facility walkdowns to verify that the assumptions in the SB documents are consistent with current hazards and the facility configurations.</p> <p>Interview managers and personnel responsible for SB documents.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• What are the current SB documents (e.g., SAR, BIO, hazard analyses, TSR, OSR, USQDs, and SERs)? When were they prepared, and what is the status of DOE approval?</li> <li>• Are the SER findings and conditions reflected in SB documents?</li> <li>• Are the descriptions of facilities and activities in the SB documents of sufficient detail and clarity to establish the scope of authorized activities?</li> <li>• Based on a tour of the facility and interviews with facility personnel, are there any ongoing hazardous activities that are not addressed in the SB documents (including USQDs)?</li> <li>• Have the scope of activities increased significantly beyond that described in the SB documents?</li> <li>• Are the safety SSCs described in the SB documents (or SSCs that are important to safety, if not identified as "safety SSCs") operational as described in the SB documents?</li> </ul>

<b>Adequacy of BJC Safety Basis Documents</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>The hazards and accidental risks to the workers, public, and the environment are adequately identified and evaluated.</b></p> <ul style="list-style-type: none"> <li>• Hazards associated with the facility processes and operations are systematically identified in terms of type, quantity, form, and location.</li> <li>• The facility is categorized properly in accordance with DOE-STD-1027 methodology.</li> <li>• The hazard analysis has thoroughly evaluated the identified hazards, including the potential accidents, initiating events or causes, preventive and mitigative features, and consequence estimates.</li> <li>• The accident analysis identifies and evaluates the dominant accident scenarios in accordance with DOE-STD-3009 (for Hazard Category 2 facilities).</li> </ul>	<p>Review hazard and accident analysis sections of SARs, BIOs, and ASAs.</p> <p>Review hazard categorization approaches and documents.</p> <p>Interview BJC analysts and safety personnel involved in hazard categorization, hazard analysis, and accident analysis activities.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Based on the facility tour and facility records, are all significant hazards identified in the SB documents (including USQDs)?</li> <li>• Do the identified hazards include those that are a significant risk to worker safety, as well as hazards that are a risk to the public and the environment?</li> <li>• Are all significant hazards properly characterized in the SB documents (e.g., accurate identification of materials and their forms)?</li> <li>• How was the hazard categorization made? Was it done in accordance with the DOE-STD-1027 methodology?</li> <li>• If the facility is in a Radiological Facility category, what is the safety documentation and how is the inventory controlled?</li> <li>• Are the quantities of hazardous materials present (or allowed by in-place administrative controls) within the quantities assumed in the SB documents?</li> <li>• Has the standard set of initiating events been considered in the hazard analysis? This includes operational events, fires, explosions, nuclear criticality, natural phenomena (e.g., seismic events), and external events.</li> <li>• Was an FHA performed and appropriately linked to the hazard analysis?</li> <li>• Are the criticality hazards adequately covered in terms of the criticality prevention program and hazard analysis?</li> <li>• Has a technically sound evaluation of potential accidents been performed, and have the design basis accidents (or evaluation basis or limiting accidents) been identified?</li> <li>• Have adequate analyses been performed for the design basis accident scenarios using accepted methods and models?</li> <li>• Do the analyses accurately model the accident scenario, including, in particular, performance of facility safety SSCs?</li> </ul>

<b>Adequacy of BJC Safety Basis Documents</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>The controls to prevent or mitigate hazards are clearly identified and implemented.</b></p> <ul style="list-style-type: none"> <li>• Safety controls (i.e., safety SSCs, programmatic, and administrative controls) should be identified and described consistent with the results of the hazard and accident analyses.</li> <li>• Safety functions and associated performance requirements for safety SSCs should be clearly defined and consistent with the assumptions and bases in the hazard and accident analyses.</li> <li>• Adequate technical basis is given when SSCs are to be retired from service</li> <li>• Configuration control and maintenance requirements for safety SSCs are in place and implemented.</li> <li>• Appropriate safety controls, including programmatic controls are specified in a TSR, OSR, or BIO.</li> <li>• The technical bases for TSRs should be clearly documented.</li> <li>• Implementation of TSRs or other safety controls is demonstrated through documented procedures, training, and internal audits/ assessments.</li> </ul>	<p>Walk down safety SSCs during the facility visit, checking for consistency with the descriptions in the SB documents.</p> <p>During a walkdown, check for possible system interaction during accidents.</p> <p>Check for consistencies between Chapters 3, 4, and 5 of the SAR.</p> <p>Check selected procedures against the LCOs.</p> <p>Interview BJC and ORO personnel involved in control selection.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Does the hazard analysis/accident analysis identify preventive and mitigative features?</li> <li>• Does the hazard analysis/accident analysis identify procedural and administrative controls?</li> <li>• Does the hazard analysis/accident analysis specify performance requirements for safety features?</li> <li>• Are important preventive and mitigative features identified as safety SSCs (safety significant, important-to-safety, or other similar classification)?</li> <li>• Are the preventive and mitigative features and administrative controls adequate?</li> <li>• Are LCOs for safety SSCs identified in the TSRs or OSRs?</li> <li>• Are the administrative controls (including procedural controls) assumed for the safety analyses implemented in procedures?</li> <li>• Are the essential elements of safety programs identified as administrative controls in TSRs, OSRs, or BIOs?</li> <li>• Is implementation of the essential elements of safety programs evident?</li> <li>• If safety controls are not identified as such in the SB, do the installed SSCs and procedural/administrative controls that are present adequately prevent and mitigate potential accidents?</li> <li>• Are BJC's operators, technicians, and maintenance personnel involved in development of procedures?</li> </ul>

<b>DOE and BJC SB Management Processes</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>Line management should be committed to manage and maintain the SB per applicable DOE directives.</b></p> <ul style="list-style-type: none"> <li>• Line management should have appropriate plans and resources for developing, updating, reviewing, approving, and implementing facility SB's, including SERs, USQ reviews, readiness reviews (when needed), and self-assessments.</li> <li>• USQs should be identified and evaluated in a timely manner. Positive USQDs should be promptly approved and incorporated into the facility SB, procedures, and training.</li> <li>• Line management should update SB documents per DOE requirements.</li> </ul>	<p>Interview ORO and BJC SB personnel on their interactions during SB preparation, review, and approval processes.</p> <p>Review SERs.</p> <p>Review the USQ process, recent actions, and subsequent SB updates.</p> <p>Review BJC's plans and schedules for development and upgrade of SB documents.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Are expectations on SB preparation and implementation clearly communicated by DOE?</li> <li>• Is the SB review and approval process conducted consistent with DOE-STD-1104 concepts?</li> <li>• Are SER review criteria clearly established?</li> <li>• Are SER findings and corrective actions clearly identified, documented, and tracked?</li> <li>• Are organizational responsibilities clearly established for the SB review and approval process?</li> <li>• Are SB approval authorities clearly linked to specific DOE field organizations?</li> <li>• What organization prepared the current SB documents?</li> <li>• Did line management and the operating staff participate actively in the SB document preparation?</li> <li>• What qualifications did the preparing organization/ individuals have?</li> <li>• What was the BJC review process for the SB documents?</li> <li>• What detailed BJC direction/guidance was provided or in place? What technical standards were identified for the analysis and for document format and content (i.e., site standards, DOE directives and standards, nuclear industry standards)?</li> <li>• Are USQDs responsive to DOE 5480.21 and associated screening criteria?</li> <li>• What is the average time necessary to resolve USQs ?</li> <li>• Is the DOE process for evaluation and resolution of USQs clearly communicated in site directives and procedures?</li> </ul>

<b>DOE and BJC SB Management Processes</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>Managers and staff demonstrate a high degree of technical competence and a good understanding of programs and facilities.</b></p> <ul style="list-style-type: none"> <li>• Policies and procedures exist that describe personnel selection, training, and qualification requirements, including minimal requirements for education, experience, skill level, and physical condition. SB-related processes are covered within policies and procedures.</li> <li>• Organizations adequately describe training and qualification needs, including requirements, interfaces, training methods, training responsibilities, and duties.</li> <li>• Workers and managers are technically competent to perform their jobs and are appropriately educated and knowledgeable of the hazards, vulnerabilities, and risks.</li> </ul>	<p>Review ORO technical qualification criteria and position descriptions for personnel leading or participating in review and approval of SB documents.</p> <p>Examine the BJC technical qualification program and interview a sample of personnel on the effectiveness of program.</p> <p>Review BJC's procedures for certification and qualification of subcontractors.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Was a needs analysis conducted regarding technical competencies needed for ORO to carry out its approval authority role?</li> <li>• Are technical qualifications established for SER team leaders and staff?</li> <li>• Are knowledge, skills, and education for BJC staff reflected in technical qualification requirements (i.e., are qualifications of DOE 5480.20A met for nonreactor nuclear facility personnel)?</li> <li>• Do BJC's technical qualification requirements sufficiently address a cross-section of managers, supervisors, operators, technicians, maintenance personnel, technical staff, and training instructors?</li> <li>• Are ORO and BJC and their subcontractors qualified according to specific technical qualifications?</li> <li>• Are subcontractors employed to work on facility-engineered safety features?</li> <li>• Are subcontractor qualifications established consistent with job functions?</li> <li>• Have subcontractor records been audited to ensure the qualifications of personnel?</li> </ul>
<p><b>Line managers plan and implement training to ensure that SB personnel are technically qualified to perform their duties.</b></p> <ul style="list-style-type: none"> <li>• ORO annually identifies its critical training needs through organizational analyses and annual review and revision of individual development plans.</li> <li>• Training plans are prepared, are inclusive of SB training needs and resources needed to meet the plan's priorities, and are communicated in site budgets.</li> <li>• Training plans, programs, and activities are consistent with current procedures, facility hazards, work methods, and job responsibilities.</li> <li>• SB documents adequately describe training programs.</li> <li>• Training records relevant to SB personnel are complete and maintained.</li> </ul>	<p>Review ORO and BJC training plans, programs and activities related to SB activities</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• What types of SB training are provided to managers and staff?</li> <li>• What type of SB training is given to technicians, maintenance personnel, and operators?</li> <li>• Are resources adequate to meet DOE's and BJC's training needs?</li> </ul>

<b>DOE and BJC SB Management Processes</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities and Lines of Inquiry</b>
<p><b>Staffing needs are identified and resources are committed to facilitate the training and qualification processes for SB personnel.</b></p> <ul style="list-style-type: none"> <li>• SB-related training needs are evaluated, prioritized, and communicated in annual budget submissions.</li> <li>• Resources needs are consistent with priorities identified in training plans.</li> <li>• Staffing of SB personnel reflects an adequate skill mix to carry out the SB management responsibilities.</li> </ul>	<p>Review ORO and BJC staffing levels and plans.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Is there a sufficient number of qualified staff available to participate in the SB preparation, review, and approval process?</li> <li>• Do staffing plans reflect needs related to monitoring of SB implementation, SB modifications, and periodic updates?</li> <li>• What management commitments and milestones have been established to improve SB capabilities (e.g., training and professional development, new hires, etc.)?</li> </ul>



<b>Flowdown of Responsibilities for Technical Direction</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities</b>
<p><b>Clear Lines of Responsibility and Authority:</b> ORO line management defines, documents, and maintains clearly delineated roles for the development, review, approval, implementation, and maintenance of SB documents. Pursuant to DOE Manual 411.1-A and DOE Policy 450.4, functions, roles, responsibilities, and authorities are clearly defined, communicated, understood, and implemented.</p> <ul style="list-style-type: none"> <li>• Roles, responsibilities, and authorities for the site's SB are clearly defined, documented, and understood by organizations and individuals at every level in the organization.</li> <li>• Line management has implemented a process to ensure SB responsibilities flow down from senior management to each person performing work.</li> <li>• Clear roles, responsibilities, authorities, delegations, and interfaces exist between EM headquarters and ORO.</li> <li>• ORO has an organization and processes in place to support the approval and implementation of SB documents.</li> </ul> <p><b>Defined Responsibilities and Accountability:</b> Line managers are responsible and accountable for the development, review, and implementation of the site's SB.</p> <ul style="list-style-type: none"> <li>• Line managers effectively address SB deficiencies identified in prior commitments or assessments.</li> <li>• Line managers have clear mechanisms throughout the line organizations for resolving issues related to the development and implementation of SB documents.</li> </ul> <p><b>Accountability for Performance:</b> Line managers are accountable for carrying out their SB responsibilities through performance objectives and appraisal systems. Performance is explicitly tracked and measured, and inadequate performance has visible and meaningful consequences.</p> <ul style="list-style-type: none"> <li>• DOE and contractor managers, supervisors, and workers are held accountable for performance related to SB development and implementation through establishing clear performance expectations, providing positive reinforcement, or invoking negative consequences for poor</li> </ul>	<p>Review appropriate documents and policies/procedures that define the roles, responsibilities, authorities, and accountabilities for line managers and personnel involved in SB activities.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Are the ORO functions, responsibilities, and authorities documents in place that accurately reflect SB-related responsibilities?</li> <li>• Do the functions, responsibilities, and authorities documents accurately reflect the delegation of authority to ORO for nuclear facility safety?</li> <li>• Are mechanisms in place that ensure SB-related roles, responsibilities and accountabilities are understood and flow down through each Division to individuals responsible for performing work?</li> <li>• Have clear roles, responsibilities, authorities, delegations, and interfaces been established among ORO safety and line management organizations?</li> <li>• Are roles and responsibilities adequately defined for the SB approval authority and lead reviewers?</li> </ul> <p>Review oversight assessment reports, ISMS verification reviews, DNSFB correspondence and technical reports, and internal assessments associated to understand deficiencies involving roles, responsibilities, and authorities, including those involving SB organization changes, implementation of controls, and managing safety commitments.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• Have corrective actions related to SB organizational deficiencies or issues been resolved?</li> <li>• Is ORO on schedule in responding to assessment findings?</li> </ul> <p>Interview ORO line managers, SB Managers, and supporting staff.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>• How have the roles and responsibilities for SB-related activities (i.e., hazard analysis and controls) been communicated to the line organization?</li> <li>• Has ORO line management been given the necessary authority to fulfill its SB responsibilities?</li> <li>• Are there overlaps or gaps in responsibility for organizations reviewing and approving SB documents or developing/communicating SB policies and procedures?</li> </ul> <p>Review documents that demonstrate how accountability for SB performance is achieved. Such documents may</p>

<b>Flowdown of Responsibilities for Technical Direction</b>	
<b>Evaluation Criteria</b>	<b>Evaluation Activities</b>
<p>performance.</p> <ul style="list-style-type: none"> <li>Contractors and subcontractors are held accountable for performance related to SB development and implementation through appropriate contractual and appraisal mechanisms (contracts and contractor performance reviews). Appropriate contractor performance expectations are established, reliably measured, verified, and used by line management to influence the timely and effective development and implementation of SB documents.</li> </ul> <p><b>Identification of Standards and Requirements:</b>                      ORO adequately discharge its responsibilities related to the review and approval of the set of nuclear safety standards and requirements selected to govern BJC's work.</p> <ul style="list-style-type: none"> <li>ORO's activities and procedures are consistent with DOE responsibilities as described in DOE Policy 450.2A and DOE Policy 450.3 and as required by DOE Manual 411.1.</li> <li>ORO directs BJC to propose site- and facility-specific standards tailored to the work and the hazards. [FRAM 9.4.1.2]</li> <li>ORO reviews and approves the specific requirements to be included in contracts, authorization agreements, safety documentation, and SBs where this authority has been delegated. [FRAM 9.4.1.2]</li> <li>ORO provides documentation to the cognizant Secretarial Office and headquarters program office for information or approval, unless delegated that authority. [FRAM 9.4.1.2]</li> </ul> <p><b>BJC Contract - List of Directives:</b> DOE contracting procedures require that the requirements of applicable federal, state and local regulations (List A) and the requirements of DOE directives (List B) are appended to the BJC contract. [DEAR]</p> <ul style="list-style-type: none"> <li>The list is current and consistent with the latest approved set of standards agreed upon with DOE.</li> </ul>	<p>include contract performance measures, fee awards, and personnel performance appraisals.</p> <p><b>Lines of Inquiry:</b></p> <ul style="list-style-type: none"> <li>Are contractor performance measures and award fee used to hold BJC accountable for SB-related performance?</li> <li>Is the personnel performance appraisal process used to hold ORO line management, as well as safety support personnel, accountable for performance related to their SB responsibilities?</li> </ul> <p>Review the Standards/Requirements Identification Document, WSS documents, BJC contract, or other means used to justify the standards and requirements selected for BJC's work.</p> <ul style="list-style-type: none"> <li>Was a DOE-approved process followed?</li> <li>Is the resulting set of SB standards and requirements sufficient to address BJC's operations and hazards?</li> <li>Are BJC and DOE personnel technically qualified to fulfill their roles in reviewing, selecting, and approving requirements and standards?</li> <li>Are SB standards and requirements reflected in the BJC contract?</li> </ul>

## **Appendix E – Facility Safety Basis Document Reviews**

**Facility Name****K-25 Building at ETTP****Hazard Category**

Even though, the hazard categorization is based on segmentation of the facility and selection of a "representative" ARF/RF instead of the default ARF/RF in DOE-STD-1027, the facility has been correctly identified as a Hazard Category 2 facility. While the segmentation may seem reasonable for operational accidents, it has not been proved to hold, especially with respect to natural phenomena and/or external events. In other words, the BIO has not demonstrated that the facility will be able to survive all postulated accident scenarios, including fires and seismic events, without impact to all MAR within the facility.

**Documents Reviewed**

1. *Basis for Interim Operation for the K-25 Bldg. at ETTP, Oak Ridge, K/ER-335 R1, dated August 2000.*
2. *ETTP: Approval of BIO Document for K-25 Bldg., SER-ET-K25-0002 Ra, dated August 2000.*

**Adequacy of the Hazard Identification**

The hazards are poorly characterized. For example, while the maximum inventory for fissile material inventory in the storage vault is provided, the material form (e.g., metal, oxide powder, liquid, etc.) is not provided.

**Adequacy of the Hazard Analysis**

Given that the SB for this facility is a BIO and the status of the life of the facility is short, the SB presents a "reasonable" graded hazard analysis, with some noticeable deficiencies as noted below. The following deficiencies are identified and need to be considered in upgrading this hazard analysis in the future:

- The frequencies for many of the postulated scenarios are mitigated (i.e., the frequency of occurrence of several scenarios credits the presence of the preventive controls in reducing the frequency), thus the low frequency that is provided in the hazard analysis.
- The hazard analysis fails to identify important (potential safety significant) controls that are either explicitly or implicitly credited in preventing or mitigating the postulated scenarios and associated consequences.
- Even though, the hazard analysis identifies a few potential criticality scenarios, it does so in a very generic way. For example, one of the postulated scenarios leading to a criticality is "human errors in the fissile material storage area," with a reference to having at least two independent and unlikely changes in process conditions before such a criticality could take place. However, no specific contingency evaluation is provided to determine the controls that are in place or the actions that could lead to such event. The criticality discussions are somewhat weak with respect to identifying a reasonable set of potential initiating events or scenarios that could lead to such a criticality and the controls that are in place to prevent such a scenario.

Even though more potential initiating events could be postulated, given that this is a BIO, the relatively passive nature of the operations within the facility and the life expectancy of the facility means that the hazard analysis identifies a reasonable set of initiating events.

**Adequacy of the Accident Analysis**

The BIO identifies a set of dominant accident scenarios as part of the hazard analysis, but no specific accident analysis was found to evaluate such scenarios beyond the discussion of such scenarios in the hazard analysis section.

**Adequacy of Controls**

The SB documents, including the TSR, do not provide appropriate controls that are specific enough to allow assurance that they will be maintained.

Even though the hazard analysis identifies some of the controls to prevent and mitigate the postulated accident scenarios, it does a poor job of identifying which ones provide the most protection and, thus, are the ones that might should have been designated as safety controls for TSR coverage. In other words, the SB documents lack complete identification of safety controls that could have been derived from the limited hazard analysis that was performed. For example, no single, specific administrative control (e.g., inventory/combustible/ignition control) or potential safety significant SSC (e.g., fire sprinkler system, facility structure fire barriers, containers, etc.) was identified for the TSR.

**Adequacy of Implementation of Controls**

Because the TSR only focuses on the CAAS, there is no way to verify that controls that ought to have been designated as safety significant or important to safety (i.e., specific administrative controls for DID) are being flowed down to procedures or implemented on the floor. However, based on facility walkthroughs and interviews, it looks like the facility is being reasonably operated and that the controls are in place to assure a reasonable safety posture for the facility.

## **Facility**

### **Tower Shielding Facility at ORNL**

## **Hazard Category**

Hazard Category 2

## **Documents Reviewed**

*Basis for Interim Operation for the Tower Shielding Facility*, ORNL/RRD/INT-109, dated May 1996

*Technical Specifications for the Tower Shielding Reactor II*, ORNL/TM-4641/R3

## **Adequacy of Hazard Categorization**

The facility was originally categorized as Hazard Category 2 because of radioactive fuel stored in the reactor vessel. The facility is no longer operating, but the reactor is still fueled. Because of criticality potential, Hazard Category 2 is appropriate.

## **Adequacy of Hazards Evaluation**

The Chapter 5 safety analysis adequately identifies the major hazards associated with the facility's current mission of surveillance and maintenance. Both chemical and radiological hazards are analyzed. Sodium and lithium inventories have since been removed. The BIO does not reflect the current material inventory, but it is conservative. Various accident scenarios are evaluated for damaging a fuel element, as well as a nuclear criticality. Fire and explosion hazards are primarily related to the chemical inventories, which are no longer present.

## **Adequacy of Controls**

A Technical Specification was originally prepared in 1989 based on an operating reactor at 1 MW. Three safety significant SSCs are identified (i.e., fuel cladding, reactor control plates, and big beam shielding). Surveillances are established for these SSCs, as well as for the DID SSCs identified in the accident analysis. The Technical Specification contains three administrative controls, including one that clarifies a change in DOE's programmatic responsibility (and which is now outdated).

Maintaining the safety envelope is heavily dependent on the SMPs, particularly training of operator and maintenance personnel. A procedural noncompliance caused by operator/maintenance personnel error can lead to one of the primary initiators for fuel damage or an inadvertent criticality. The adequacy of the training program was not verified.

## **Adequacy of Implementation of Controls**

This was not assessed, although the facility was toured by the team.

## **Sense of Overall Risk (L, M, H)**

The overall risk from the current facility mission is low, primarily because of inactivity at the facility and the passively safe nature of the reactor vessel.

**Facility Name****Isotopes Development Laboratory Building 3038****Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. BIO/3038/F/RT-15/R-1, *Basis for Interim Operation for the Isotopes Development Laboratory Building 3038*, dated February 18, 1997
2. SER-OR-3038-0012, *Safety Evaluation Report BIO for Building 3038 Isotopes Development Laboratory at the ORNL Site*, dated April 18, 1997
3. OSR/3038/F/RT-15/R-2, *Operational Safety Requirements Building 3038 The Isotopes Development Laboratory*, dated February 10, 1997
4. USQD-OR-3038-0131
5. "Master List of BJC Standard Specifications" (contract Exhibit E, "Technical Specifications," Revision 12)
6. SB 2001-1 Revision 0, *Classification of Radiation Protection Engineered Safety Features as Safety Significant*, dated October 2001
7. ORNL/WMRAD/AD-109/R2, *Hazard Classification Criteria for ORNL Waste Management and Remedial Action Division Facilities*, dated June 6, 1997
8. AX2825-SSE-003, *Toxic Material Hazard Evaluation for Various ORNL WMRAD Facilities*, dated March 11, 1998
9. AX2827-SSE-001, *Recommended Effective Release Fractions for use in Calculating Revised Category 2 Threshold Quantities for ORNL WMRAD Facilities*, dated January 15, 1998
10. AX2826-SSE-001, *Inventory Limits Based on Direct Exposure Consequences*, dated January 31, 1997

**Adequacy of Hazard Categorization**

This facility is appropriately categorized in accordance with the criteria provided in DOE-STD-1027.

**Adequacy of Hazard Evaluation**

The document appears to identify the hazards associated with the facility, although it is not clear that the suite of accidents is complete. Hydrogen explosions and handling accidents are not specifically addressed, but they may be reasonably considered bounded by the accidents presented, such as earthquake.

**Adequacy of Controls**

Fire is included as an accident of concern. The analysis credits a solid masonry wall and a special welded container to preclude a fire that engulfs the facility and involves the majority of the facility's material. Neither of these features is identified in the control set. The facility is noted to have a sprinkler system, but only the administrative control of the fire protection system is included as an OSR. The combustible control program is listed in the Preliminary Hazard Analysis (PHA) to reduce the frequency of fire, but it is not carried into the OSR set. The Fire Protection Program does not specify this as element of the program that must be maintained.

**Adequacy of Implementation of Controls**

Two LCOs are included in the OSR set; however, no operability or performance criteria are provided in either the LCO or the basis. The BIO is authorized for the express mission of storage through Fiscal Year 1997. The document was extended using a USQD.

**Sense of Risk (L, M, H)**

The facility is used for waste storage. Limited activities, in conjunction with the engineered safety features available in the facility, minimize the risk of release of material to the public. The risk of material release is judged to be low given the current activities.



**Facility Name****Y-12 Old Salvage Yard****Hazard Category**

This is a Hazard Category 3 facility that has been reclassified from a Radiological Facility by the JCO, which authorizes limited operations of containerized waste only to support characterization.

**Documents Reviewed**

1. *Justification for Continued Operation of the Y-12 Old Salvage Yard*, dated August 2000
2. Y/M-053, Revision 0, *Preliminary Hazard Classification for the Old Salvage Yard*, dated March 1991
3. SER-YT-OSY-0001, *Safety Evaluation Report for the Justification for Continued Operation of the Y-12 Old Salvage Yard*, dated September 7, 2000
4. NCSE-YT-CAAS-1503, Revision 0, "Criticality Accident Alarm Coverage for WESKEM Containerized Waste Storage Facilities at the y-12 National Security Complex," DRAFT, dated November 2001
5. "Master List of BJC Standard Specifications" (contract Exhibit E, "Technical Specifications," Revision 12)
6. Y12/ENG/CR-1, *Potential for Nuclear Criticality in Waste Container Arrays in Containerized Waste Storage Facilities at the Y-12 Plant*, dated April 1997
7. ANSI/ANS-8.3-1997, *Criticality Accident Alarm System*
8. *Y-12 Old Salvage Yard 2109 Review and Inventory Inspection Report*

**Adequacy of Hazard Categorization**

The recategorization is based on the lack of characterization and the potential to exceed 700 g of U<sub>235</sub>. This introduces the potential for criticality, which should trigger a Hazard Category 2. This document does not provide the total inventory (either expected or present), and it does not provide an unmitigated analysis to communicate the relative risk of the facility.

The facility appears to be conservatively characterized, given the data known and the procedures governing the material release process and characterization data that were developed since the JCO. The total estimated quantity of radionuclides is not stated in the document; however, it is predominantly depleted U components and fixed surface contamination, and it is not expected to exceed Hazard Category 2 thresholds. Given data subsequent to the categorization, the facility is properly categorized as Hazard Category 3.

**Adequacy of Hazard Evaluation**

The hazards appear to be adequately identified based on document review only. No facility walkdown was performed.

**Adequacy of Controls**

The accidents of concern are criticality and fire. Administrative controls have been identified to reduce the possibility of an accidental criticality and to provide notification to personnel in accident conditions, thereby mitigating the consequences of a criticality. DOE directed correction of a technical error with respect to the required response time for personal radiation detection instruments through its approval of the JCO. ORO approved a request to extend the JCO until August 2002. An updated SB document was submitted to ORO for approval in December 2001.

No controls are provided to reduce the possibility of a fire. The fire is dismissed as not credible based on low combustible loading and dispersion of combustibles within the scrap piles. However, no control is imposed to ensure that this assumption is valid. Pyrophoric materials may be present (e.g., magnesium

oxide) that might be ignited through routine handling. Formal commitment to combustible control and ignition source control would appear to be appropriate.

**Adequacy of Implementation of Controls**

The contractor JCO states that the authorization is valid through August 2001, but it is still relied on as the SB. The inventory has not been changed (i.e., no material goes in or out). Inspections are currently done outside the yard to preclude violation of the personal radiation detection instrument control.

**Sense of Risk (L, M, H)**

The facility, operated as described, should present a low risk. The facility is not currently performing operations.

**Facility Name**

Retrievable Waste Storage Well Facilities, Buildings 7822A, 7823A, 7827, and 7829

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. ORNL/WM-RSWOG/WELL/SAR/R0-1, *Safety Analysis Report for the Retrievable Waste Storage Well Facilities Building 7822A, 7823A, 7827, and 7829*, dated May 8, 1998
2. ORNL/WM-SWO/7827-7829/USQD-001/R0, dated January 4, 1996
3. ORNL/WM-RSWOG/WELLS/TSR/R0-1, *Technical Safety Requirements for the Retrievable Waste Storage Well Facilities, Buildings 7822A, 7823A, 7827, and 7829*, dated May 1998
4. "Master List of BJC Standard Specifications" (contract Exhibit E, "Technical Specifications," Revision 12)
5. SB 2001-1 Revision 0, *Classification of Radiation Protection Engineered Safety Features as Safety Significant*, dated October 2001
6. ORNL/WMRAD/AD-109/R2, *Hazard Classification Criteria for ORNL Waste Management and Remedial Action Division Facilities*, dated June 6, 1997
7. AX2825-SSE-003, *Toxic Material Hazard Evaluation for Various ORNL WMRAD Facilities*, dated March 11, 1998
8. AX2827-SSE-001, *Recommended Effective Release Fractions for use in Calculating Revised Category 2 Threshold Quantities for ORNL WMRAD Facilities*, dated January 15, 1998
9. AX2826-SSE-001, *Inventory Limits Based on Direct Exposure Consequences*, dated January 31, 1997

**Adequacy of Hazard Categorization**

This facility SB appropriately acknowledges that it exceeds Hazard Category 2 material thresholds, but it continues to present an argument to raise the threshold in accordance with the criteria provided in DOE-STD-1027. Several assumptions are relied on to support the revised thresholds, although the basis for the assumptions is not well substantiated (as presented in the documents provided) and unconservative selections are made to select revised ARFs and RFs in some cases. Due to the lack of specific information (i.e., isotope composition/material form), it is difficult to determine if the categorization is appropriate. For example, two wells are storing spent nuclear fuel with an ARF and RF of 6E-3 and 0.01 respectively. The analysis applies an ARF x RF of 1.3E-5, which is a factor of 4.6. Based on the distance to the MOI and the areas that are routinely occupied, the consequences associated with accident conditions are still anticipated to be low and localized. Although the methodology is permitted by DOE-STD-1027, the application appears to be based on assumptions that may not be substantiated. Calculation DAC-AX2827-SSE-001 should be re-evaluated. The facility has imposed an inventory control to restrict the material to Hazard Category 3 quantities.

**Adequacy of Hazard Evaluation**

The evaluation is based on document review only. No facility walkdown was performed. The document appears to identify the hazards associated with the facility, although it is not clear that the suite of accidents is complete. Hydrogen explosions and criticality accidents are not specifically addressed, but they may be reasonably considered bounded by the accidents presented, such as earthquake. The wells were repaired in 1998 to prevent leakage of groundwater into the confinement barrier and the resulting corrosion of primary waste containers, but flooding is excluded from the analysis as incredible. No FHA is identified for this facility, although it is not apparent that an FHA would contribute significantly to the analysis. The documents do not present an unmitigated analysis. The accidents presented credit assumptions and administrative controls that are not well substantiated in some cases (e.g., particle size and waste composition).

### **Adequacy of Controls**

The accident analysis evaluates fire, handling accidents, high wind, and earthquake. These represent the dominant accidents, with the exception of a criticality. An earthquake would be required to induce the criticality under normal circumstances. Failure of the inventory control or the criticality program represent the other mechanisms to initiate a criticality; however, the evaluation presented in ORNL/WMRAD/AD-109/R2 provides the basis for exclusion of the inadvertent introduction of fissionable material.

An administrative control is established that requires a criticality program that (a) addresses and reviews the nuclear criticality safety of operations involving fissionable materials and (b) identifies and implements controls, training, and inspections. The basis requires evaluation if material in the facility exceeds 250 g fissile gram equivalent. The program is relied on to perform the requisite reviews. This limit is not specified in the inventory control.

An inventory control is established to limit the amount of material that is less than 10 microns, liquid hazardous waste, and curies of each isotope. This control relies on generator certification and characterization of waste streams. Follow-up is required to ensure that the 10 micron criterion can be verified.

The SAR discussion recognizes that the waste containers provide primary confinement and the well structure provides secondary confinement and prevents deformation during earthquake. Neither of these is identified in the control set.

### **Adequacy of Implementation of Controls**

The containers are inspected prior to storage, and the wells are inspected periodically.

### **Sense of Risk (L, M, H)**

The facility, operated as described, should present a low risk to the public.

**Facility Name****Remote-Handled Transuranic Waste Storage Facility Building 7855**

(Note: Typographical error on the cover of the SAR; RU-TRU is incorrect.)

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. ORNL/WM-RSWOG/7855/TSR/R0, *Technical Safety Requirements for the RH-TRU Waste Storage Facility Building 7855*, dated November 10, 1997
2. ORNL/WM-RSWOG/7855/SAR/R0, *Safety Analysis Report for the RH-TRU Waste Storage Facility, Building 7855*, dated November 10, 1997
3. "Master List of BJC Standard Specifications" (contract Exhibit E, "Technical Specifications," Revision 12)
4. SB 2001-1 Revision 0, *Classification of Radiation Protection Engineered Safety Features as Safety Significant*, dated October 2001
5. ORNL/WMRAD/AD-109/R2, *Hazard Classification Criteria for ORNL Waste Management and Remedial Action Division Facilities*, dated June 6, 1997
6. AX2825-SSE-003, *Toxic Material Hazard Evaluation for Various ORNL WMRAD Facilities*, dated March 11, 1998
7. AX2827-SSE-001, *Recommended Effective Release Fractions for use in Calculating Revised Category 2 Threshold Quantities for ORNL WMRAD Facilities*, dated January 15, 1998
8. AX2826-SSE-001, *Inventory Limits Based on Direct Exposure Consequences*, dated January 31, 1997

**Adequacy of Hazard Categorization**

The total estimated quantity of radionuclides is not stated in the document, although it is noted that Hazard Category 2 threshold values were determined. The Hazard Category was reduced to 3 by considering the dispersive energy sources present and the form of the waste materials involved and reducing the RFs. Although the methodology is permitted by DOE-STD-1027, the application appears to be based on assumptions that may not be substantiated. Calculation DAC-AX2827-SSE-001 should be re-evaluated.

The Hazard Category is controlled by imposing inventory limits.

**Adequacy of Hazard Evaluation**

The hazards appear to be adequately identified based on the document review and discussion with the Facility Representative. No facility walkdown was performed.

**Control Adequacy**

The accident analysis evaluates fire, handling accidents, high wind, internal reaction, and earthquake. These represent the dominant accidents with the exception of a criticality. An administrative control is established that requires a criticality program that (a) addresses and reviews the nuclear criticality safety of operations involving fissionable materials and (b) identifies and implements controls, training, and inspections. The basis requires evaluation if material in the facility exceeds 250 g fissile gram equivalent. The program is relied on to perform requisite reviews. This limit is not specified in the inventory control.

An inventory control is established to limit the amount of material that is less than 10 microns, liquid hazardous waste, and curies of each isotope. This control relies on generator certification and characterization of waste streams. Follow-up is required to ensure that the 10 micron criterion can be verified. Inventory is managed using a complex system for transferring data between multiple databases.

This system may warrant evaluation. The inventory controls relied on to preserve the assumptions are difficult to substantiate and must be controlled at the packaging end of operations. The mechanism to ensure this is not clear from the review performed. Waste containers are recognized as the primary confinement system, but they are not designated as design features.

The sump/trench system is used to remotely monitor leakage from the facility. As an underground storage facility, there is some concern that the water table could infiltrate the facility. This may warrant consideration as a DID.

The SAR discussion recognizes that the waste containers provide primary confinement and the building structure provides secondary confinement. Neither of these is identified in the control set.

No credited safety SSCs are included. The other available systems important to safety are described, but no operating parameters are included.

**Adequacy of Implementation of Controls**

The facility is full and is bricked off. No activity is currently taking place.

**Sense of Risk (L, M, H)**

The facility, operated as described, should present a low risk to the public.

**Facility Name**

Waste Examination and Assay Facility, B7824

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. ORNL/WM-RSWOG/7855/SAR/R0, *Safety Analysis Report for the RH-TRU Waste Storage Facility, Building 7855*, dated November 10, 1997
2. ORNL/WM-ARMG/7824/TSR/R0, *Safety Analysis Report for the Waste Examination and Assay Facility Building 7824*, dated September 10, 1998
3. "Master List of BJC Standard Specifications" (contract Exhibit E, "Technical Specifications," Revision 12)
4. ORNL/WM-ARMG/7824/SAR/R0, *Technical Safety Requirements for the Waste Examination and Assay Facility Building 7824*, dated September 10, 1998
5. SB 2001-1 Revision 0, *Classification of Radiation Protection Engineered Safety Features as Safety Significant*, dated October 2001
6. ORNL/WMRAD/AD-109/R2, *Hazard Classification Criteria for ORNL Waste Management and Remedial Action Division Facilities*, dated June 6, 1997
7. AX2825-SSE-003, *Toxic Material Hazard Evaluation for Various ORNL WMRAD Facilities*, dated March 11, 1998
8. AX2827-SSE-001, *Recommended Effective Release Fractions for use in Calculating Revised Category 2 Threshold Quantities for ORNL WMRAD Facilities*, dated January 15, 1998
9. AX2826-SSE-001, *Inventory Limits Based on Direct Exposure Consequences*, dated January 31, 1997

**Adequacy of Hazard Categorization**

The total estimated quantity of radionuclides is not stated in the document, although it is noted that Hazard Category 2 threshold values were determined. The Hazard Category was reduced to 3 by considering the dispersive energy sources present and the form of the waste materials involved and reducing the RFs. Although the methodology is permitted by DOE-STD-1027, the application appears to be based on assumptions that may not be substantiated. Calculation DAC-AX2827-SSE-001 should be re-evaluated. The Hazard Category is controlled by imposing inventory limits.

**Adequacy of Hazard Evaluation**

The document appears to identify the hazards associated with the facility, although it is not clear that the suite of accidents is complete. Hydrogen explosions and criticality accidents are not specifically addressed, but they may be reasonably considered bounded by the accidents presented, such as earthquake. No FHA is identified for this facility. The documents do not present an unmitigated analysis. This evaluation was based on the document review only. No facility walkdown was performed.

**Adequacy of Controls**

The accident analysis evaluates fire, handling accidents, and earthquake. These represent the dominant accidents, with the exception of a criticality. An inventory control is established to limit the amount of material that is less than 10 microns, liquid hazardous waste, and curies of each isotope. This control relies on generator certification and characterization of waste streams. Follow-up is required to ensure that the 10 micron criterion can be verified. Inventory is managed using a complex system for transferring data between multiple databases. This system may warrant evaluation. The inventory controls relied on to preserve assumptions are difficult to substantiate and must be controlled at the packaging end of operations. The mechanism to ensure this is not clear from the review performed.

Limits on material to preclude criticality are recognized, but the mechanism for control is not clearly established. No credited safety SSCs are included.

The building structure and waste containers are recognized to provide confinement for earthquake, wind, and handling accidents, but they are not included in the control set. The building is designated as PC-1.

The SAR discussion includes a fire alarm and automatic, wet-pipe fire sprinkler system. Two fires were evaluated. The large fire progresses from a smaller fire in which the sprinkler system does not activate. The consequences of the fire are determined to be low. Calculation DAC-AX2575-SSE-001 should be reviewed to validate the conclusions. Neither of these is credited in the analysis or carried into the TSR beyond the administrative control that requires inspection, testing, and maintenance of the fire protection equipment.

An administrative control is established that requires a criticality program that (a) addresses and reviews the nuclear criticality safety of operations involving fissionable materials and (b) identifies and implements controls, training, and inspections. The basis requires evaluation if material in the facility exceeds 250 g fissile gram equivalent. The program is relied on to perform requisite reviews. This limit is not specified in the inventory control.

The accident analysis does not include an aircraft crash or the explosion of a pressurized waste container.

**Adequacy of Implementation of Controls**

No information was obtained with respect to implementation of controls.

**Sense of Risk (L,M,H)**

The facility, operated as described, should present a low risk to the public. This is based primarily on its remote location.



**Facility Name**

**Oak Ridge Research Reactor 3042**

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. BJC/OR-72, *Auditable Safety Analysis: Oak Ridge Research Reactor*, dated July 1999
2. SER-OR-3042-0003, *Safety Evaluation Report for the Oak Ridge National Laboratory Oak Ridge Research Reactor Building 3042, Auditable Safety Analysis, BJC/OR-72*, dated June 4, 1999
3. SB 2001-1 Revision 0, *Classification of Radiation Protection Engineered Safety Features as Safety Significant*, dated October 2001

**Adequacy of Hazard Categorization**

This facility is appropriately categorized as a Hazard Category 3 facility. The SB is documented as an ASA. The hazards presented by the facility are predominantly radiological hazards to the worker. The hazard analysis appears to have thoroughly evaluated the hazards and potential accidents, and it includes preventative and mitigative systems, while qualitatively estimating the consequences.

The Hazard Category is controlled by imposing inventory limits.

**Adequacy of Hazard Evaluation**

The accident analysis evaluates fire, handling accidents, loss of pool water, winds, explosions, and earthquake. The document appears to identify the hazards associated with the facility, although it is not clear that the suite of accidents is complete. Hydrogen explosions (reactive or confined material) and a crane drop are not specifically addressed, but they may be reasonably considered bounded by the accidents presented, such as earthquake. No FHA is identified for this facility. The documents do not present an unmitigated analysis. This evaluation was based on the document review only. No facility walkdown was performed.

**Adequacy of Controls**

The radiation protection program is relied on to provide routine protection and monitoring. No specific controls are identified. A general commitment is made to the program. No credited safety SSCs are included. Pool walls, water, ventilation, and fire suppression systems exist. No systems are credited in the analysis. DOE directed inclusion of the pool walls as safety significant, and they should be included in the next revision

**Adequacy of Implementation of Controls**

No information was obtained with respect to implementation of controls.

**Sense of Risk (L,M,H)**

The facility, operated as described, should present a low risk.

**Facility Name****Paducah, DOE Retained Areas and the Building C-410 Complex****Hazard Category**

Radiological Facility. However, the categorization should be Hazard Category 2.

**Documents Reviewed**

1. Paducah SAR, KY/EM-174, dated January 14, 1997
2. Paducah TSRs, KY/EM-175, Revision 2, dated August 28, 2001
3. Paducah SER on SAR and TSRs
4. McBride (ORO NSD) to Jackson (ORO Enrichment Facilities) memorandum, dated March 8, 1999, "Review of Safety Analysis Reports for Portsmouth and Paducah"
5. Thiesing (BJC Vice President and General Manager) letter to Sleeman (ORO Contracting Officer's Representative), dated October 23, 2000, "Justification for Continued Operation for Portsmouth and Paducah"
6. Benedict (ORO Uranium & Engineering Services) letter to Massey (BJC MOP), dated September 16, 1999, "Safety Evaluation Report for Unreviewed Safety Question Associated with Department of Energy Material Storage Areas – EM&EF-078"
7. Seaborg (ORO Paducah Site Manager) memorandum to Nelson (ORO AMEM), dated June 14, 2001, "Safety Evaluation Report for the Authorization Basis Change Package for Characterization Activities Within Department of Energy Material Storage Areas and the C-410 Department of Energy Retained Area – USQD Number: USQD-RM-DMSADRA-5R2"
8. ATL "Evaluation of Paducah Building C-410 SB Change Package and SER", dated September 26, 2001
9. Seaborg (ORO Paducah Manager) memorandum to Nelson (ORO AMEM), dated October 12, 2001, "Revision 1 of the Safety Evaluation Report for the Authorization Basis Change Package for Characterization Activities Within Department of Energy Material Storage Areas and the C-410 Department of Energy Retained Area - USQD-RM-DMSADRA-5R2"
10. McBride (NSD) memorandum to Fritz (Deputy Manager for AMEM), dated November 19, 2001, "Nuclear Safety Division Review of Safety Evaluation Report SER-PAD-USQD-RM-DMSADRA-5R2-PSO-2001 and Authorization Basis Change Package USQD-RM-DMSADRA-5R2"

**Adequacy of Hazard Categorization**

The Radiological Facility designation is incorrect for Building C-410. It should be a Hazard Category 2 facility due to the characterized and uncharacterized Enriched U (EU) fissile holdup. In March 2001, a characterization sample showed up at approximately 13 wt% EU holdup in a valve, and subsequent samples have identified that approximately a dozen pieces of equipment exceed the 1wt% EU fissile threshold that warrant criticality concerns. Building C-410 contains an as-found condition where spare gaseous diffusion process equipment was improperly stored. The Building C-410 process equipment (which was not part of the gaseous diffusion enrichment cascade) was a feed facility, which processed normal assay U and some reactor returns, which introduced transuranic material. Some spare process equipment stored within the abandoned facility contains U enriched to greater than 1 wt% U<sub>235</sub>. The mass of EU is unknown at this time. BJC intends to relocate this spare process equipment to a storage area in a facility with permanent CAAS coverage.

The ORO AMEM approved the continued designation as a Radiological Facility with a criticality hazard via the SER (reference #7). This Hazard Category 2 determination is also the opinion of the ORO NSD and the Advanced Technologies and Laboratories International, Inc. (ATL), assessment (reference #8). For the numerous facilities designated as Radiological Facilities, there is the possibility that others could become Hazard Category 2 facilities due to future discoveries of significant EU holdup.

### **Adequacy of Hazards Evaluation**

A commitment to the NRC for DOE to lease operations to the United States Enrichment Corporation (USEC) required DOE approval of the SAR and TSR. The NRC licensed the USEC for EU processing operations under 10 CFR 76, and USEC now operates under a separate SB. Reference #3, the SER for the original SAR and TSR, was issued by the ORO Assistant Manager for Enrichment Facilities over objections from the ORO AMESH in order to meet highly visible milestone commitments to transition the facility to partial NRC licensing. (Note: The Assistant Manager for Enrichment Facilities organization is no longer in existence. The majority of the activities under DOE's auspices were transferred to the AMEM.) Late in the DOE review cycle, the AMESH was asked to review the SAR and TSR. Numerous comments were provided by the AMESH (reference # 4 is a later, updated version of the original comments provided circa 1997) that were not dispositioned by the AMEM before approving the initial SER. Failure to address the AMESH's comments raises questions about the adequacy of the original SER and SAR/TSR. Subsequently, those comments designated "A" priority, based on ease of resolution within the available funding as determined by BJC and the AMEM, were incorporated into a proposed annual update to the SAR and TSR, along with an attempt to split out the USEC/NRC activities so that the SAR and TSR would be applicable to DOE/BJC activities. This first and only annual update has not been approved by ORO. Tougher resolutions of the comments prioritized as "B" and "C" have not been addressed, and many remain valid today. The AMESH did not concur with the proposed resolutions of all the A comments or the A-B-C prioritization. Examples of some of the more significant issues include lack of worker safety and chemical hazard evaluations, lack of TSR controls to protect the facility workers, and incomplete evaluation of natural phenomena and external hazards in the SAR. A JCO (reference #5) was submitted by BJC on the worker safety and chemical safety issues, but this was never approved.

The SAR hazard and accident analysis primarily addresses the EU processing activities that bound the remaining DOE activities and facilities. This makes USQDs more difficult and potentially subject to debatable interpretations that the proposed changes and discovery issues do not constitute a USQ, when perhaps the decision should err on the conservative side and declare more positive USQs. The negative USQD database was not reviewed to determine whether the conclusions are appropriate. A Plant Safety Operational Analysis addresses most of the common initiating events/accident categories (e.g., energy sources to cause spills, fires, explosions, and criticalities); however, see the earlier comment on the lack of natural phenomena and external events.

Reference #7 is the primary SB for this discovery USQ. The site SAR relies on a Preliminary Hazards Screening to make the initial Radiological Facility categorization based on limited available information. The reference #7 USQD and SER provide the safety analysis without a hazards and accident analysis to derive the TSR-equivalent controls. A JCO should have been developed to establish the SB, rather than having a positive USQ with a SER that imposes controls in the form of "conditions for approval." JCOs have been used successfully for other BJC nuclear activities at ORNL.

### **Adequacy of Controls**

Most of the original TSR applies to the USEC EU processes, which are no longer applicable due to their NRC-prescribed Technical Specifications. Building C-410 does not have fixed CAAS coverage. BJC has submitted a TSR change to authorize a temporary CAAS and alarming personal dosimeters for those areas/activities that are not covered by a fixed CAAS (see later comment).

The criticality hazards associated with Building C-410 were reviewed. Controls specified in the original ORO SER (reference #6) for the USQD appear to be adequate for the characterization activity. A new SER was approved by the ORO AMEM without the concurrence from the AMESH NSD, although reference # 7 lists three NSD members as reviewers (even though their concerns were not dispositioned), and the AMEM didn't include the NSD on distribution of the approved SER. This is a continuation of the

practice that the AMEM line organization started in 1997 during the initial SAR/TSR approval, and it raises questions regarding the adequacy of the current SER that authorizes DMSA activities (i.e., it provided no technical bases for the approval, and it was not performed to any ORO procedure or DOE-STD-1104). The NSD does not concur with the revised TSR that permits both the temporary CAAS and the use of alarming personal dosimeters, which were specifically prohibited by the original SER.

Activities relying on these new TSR controls should not be restarted until the NSD's issues are resolved.

The AMEM and BJC developed a revision of the USQD and SER to address the NSD's comments (reference #9). The NSD's review (reference #10) indicates that many of the original comments have not been resolved, and the draft SER still shows that the NSD performed the review, contrary to the written correspondence previously noted highlighting the false and misleading information. In November 2001, ATL personnel (commissioned by BJC) reviewed the criticality and SB issues, and their findings are documented in reference #8. These findings confirm that there are issues that need resolution. The AMEM and BJC need to work with the NSD to resolve these issues. References #7 and #9 demonstrate that the AMEM is not using DOE-STD-1104 guidelines as a basis to issue SERs, and is not relying on AMESH SB expertise to resolve valid issues.

#### **Adequacy of Implementation of Controls**

No TSR is applicable to the DOE Retained Areas, since they are designated as non-nuclear Radiological Facilities. Building C-410 was abandoned approximately 20 years ago and has no energy sources, such as electrical power or other utilities, except for temporary power for occupancy. The facility is secured and requires radiological controls for entry. Due to the discovery USQ, the SER-imposed "conditions of approval" that have been in place since 1999 for the DMSA (see the separate DMSA report) were adopted for Building C-410. These controls were updated and revised as described in the reference #7 SER. However, see the above comment on the adequacy of the revisions.

#### **Sense of Overall Risk (L, M, H)**

It seems like moderate risk due to the unknown/uncharacterized criticality hazard for the facility worker but low risk for the public and collocated workers. Except for the personal dosimeter and temporary CAAS issue, the original USQD controls (reference #6) for Phase 1 and 2 characterization appear adequate to reduce the risks as much as is reasonable until all characterization is completed. The reference #7 SER controls need revision to resolve the NSD's review comments. Past funding has been an issue for this characterization, especially for radiological facilities, and it may not be getting the appropriate attention from the BJC MOPs and the ORO AMEM.

**Facility Name**

Paducah, DMSAs

**Hazard Category**

Hazard Category 2 for many DMSAs, with many others designated as Radiological Facilities. There are no Hazard Category 3 designations.

**Documents Reviewed**

1. See the Paducah DOE Retained Area/C-410 assessment report for the referenced SAR, TSRs, SER, and ORO AMESH unresolved review comments.
2. Benedict (ORO Uranium & Engineering Services) letter to Massey (BJC MOP), dated September 16, 1999, "Safety Evaluation Report for Unreviewed Safety Question Associated with Department of Energy Material Storage Areas – EM&EF-078"
3. Seaborg (ORO Paducah Site Manager) memorandum to Nelson (ORO AMEM), dated June 14, 2001, "Safety Evaluation Report for the Authorization Basis Change Package for Characterization Activities Within Department of Energy Material Storage Areas and the C-410 Department of Energy Retained Area – USQD Number: USQD-RM-DMSADRA-5R2"
4. ATL "Evaluation of Paducah Building C-410 SB Change Package and SER," dated September 26, 2001

**Adequacy of Hazard Categorization**

The Hazard Category 2 categorization is appropriate for due to the uncharacterized criticality hazard. For the numerous facilities designated as Radiological Facilities, there is the possibility that some of these could become Hazard Category 2 facilities due to future discoveries of significant EU holdup.

**Adequacy of Hazards Evaluation**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of the hazards analysis. DMSAs are designated storage areas for equipment removed from service, many of which have EU holdup, causing criticality and radiological control hazards. Many DMSAs are "islands" within facilities managed by USEC under NRC licensing, but others are in facilities controlled by DOE/BJC. The USEC locations vary from roped-off areas to rooms with postings. One particular area was returned from USEC/NRC to DOE/BJC control in July 2000 due to a high EU fissile characterization. This area is fenced off, but other areas that are roped off experienced the problem of the unexpected appearance of uncharacterized, contaminated materials. The DMSAs were de-leased to DOE on December 31, 1996. A discovery USQ was started in September 1998, but the positive USQ was not declared until over a year later. (Note: It was approved by ORO based on the AMESH NSD SER, reference #2). This USQD provides the safety analysis without a hazards and accident analysis to derive the TSR-equivalent controls.

**Adequacy of Controls**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of controls. The DMSAs rely on the USEC/NRC LCO, with its surveillance requirements on the CAAS, since the USEC facilities are subject to the NRC SB requirements. BJC has submitted a TSR change to authorize a temporary CAAS and alarming personal dosimeters for those areas/activities that are not covered by a fixed CAAS (see later comment). The criticality hazards associated with the DMSAs were reviewed, and these were also included in previous EH headquarters criticality assessment. Controls specified in the original ORO SER (reference #2) for the USQD appear to be adequate for the characterization activity. A new SER was approved by the ORO AMEM without concurrence from the AMESH NSD. Although reference # 3 lists three NSD as reviewers, their concerns were not dispositioned, and the AMEM didn't include the NSD on distribution of the approved SER. This is a continuation of the practice the AMEM line organization started in 1997

during the initial SAR/TSR approval, and it raises questions regarding the adequacy of the current SER that authorizes the DMSA activities (i.e., it provided no technical bases for the approval, and it was not performed to any ORO procedure or DOE-STD-1104). The NSD does not concur with the revised TSR that permits both temporary CAAS and the use of alarming personal dosimeters, which were specifically prohibited by the original SER. Activities relying on these new TSR controls should not be restarted until the NSD's issues are resolved. ATL personnel (commissioned by BJC) reviewed the criticality and SB issues, and their findings are documented in reference #4. These findings confirm that there are issues that need resolution. (Note: The full report is worth reviewing.) See the Paducah DOE Retained Area/C-410 report regarding more recent developments on this SER.

#### **Adequacy of Implementation of Controls**

Both BJC and the ORO AMEM had the current Revision 2 of the TSR. The AMEM Facility Representatives have recently assessed the fixed criticality alarm TSR procedures. The status of TSR administrative control compliance is unknown. Combustible controls and housekeeping in the DMSAs, as well as in the USEC facility, are good. However, since it is an industrial facility with a lot of process and utility equipment with high energy sources, a large fire is a potential hazard. A source of combustibles is the large volume of contamination-control plastic wrapping of equipment. An ISMS-generated activity hazards analysis was reviewed for a DMSA job in progress to characterize asbestos contamination. The hazards analysis and identified controls are available at the job site and show evidence of being used for worker orientations and use. This portion of the ISMS process seems to be working.

#### **Sense of Overall Risk (L, M, H)**

It seems like moderate risk due to the unknown/uncharacterized criticality hazard for the facility worker but low risk for the public and collocated workers. The USQD controls for Phase 1 and 2 characterization appear adequate to reduce risks as much as is reasonable until all the characterization is completed. Past funding has been an issue for this characterization, and it may not be getting the appropriate attention from the BJC MOP and the ORO AMEM.

**Facility Name****Paducah, Building C-746-Q, Solid Waste Container Storage****Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. See the Paducah DOE Retained Area/C-410 assessment report for the referenced SAR, TSR, SER, and the ORO AMESH's unresolved review comments.
2. USQD # EM&EF 00-128 on Building C-746-Q and C-752-A, treatment of wastes (USQD Worksheet and USQD Change Package)
3. SER-PAD USQD 00-128-NSD-01-09 on USQD # EM&EF 00-128
4. Building C-746-Q FHA

**Adequacy of Hazard Categorization**

The categorization is appropriate. Solid EU of 2% and 5.5% is present in quantities greater than the 700 g U<sub>235</sub> Hazard Category 2 threshold of DOE-STD-1027.

**Adequacy of Hazards Evaluation**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of the hazards analysis. Related to the solid waste container storage in Building C-746-Q, a recent positive USQ was discovered due to the nondestructive assays being underestimated by perhaps up to a factor of 7. A previous positive USQ (reference #2) addressed proposed waste treatment activities that will be performed in a HEPA-filtered enclosure in Building C-752-A, but this was not reviewed. Criticalities are credible due to the high EU limits for the drums.

The SAR was developed without an FHA in the mid-1990s. A fire alarm system is currently being installed and is used as partial justification to not install a fire suppression system. An exemption involving EH headquarters is in process. The current FHA recommends eliminating the wooden pallets, which is being accomplished as the need arises to move drums (rather than having an expedited campaign to eliminate them). These pallets could propagate a fire throughout the storage array and result in greater radiological consequence and risk than was evaluated in the SAR. Although housekeeping is excellent, RCRA flammable/combustible waste liquids have secondary containment, and the miscellaneous combustibles have been removed, these wooden pallets still pose a significant fire hazard (e.g., if they are stacked due to failure of the combustible control program) and could even cause collapse of a Butler-type building. Unless there are significant programmatic barriers, BJC and ORO should expedite elimination of all wooden pallets as soon as practicable.

The positive USQ for the proposed waste treatment activity in Building C-752-A was approved by the ORO AMEM based on a SER developed by the AMESH NSD. The SER (reference #3) is an example of the concerns still present today regarding the failure to evaluate hazards from potential accidents that primarily affect the facility worker (e.g., potential drum explosions causing fatalities or serious injuries and significant chemical exposures) and the failure to identify preventive and mitigative controls, some of which may warrant inclusion in a TSR.

**Adequacy of Controls**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of controls. The CAAS is maintained by USEC personnel per the DOE TSR. DOE/BJC only manages 1 of the 32 triple-detector cluster units. A criticality control for specified drums with high EU quantities has been over-designed by requiring oversized metal cages with a sloped, open-mesh roof surrounding a single drum with a skirt. A new, seismically-designed, four-

tier storage rack with secondary containment is being constructed for the USEC 5.5% EU drums. RCRA and Toxic Substances Control Act waste controls are required (e.g., segregation, secondary containment, weekly inspections, aisle width, etc.). Due to the nondestructive assay positive USQ, special criticality controls are in place until this issue gets resolved. Many of the drums are less than 15 g EU. The SER (reference #3) for the proposed waste treatment activity imposes "conditions of approval" in the form of additional controls to protect the facility workers and to provide DID. These are equivalent to TSR-level controls, but they have not been formally incorporated into a revision of the TSR. The SB/USQD Change Package provides a safety analysis for the proposed new activity; however, by not revising the SAR and TSR, the change package and the SER make maintenance of the SB more difficult.

**Adequacy of Implementation of Controls**

The TSR is being implemented. Both BJC and the ORO AMEM had the current Revision 2 of the TSRs. The ORO AMEM Facility Representatives have recently assessed the criticality alarm TSR procedures. The status of TSR administrative control compliance is unknown.

**Sense of Overall Risk (L, M, H)**

It seems like moderate risk due to the criticality, the fire hazard involving the wooden pallets in the storage areas, and the facility worker risks associated with waste treatment. For this waste storage operation, the ISMS seems to be working. The operator who conducted the tour seemed properly trained and knowledgeable of requirements, and he maintains a well-kept facility, which was reported as not the case a few years ago (e.g., much more combustibles and other hazards such as propane forklifts inside).



**Facility Name:**

**Paducah, UF<sub>6</sub> Cylinder Storage Yards**

**Hazard Category**

Hazard Category 2

**Documents Reviewed**

See the Paducah DOE Retained Area/C-410 assessment report for the referenced SAR, TSRs, SER, and ORO AMESH's unresolved review comments.

**Adequacy of Hazard Categorization**

The categorization is appropriate, primarily due to the criticality hazard.

**Adequacy of Hazards Evaluation**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of the hazards analysis. Most of the cylinders are filled with solid, depleted UF<sub>6</sub>, or they are empty but contaminated.

**Adequacy of Controls**

See the Paducah DOE Retained Area/C-410 report regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of controls. The only LCO control that affects the UF<sub>6</sub> cylinders is the boundary fence to protect the public from Hydrogen Fluoride exposures, as well as the general TSR administrative controls. All other controls are driven by SMPs.

**Adequacy of Implementation of Controls**

Both BJC and the ORO AMEM had the current Revision 2 of the TSR. The ORO AMEM Facility Representatives have recently assessed the TSR LCO-required fence to maintain a minimum distance to the site boundary due to exceeding the Hydrogen Fluoride ERPG-2 limit. There was no procedure/checklist to verify the surveillance requirements; however, this has since been corrected.

**Sense of Overall Risk (L, M, H)**

It seems like moderate risk due to the potential for public Hydrogen Fluoride exposure; however, this is adequately controlled by the physical fence and preventive controls to reduce the likelihood of a release. Risk for collocated workers could also be moderate. There are much higher facility worker risks that could cause fatalities or serious injuries from material-handling accidents or chemical exposures. Large material-handling equipment is required (e.g., cranes or a logging-type grapppler to move the cylinders, which can weigh up to 14 tons). A high degree of emphasis on industrial safety and industrial hygiene is required for this activity. Therefore, the site needs a high confidence in its ISMS to protect facility workers. This was not assessed by the team, and it needs further investigation during the planned ISMS or restart review.

**Facility Name****ETTP UF<sub>6</sub> Cylinder Storage Yards****Hazard Category**

The UF<sub>6</sub> Cylinder Storage Yards has been designated as a Hazard Category 2 activity, based on the DOE-STD-1027 guidance and threshold values. Because of the large quantities of U, all of the yards except K-1066-F are classified as Hazard Category 2. The inventory within the K-1066-F yard is very limited and, as such, it was designated as a Hazard Category 3 storage activity.

The yards also have been identified as a moderate hazard operation, based on the chemical inventories in storage and using DOE 5480.1B guidance.

**Documents Reviewed**

1. *ETTP UF<sub>6</sub> Cylinder Storage Yards, Final Safety Analysis Report*, K/D-SAR-29/R1, dated May 1998
2. *Safety Evaluation Report for K-25 Site UF<sub>6</sub> Cylinder Storage Yards, Oak Ridge*, DOE/OR/02-1578

**Adequacy of the Hazard Identification**

The hazard identification is very well done. It has a very comprehensive hazard identification screening.

**Adequacy of the Hazard Analysis**

The documents reviewed do not provide hazard analysis tables, they only present a summary of postulated scenarios of concern and their associated controls, the frequency of occurrence, and the consequences. No reference is made to any hazard analysis, so it is assumed that the hazard analysis and results presented in the FSAR are all that there is. As such, even though it seems that at least the major scenarios of concern (including their potential causes) are identified, there is no comprehensive evaluation of the hazards, scenarios, and controls that could be used to trace the material presented in this section. However, for the most part, the results of the hazard analysis seem to be thorough. There are a few inconsistencies in the documentation with respect to reference to tables (e.g., Page 3-29 indicates that Table 3-10 contains the preventive and mitigative features/programs and administrative controls; however, Table 3-10 in the FSAR is the table on frequency categories).

**Adequacy of the Accident Analysis**

In general, the accident analysis is very thorough and a major improvement from the hazard analysis, at least with respect to documentation and development. The accident analysis is focused on source terms and consequence analysis, and this subsection is very comprehensive in the analytical approach used and the documentation.

**Adequacy of Controls**

The accident analysis does a better job in identifying safety controls (i.e., safety significant SSCs and TSR administrative controls) than the hazard analysis itself. The hazard analysis is very vague with respect to the specified controls that were designated to be safety significant SSCs or "specific" administrative controls requiring TSR coverage. The accident analysis, on the other hand, does a better job of identifying these specific administrative controls. At least the set of controls identified as safety significant SSCs and safety administrative controls seems to be reasonable for the operations at hand.

**Adequacy of Implementation of Controls**

Chapter 5 does a poor job of summarizing and identifying all the safety significant SSCs and safety administrative controls requiring TSR coverage. Specially, it does a poor job on the identification of specific administrative controls and how these will be covered under each of the programmatic safety programs included in the TSR. No TSR was reviewed for this operation. The facility was not toured during the site visit.

**Facility Name**

**ORNL LLLW Management Systems, including Bethel Valley and Melton Valley Receiving Tanks and Transfer Lines**

**Hazard Category**

Hazard Category 2 for the LLLW Complex, with Hazard Category 3 for individual buildings or segments

**Documents Reviewed**

1. *Basis for Interim Operation, Liquid Low-Level Waste Management Systems*, ORNL/WM-LGWO/LLLW/BIO/R1, dated November 17, 1997
2. *Operational Safety Requirements for the Liquid Low-Level Waste System*, WM-LGWO-LLLW-OSR, Revision 12, dated August 2000
3. *Safety Analysis Report for the Liquid Low-Level Waste Solidification Facility, Building 7877*, WM-LGWO-7877-SAR, Revision 1, dated February 22, 2001
4. *Safety Evaluation Report, Safety Analysis Report for the Liquid Low-Level Waste Solidification Facility, Building 7877 (WM-LGWO-7877-SAR/R1)*, SER-OR-7877-0020, dated February 21, 2001
5. *Technical Safety Requirements, Building 7877 Operations*, WM-LGWO-7877-TSR, Revision 1, dated February 21, 2001
6. *SER for Technical Safety Requirements, Building 7877 Operations (WM-LGWO-7877-TSR/R1)*, SER-OR-7877-0021, dated February 21, 2001

Other Liquid LLW Complex documents received and scanned:

1. *System Safety Analysis Report for the Melton Valley Storage Tanks – Capacity Increase Project, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, WM-LGWO-7856-SSA, dated June 1998
2. *Safety Evaluation Report for the ORNL System Safety Analysis Document for the Melton Valley Storage Tanks – Capacity Increase Project*, WM-LGWO-7856-SSA/R0, dated February 26, 1998, and the associated TSR, *Technical Safety Requirements for Building 7856*, WM-LGWO-7856-TSR/R0
3. *Technical Safety Requirements for Building 7856*, WM-LGWO-7856-TSR, Revision 3, dated February 21, 2001
4. *Safety Evaluation Report for Revision 3 of Technical Safety Requirements Document for Building 7856*, WM-LGWO-7856-TSR/R3, dated February 21, 2001
5. *System Safety Analysis Report for the Melton Valley Liquid Low-Level Waste (LLLW) Collection and Transfer Upgrade Project, Oak Ridge National Laboratory LLW System Modifications*, SSA/7966-WMRAD/SSE/R0, dated August 1997
6. *Technical Safety Requirements (U), Transported Waste Receiving Facility Building 2649*, WM-LGWO-2649-TSR, dated May 1997
7. *USQD for Evaluation of As-Found Condition in LLLW OSR LCO*, USQD No. WM-GWO-USQD-1997-12, dated September 2, 1997

**Adequacy of Hazard Categorization**

The LLLW Complex was initially classified as Hazard Category 2 based on the inventory. BJC then applied ARF adjustments based on the liquid form of the material to conclude Hazard Category 3 for individual facilities or segments (e.g., transfer lines). The ARF adjustments for liquids seem reasonable. The Building 2531 evaporators are Hazard Category 2. The Building 7877 Waste Solidification was downgraded to Hazard Category 3.

**Adequacy of Hazards Evaluation**

There are multiple SBs in the form of a master BIO and “system” SARs on facility upgrades. The BIO, Chapter 5, safety analysis is based on a 301 I BIO PHA, which is primarily qualitative. The PHA addresses most of the common initiating events/accident categories (e.g., energy sources to cause spills,

fires, explosions, seismic, etc.). However, it applies the "incredibility" criterion to screen out some of these events. Frequencies without preventive controls are mostly U or EU. It seems like some preventive controls are being credited. Therefore, unmitigated risks could be higher. The bounding accidents are earthquakes and spills that could lead to the Clinch River. Ingestion dose is more important than inhalation. Criticalities are incredible. Criticality safety evaluation controls are incorporated into the waste acceptance criteria. The EH headquarters criticality safety assessment identified a concern with the ETP LLLW system. It does not apply to the ORNL system. It was not further investigated.

**Adequacy of Controls**

There is an OSR with surveillance requirements for the evaporators, and a TSR for the Waste Solidification Facility. These address tank volume control, transfer line double containment, tank secondary containment, and methane concentration. There is a USQD related to the LCO language on tank volume control, with a DOE SER-approved change to the OSR to resolve it. The SMP chapter descriptions are very generic and weak. Key programmatic elements are not described or committed to. This is not the standard expected today to approve a BIO. There are no SMPs invoked in the BIO OSR, but five SMPs are in the upgrade facilities' TSR. The administrative controls, therefore, are relying on the ISMS.

**Adequacy of Implementation of Controls**

Implementation is appropriate. The team verified the OSR procedures in the field.

**Sense of Overall Risk (L, M, H)**

It seems like low risk, although the BIO identifies six Risk Class II events. In addition to the "system" SARs, there are numerous USQDs on upgrade projects to maintain the SB. An FSAR was developed per DOE-STD-3009 and submitted to DOE as 10 CFR 830 compliant, but it was recently pulled back. Instead of revising the BIO, numerous DOE review comments and their dispositions are included in its Appendix B.

**Facility Name****Bulk Shielding Facility, Building 3010****Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. *Basis for Interim Operation for the Bulk Shielding Facility, Building 3010*, ORNL/RRD/INT-108, dated December 1997
2. *Unreviewed Safety Question Determination (USQD), Bulk Shielding Facility Operational Controls*, USQD-3010-1998-1/R-0, dated September 1998
3. *Review of Unreviewed Safety Question Determination (USQD) for Revised Basis for Interim Operation for the Oak Ridge National Laboratory Bulk Shielding Facility (Building 3010)*, USQD-3010-1998-1/R-0, dated September 1998

**Adequacy of Hazard Categorization**

The facility was originally categorized as Hazard Category 2 because of the fissile materials present. However, the 73 fuel elements have since been removed. References 2 and 3 provide the SB for the remaining 10 Ci Radium/Boron source and activated components from reactors. The USQD defaults to the original Hazard Category 2 rather than making a new determination, which would probably be Hazard Category 3 (or perhaps a Radiological Facility). The DOE SER approval of a negative USQD is unusual but necessary in this case, since the BIO has not been updated.

**Adequacy of Hazards Evaluation**

The Chapter 5 safety analysis is based on a 3011 BIO PHA. The PHA addresses most of the common initiating events and accident categories (e.g., energy sources to cause spills, fires, explosions, seismic, etc.), but they are for the 73 fuel elements that have been removed and which are assumed to bound the remaining inventory. However, it applies the "incredibility" criterion to screen out some of these events (e.g., release plus loss of Heating, Ventilation, and Air Conditioning [HVAC] and HEPA filters). Accidents were chosen for dose calculations based on bounding consequences for the accident category (not risks or frequency bins). Many frequencies without preventive controls are U or EU. It seems like some preventive controls are being credited. Therefore, unmitigated risks could be higher. The consequences were qualitatively assessed, always as "Low." Therefore, all risks are Risk Class III or IV.

**Adequacy of Controls**

There is no OSR or TSR. Instead, BJC has a BIO Chapter 6, "Operational Controls," that is called "TSR equivalent." The still-applicable safety significant SSCs identified in Chapter 2 are the radiological monitoring system, pool water level, and confinement system. These are addressed in "Specifications" and "Surveillances." The Chapter 4 SMP descriptions are very generic and weak. Key programmatic elements are not described or committed to. This is not the standard expected today to approve a BIO. No SMPs are invoked in the Chapter 6, "Operational Controls." Instead, they have reactor Technical Specification-like administrative controls.

**Adequacy of Implementation of Controls**

Not assessed (i.e., the team did not tour the facility).

**Sense of Overall Risk (L, M, H)**

The BIO concludes that all risks are low/negligible. The unmitigated risks are probably low, even though they are not quantitatively estimated for the remaining storage activities and the frequencies credit preventive controls. The mitigated risks are low due to the remaining safety significant SSCs and the Chapter 6, "Operational Controls," which are "TSR equivalent."

**Facility Name****Fission Product Development Laboratory, Building 3517****Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. *Basis for Interim Operation, Building 3517, The Fission Product Development Laboratory, BIO/3517/F/RT-29/R-1, dated February 10, 1997*
2. *Operational Safety Requirements, The Fission Product Development Laboratory, OSR/3517/F/RT-29/R-2, dated February 10, 1997*
3. *Safety Evaluation Report for Review of the Revised Basis for Interim Operation and Operational Safety Requirement (OSR) for the Fission Product Development Laboratory, Bldg. 3517, at the Oak Ridge National Laboratory, Oak Ridge, Tennessee, SER-OR-3517-0025, dated December 2001*
4. *Unreviewed Safety Question Determination Screening for Evaluating the Dates for Material Removal and Facility Deactivation in the Basis for Interim Operation, Building 3517, The Fission Product Development Laboratory*

**Adequacy of Hazard Categorization**

The facility is categorized as Hazard Category 2 because the BIO-allowed inventory (e.g.,  $2E+6$  Ci  $Sr_{90}$ ,  $2.5E+5$  Ci  $Cs_{137}$ ,  $1E+4$  Ci  $Co_{60}$ ) exceeds thresholds. No segmentation or ARF adjustments are applied. The 500 g  $Cm_{244}$  has been removed from the facility.

**Adequacy of Hazards Evaluation**

The Chapter 5 safety analysis is based on a 3011 BIO PHA. The BIO authorizes storage of single- and double-contained sealed sources and re-encapsulation, which has not been performed. The PHA addresses most of the common initiating events/accident categories (e.g., energy sources to cause spills, fires, explosions, seismic, etc.). However, it applies the "incredibility" criterion to screen out some of these events (e.g., no credible explosions from forklift propane, no breach of Department of Transportation Type B casks, etc.). Accidents were chosen for dose calculations based on the bounding consequences for the accident category (not risks or frequency bins). The frequencies without preventive controls are mostly U or EU. It seems like some preventive controls are being credited. Therefore, unmitigated risks could be higher. Facility worker consequences are "negligible" for all of the accidents evaluated (partly due to crediting evacuation). The dispersion analysis for stack releases has conflicting assumptions (i.e., D & 4.5 m/s & 76 m versus A & 1 m/s & 83 m). It may need further investigation to determine if the appropriate maximum dose off site (reported as 1,400 m) is correct.

The Type B cask assumption may not be valid. Casks are stored outdoors in the weather. One is painted but badly rusted, and another is missing bolts and has carbon-steel bolts that may not be the original specification. A SARP may exist for some of these locally designed casks. This could be a discovery USQ, because credible accidents may breach nonqualified Type B containers. This was communicated to BJC during the facility tour.

The bounding accident is an earthquake during re-encapsulation of a source, which breaks an oil-filled window and spills powder, with  $1E-3 \times 10\%$  ARF  $\times$  RF ( $1E-4$  respirable release fraction) and 10% LPF. The dose is 0.75 rem for the public and collocated workers due to the elevated stack release. BJC should not credit the 10% LPF per DOE-STD-3009 (i.e., unmitigated analysis criterion for safety classification of SSCs); therefore, it is underestimated by a factor of 10. The ARF and RF should be larger if there were truly a powder spill during the earthquake. DOE-HDBK-3010 recommends  $2E-3 \times 30\%$  for the free-fall spill (i.e.,  $6E-4$  respirable). If there is substantial ceiling debris impact but no building collapse, BJC should add  $1E-3 \times 10\%$  (i.e., overall  $7E-4$  respirable release fraction). If the building and cells collapse, BJC should add  $2E-2 \times 10\%$  (i.e.,  $2E-3$  respirable release fraction) for air turbulence, yielding an overall

2.7E-3 respirable release fraction. Therefore, the source term released may be underestimated by a factor of 6 to 27, depending on the extent of the damages. Considering the above, the dose may be underestimated by factor of 10, 60, or 270, resulting in a dose of 7.5 rem, 45 rem, or 203 rem. The higher levels would warrant a higher consequence rating and risk estimates (e.g., perhaps Risk Class II).

#### **Adequacy of Controls**

The LCO/surveillance requirements on the containment system (i.e., HEPA filters and negative dP) are very weak (i.e., there is no specificity). The system is not designated as a safety significant SSC, but it is identified as "relied upon in the PHA to prevent/mitigate accidents." It is based on DID, since the HEPA filters are not specifically credited to reduce consequences (except that a factor of 10 is being credited for seismic events due to the 10% LPF). The TSR has administrative controls on the total facility SR<sub>90</sub> equivalent and per cell unsealed MAR. The SMP chapter descriptions and the TSR are very generic and weak. Key programmatic elements are not described or committed to. This is not the standard expected today to approve a BIO. There is no SMP description of a fire protection program, but it is included in the TSR.

#### **Adequacy of Implementation of Controls**

Based on facility tour, the TSR LCO/surveillance requirements on the HEPA filters are being implemented. The filters will be replaced soon. The facility has excellent housekeeping. It is a well-kept facility. Four 55-gallon drums of mineral oil (i.e., high flashpoint NFPA Class IIIB combustible liquid) are in the facility. The drums are not restricted by a fire protection program. There is no FHA, but there is a Fire Protection Engineering Assessment that contains recommendations to remove the oils from the airlock.

Procedures were reviewed to verify that HEPA filter surveillance and dP checks are performed before operation as required by the OSR. A work control package was developed to operate the crane. Radiological control concerns have been expressed by the DNFSB regarding (a) supply openings to the cells that could result in a release to the workplace from contaminated cells during HVAC upsets or a station blackout and (b) potential breach of single-encapsulated sources during the annual inventory that could heat up and crack (i.e., should they have additional confinement?). This situation should have a radiological engineer review to assure worker safety.

#### **Sense of Overall Risk (L, M, H)**

The BIO concludes that all risks are low. Due to potentially underestimated frequencies, high MAR inventory, and potentially underestimated source term and doses, the unmitigated risks could be moderate for the public and collocated workers and high for facility workers due to the large sources.

**Facility Name****Portsmouth Gaseous Diffusion Plant****Hazard Category**

Hazard Category 2 for the following facilities: DMSA X-326 and X-333, Depleted UF<sub>6</sub> Cylinder Yards, Uranium Management Center X-744G, Oxide Conversion Facility X-705E, High EU Storage Facility X-345, Recycle Assembly Building X-7725 and X-7745R, and the RCRA Storage Area X-326 L Cage. Many others are Radiological Facilities. None of the facilities are classified as Hazard Category 3.

**Documents Reviewed**

1. *Portsmouth Safety Analysis Report*, POEF-LMES-89, January 1997
2. *Safety Evaluation Report for the Technical Safety Requirements (BJC/PORTS-7R1) For Portsmouth Gaseous Diffusion Plant, DOE Non-leased Facilities*, July 23, 1999
3. *Portsmouth Safety Evaluation Report on SAR/TSRs*, DOE/OR/02-1560/V2, December 1996
4. McBride (ORO NSD) to Jackson (ORO Enrichment Facilities) memorandum, dated March 8, 1999, "Review of Safety Analysis Reports for Portsmouth and Paducah"
5. Thiesing (BJC Vice President and General Manager) letter to Sleeman (ORO Contracting Officer's Representative), dated October 23, 2000, "Justification for Continued Operation for Portsmouth and Paducah"

**Adequacy of Hazard Categorization**

The Hazard Category 2 categorization is appropriate due to the criticality hazard. For the numerous facilities designated as Radiological Facilities, there is the possibility that some of these could become Hazard Category 2 facilities due to future discoveries of significant EU holdup.

**Adequacy of Hazards Evaluation**

See the Paducah assessment reports regarding failure to resolve the ORO AMESH review comments (references 4 and 5), which could affect the adequacy of the hazards analysis, since many of those comments also apply to Portsmouth. In addition to the Paducah hazards associated with the DMSAs, UF<sub>6</sub> cylinders, and solid waste storage facilities, Portsmouth also stores excess U (i.e., metal, oxides, UF<sub>4</sub>, UO<sub>2</sub>F<sub>6</sub>, etc.) from other DOE sites. Criticalities are a potential concern, as well as potential fires.

**Adequacy of Controls**

See the Paducah assessment reports regarding failure to resolve the ORO AMESH review comments, which could affect the adequacy of controls, since many of those comments also apply to Portsmouth. The DMSAs rely on the USEC/NRC LCO and its surveillance requirements on the CAAS, since the USEC facilities are subject to the NRC SB requirements. The waste storage facility (X-7725) has a sprinkler system, but this is not a TSR control.

**Adequacy of Implementation of Controls**

Not assessed (i.e., the team did not tour the facility).

**Sense of Overall Risk (L, M, H)**

It seems like low risk due to the criticality hazard for the facility worker but low risk for the public and collocated workers. It was reported that characterizations for criticality hazards have been completed.



**Facility Name**  
**Building 3019B**

**Hazard Category**  
Hazard Category 2

**Documents Reviewed**

1. *JCO for the High-Level Radiation Analytical Facility, Building 3019B, at Oak Ridge National Laboratory, Oak Ridge, Tennessee. JCO-OR-3019B-0001, dated June 7, 2001*
2. *Review and Approval of Building 3019B JCO, SER-OR-3019B-0022, dated June 7, 2001*
3. *Exemption Request for the As-Built Configuration of the Oak Ridge National Laboratory former High-Level-Radiation Analytical Facility – Building 3019B Sprinkler System Deactivation*
4. *Fire Hazards Analysis for former High-Level-Radiation Analytical Facility – Building 3019B at Oak Ridge National Laboratory, Oak Ridge, Tennessee, dated September 1997.*

**Adequacy of Hazard Identification – Adequate**

- Perchlorate and  $U_{235}$  hazards were identified in May 1996 through one sample of material taken from ventilation duct above the hot cells.
- Warning signs were posted in December 1996.
- A USQD was drafted in March 1999 (approximately three years after discovery).
- The USQD approved in March 2001 (approximately five years after discovery).
- The JCO was approved and implemented in June 2001. The JCO is valid until June 2002.
- Based on the one analyzed sample and pictures of the duct, it was estimated that up to 5 kg of  $U_{235}$  may be present in the duct. This is well above the 700 g threshold for a Hazard Category 2 facility.

**Adequacy of Hazard Controls – Adequate**

- The JCO removes the possibility of flooding the ventilation duct with water by making the fire suppression system a “dry pipe” system.
- The combustible loading program prevents storage of combustibles in Building 3019B.
- The portable CAAS was installed to warn personnel of an inadvertent criticality event.
- Until there is a better understanding of the material in the ductwork, the only work allowed in Building 3019B is inspections required by the documented safety analysis (and associated responses) and activities required to characterize the material in the ductwork.

**Adequacy of Implementation of Controls -- Inadequate.**

- The combustible loading program precludes the storage of combustibles in Building 3019B.
- Fire patrols are performed monthly.
- The portable CAAS is not designated as a safety significant SSC, but adequate maintenance and surveillances are established by the procedures.
- The portable CAAS alarm is not audible throughout Building 3019A and outside of Building 3019B. The alarm is hardwired and interlocked to the Laboratory Shift Superintendent Office. This office is manned 24/7, but it was not determined if the office is covered when the shift supervisor takes a break.

**Sense of overall risk of facility – Low**

Building 3019B is probably safe in its current configuration. More samples of the duct material need to be taken to determine if the perchlorates and  $U_{235}$  are distributed evenly throughout the duct and to determine a more reliable quantity. The portable CAAS should be designated as a safety significant SSC for the protection of personnel near Building 3019B. The portable CAAS alarm should be made audible in the 12 Rad zone inside and outside Building 3019A/B.

**Facility Name**

**Transuranic Waste Storage Facility, Buildings 7826 and 7834**

**Hazard Category**

Hazard Category 3, which should be Hazard Category 2

**Documents Reviewed**

1. *Transuranic Waste Storage Facilities, Buildings 7826 and 7834, Safety Basis Safety Analysis Report, ORNL/WM-RSWOG/TWSF/SAR/R0, dated November 10, 1997*
2. *Technical Safety Requirements, ORNL/WM-RSWOG/TWSF/TSR/R0, dated November 10, 1997*

**Adequacy of Hazard Identification -- Inadequate.** This should be a Hazard Category 2 facility.

- The SAR states that more than 700 g U<sub>235</sub> fissionable equivalent mass may be stored in each facility. (Note: The DOE-STD-1027-92 threshold for a Hazard Category 2 facility is 700 g U<sub>235</sub>.)
- DOE-STD-1027-92 allows facilities to be classified at a lower hazard category if it can be shown that the RF from any credible accident scenario will not be greater than that hazard category. The RF was not adequately justified.
- The PHA credits the container design for precluding a release of material during a seismic event, fire, or crane drop.
- The SAR does not adequately demonstrate that the containers will not release a quantity of material greater than the Hazard Category 2 threshold quantity of 700 g U<sub>235</sub>.

**Adequacy of Hazard Controls -- Inadequate**

- The containers are not designated as safety class/safety significant SSCs for worker protection.
- The TSR height restrictions (4 feet) are not placed on crane operations with the containers.
- The TSR surveillances are not applied to ensure container integrity.
- The controls are all administrative.

**Adequacy of Implementation of Controls -- Inadequate**

- The controls are inadequate because they are all administrative.
- The particle size limit of less than 10µm may be impossible to implement.

**Sense of overall risk of facility -- Low – Negligible**

The transuranic waste storage facilities, Buildings 7826 and 7834, are low risk. The risk can be reduced to negligible to the public and low to the on-site worker if the containers are maintained as safety significant and the TSR controls are implemented for handling.

**Facility Name**

**Federal Facilities Agreement Tanks Remediation Project**

**Hazard Category**

Hazard Category 2/3

**Documents Reviewed**

1. *Auditable Safety Analysis: FFA Tanks Remediation Project Surveillance, Maintenance and Characterization Activities*, BJC/OR-173 R0, dated May 1999
2. *Safety Evaluation Report Review of Auditable Safety Analysis: Federal Facilities Agreement Tank Remediation Project Surveillance, Maintenance and Characterization Activities*. SER-OR-FFATANKS-0013, dated April 1999.

**Adequacy of Hazard Identification -- Adequate**

- The ASA states that uncharacterized tanks will be classified as Hazard Category 2 until the characterization confirms that they are Hazard Category 3.
- The ASA states that the contents of the tanks are below the limit for fissionable quantities.
- The ASA identifies the tanks as a safety significant design feature for worker protection. (Note: The HEPA filters should be designated as safety significant, since they are part of tank integrity.)
- The Facility Representative indicated that all but three of the tanks have been remediated.

**Adequacy of Hazard Controls -- Adequate**

- The current controls are adequate to process material safely, but the HEPA filters should be upgraded to safety significant SSCs.

**Adequacy of Implementation of Controls -- Adequate**

- The HEPA filters should be safety significant to ensure worker protection.
- The current procedural controls are adequate to protect from a critical mass entering into tank.

**Sense of overall risk of facility -- Negligible**

The risk to the on-site worker and off-site population from this operation is negligible.

**Facility Name**

**Gunite and Associated Tanks Project**

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. *Safety Analysis Report for the Gunite and Associated Tanks project Remediation of the South Tank Farm, Facility 3507, Oak Ridge National Laboratory, ORNL/ER-403*
2. *Auditable Safety Analysis: Gunite and Associated Tanks Stabilization at the Oak Ridge National Laboratory, ASA-OR-3507-0090*

**Adequacy of Hazard Identification** -- Adequate. The project is completed.

- The tanks have been stabilized by the addition of concrete.
- The DOE Facility Representative indicated that all tanks have been remediated.

**Adequacy of Hazard Controls** -- Adequate

- The current controls are for maintenance, and surveillance of the pad is performed.

**Adequacy of Implementation of Controls** -- Adequate

- Implementation of the current controls is adequate.

**Sense of overall risk of facility** -- Negligible

The risk to the on-site worker and off-site population from this operation is negligible.

**Facility Name**

**ORNL Pits, Trenches, and Augered Holes**

**Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. *Basis for Interim Operation ORNL Pits, Trenches, and Augered Holes*, ORNL/BIO/PTAER/R2, date August 1997
2. *Review of Contractor-Revised Basis for Interim Operation for the ORNL Pits, Trenches, and Augered Holes, August 1, 1997*, ORNL/SER/PTA/ER/R2, dated September 29, 1997

**Adequacy of Hazard Identification -- Adequate**

- The BIO states that the ORNL trenches, pits, and augered holes used for the disposal of solid and liquid radioactive waste have been backfilled with dirt and capped with asphalt and/or concrete.
- The hazard classification is based on the remote possibility of a criticality event.
- The BIO shows that the dose from a criticality event is negligible if the cap is maintained.

**Adequacy of Hazard Controls -- Inadequate**

- The soil overburden and the asphalt and/or concrete cap should be designated as safety significant/safety class design features.
- Sampling and monitoring of the water table should be designated as a DID operation to warn personnel when radionuclides are approaching the water table so that preventive/mitigative actions can be taken.

**Adequacy of Implementation of Controls -- Inadequate**

- The controls are inadequate because they are all administrative

**Sense of overall risk of facility -- Negligible**

The risk from the ORNL pits, trenches, and augered holes are essentially negligible to the off-site populations, on-site workers, and the environment as long as the caps are maintained and are impervious to water. The probability of the radionuclides leaching to the groundwater should be negligible, since the cap will prevent water from the surface reaching the radionuclides in the ground.

**Facility Name**

Low Enriched Uranium (LEU) Process Building K-27, ETPP

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. *Basis for Interim Operation of the Low Enriched Uranium (LEU) Process Building K-27, East Tennessee Technology Park, Oak Ridge, K/ER-334, dated January 1998*
2. *Approval Basis for Interim Operations for the Low-Enriched Uranium Process Building K-27, K/ER-334, dated April 1998*

**Adequacy of Hazard Categorization**

The Hazard Category seems adequate. However, it needs to be verified by including the classified material stored at the facility. (Note: BJC needs to verify its definition of "classified solids." These drums are a stores warehouse activity per Table 2.1.)

**Adequacy of Hazard Evaluation**

The hazard evaluation is adequate, although the evaluation is not in DOE-STD-3009 format. Inclusion of the classified material may impact the hazard evaluation.

**Adequacy of Controls**

The overall selection of controls is adequate. The BIO does not identify a TSR or any SSCs. It credits SMPs and the Process Equipment Inspection Program. No TSR document exists for the facility.

**Adequacy of Implementation of Controls**

Unknown. A facility walkthrough was not done. However, since the facility does not have a TSR document, it is highly unlikely that implementation of controls (i.e., the SMPs or the Process Equipment Inspection Program) can be verified.

**Sense of Overall Risk (L, M, H)**

The overall risk by the facility is moderate. The inclusion of classified solids may increase the risk from the facility. Also, the facility cannot withstand a 0.05g seismic event. Over 3 metric tons of U (various isotopes) are present in the facility.

**Basis of Findings and Recommendations**

1. Lack of Baseline Analysis without Controls -- As required by DOE 5480.23, DOE-STD-3009-94, and the 10 CFR 830 requirements, an unmitigated safety analysis should be done. This document assumes that the controls on the inventory that will be placed in the vaults in the facility are in place, which is a violation of the requirements for preparation of the documented safety analysis.

2. Lack of Identified Controls (e.g., no TSR) -- The following controls should be considered:
  - a) Check for the presence of flammable gas in the stored drums and/or vaults.
  - b) Verify the composition and inventory in the drums to be loaded into the storage vaults.
  - c) Make the waste inventory controls (i.e., amounts, isotope ratios, combustibles in waste types II-III into an LCO).
3. Underlying References -- The lack of explicit and retrievable references for the calculation notes underlying the BIO forces the reviewers into a "trust me" position.
4. USQD Associated with Individual Vault(s) and/or Container Inventory -- Without detailed information on how the general deficiencies identified in the 1991 USQD were resolved, there is no assurance that the inventory information can either be confirmed or is valid, making the MAR uncertain and the analyses conclusions indefensible. The large amounts of classified wastes for which no information can be provided make this an indefensible BIO, since the accident analyses are tied to "vault inventory" for what one hopes is the bounding case. (See Table 5.2.)
5. Hydrogen Generation in Sealed Drums -- No explicit analysis of the subject is made for the drums that are staged or stored. The following should be considered:
  - a) Findings at Hanford and Savannah River Site indicate this is an appreciable area of concern, especially when coupled with potential internal corrosion of the drums while in storage.
  - b) Gas-generating phenomena that were not evaluated include resin degradation with gas evolution (both inorganic or organic resins) and filter cake radiolysis.
  - c) Drums in the storage facility at ORNL are mostly tightly sealed, with only a few having HEPA-vented lids. The risk from drum pressurization should be an explicitly evaluated issue.
  - d) DOE complex information on occurrences of the rupture of pressurized drums should be used in the safety analysis.
6. Building Collapse Scenario -- The basis for the assumption in the building collapse scenario that most if not all of the drums would not rupture needs further explanation, including a detailed analysis of the underlying assumptions tied to references of comparable industrial accidents associated with earthquakes that caused building collapse.
7. Building Inventory Basis -- The document makes extensive use of a building inventory of the radioactive facilities inventory (i.e., vessels, pipes, ducts, etc.), but it provides no information on how thorough that survey was. How much of the ducts and piping were checked and to what degree were areas not considered accessible (and ignored)?

**Facility Name**

**Molten Salt Reactor Experiment Facility**

**Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. The current SB documents for the Molten Salt Reactor Experiment are comprised of the BIO (ORNL/BIO/MSRE/R1.1) and the TSR (TSR/7503-ERP/003/R1)
2. TSR and BIO Change Control (ORNL/MSRE/YSRCHG/001/R0.1)
3. System Safety Analysis for RGRS (SSA/7503-ERP/003/R0)
4. SER for SSA and TSR (MSRE-SER-001)
5. SER for Revised BIO (MSRE-SER-005)
6. TSR SER (MSRE-SER-007)
7. SER for 7503 (SER-7503-NSD-01-05)

In addition, 87 USQDs have been prepared since the BIO was published in October 1998 as part of the SB. Only one or two USQDs were reviewed.

**Adequacy of Hazard Categorization**

The Hazard Category is adequate.

**Adequacy of Hazard Evaluation**

The hazard evaluation is adequate for the radiological hazards, although the evaluation is not in DOE-STD-3009 format and content.

**Adequacy of Controls**

Overall control selection is adequate in the PHA and accident analysis. However, several controls are identified as DID. These DID items are in LCO format, and it seems like they should be elevated to LCOs. The bases should be enhanced in accordance with the 10 CFR 830 requirements. Several design features are called out.

Note: The adequacy of the control hierarchy (i.e., LCO, administrative controls, or DID) needs to be re-evaluated.

**Adequacy of Implementation of Controls**

The facility walkthrough indicated that facility is well maintained and selected controls are being implemented.

**Sense of Overall Risk (L, M, H)**

The overall risk from the facility is moderate.



**Facility Name**

Radioactive Solid Waste Storage/Staging Pads, Facilities 7842A and 7822J

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. *Safety Analysis Report for the Radioactive Solid Waste Storage/Staging Pads, Facilities 7842A and 7822J*, ORNL/WM-RSWOG/RSWSSP/SAR/R0, dated November 1997
2. *Technical Safety Requirements for the Radioactive Solid Waste Storage/Staging Pads, Facilities 7842A and 7822J*, ORNL/WM-RSWOG/RSWSSP/TSR/R0, dated November 1997
3. Letter SER, *Review Safety Analysis Report and Technical Safety Requirements for the ORNL Radioactive Solid Waste Storage/Staging Pads, Facilities 7842A and 7822J, 106417*, dated November 5, 1997

**Adequacy of Hazard Categorization**

The Hazard Category seems inadequate. The hazard categorization is based on the bounding RFs. The RF assumption would have to be verified to ensure categorization. Hazard Category 3 is based on facility-specific TQs increased by RFs of E5 to E7. This seems high for assumptions of <1% and <33% respirable 10 micron particulate. (Note: No criticality hazard exists for the facility.)

**Adequacy of Hazard Evaluation**

The hazard evaluation (i.e., the PHA) is inadequate. The evaluation is not in DOE-STD-3009-94 format. The identification of preventive and mitigative controls in the PHA seems inadequate. No common cause analysis has been made of the hazards from U waste stored nearby in storage buildings and staged for vault storage under earthquake, high wind, and/or tornado conditions.

All of the bounding accidents fall in Risk Bins 2 to 4, partly because of the higher risk acceptance criteria (e.g., >25 rem for natural phenomenon off site). The highest off-site value in the summary sheets is 0.2 rem.

**Adequacy of Controls**

The overall selection of controls is inadequate. Only administrative controls and DID are identified. The SAR does not identify nuclear criticality control as required by DOE 5480.22 and credited in the PHA. In addition, the adequacy of the control hierarchy (i.e., administrative controls, DID, or design features) needs to be re-evaluated.

The TSR does not address the four waste types established in the FSAR and discussed in Chapter 5.0. The TSR only states that a program shall be in place to limit the inventory within the bounds of the SAR. No actual limits for isotope curie quantities are provided in the SAR or TSR.

**Adequacy of Implementation of Controls**

Unknown. A facility walkthrough was not done.

**Sense of Overall Risk (L, M, H)**

The overall risk from the facility is low.

**Facility Name**

Radioactive Solid Waste Storage Facilities; Buildings 7823B, C, D, E; 7831A; 7831C; 7842; 7842B, C; 7878; 7878A; 7879; 7934; 7572; and 7574

**Hazard Category**

Hazard Category 3

**Documents Reviewed**

1. *Safety Analysis Report for the Radioactive Solid Waste Storage Facilities, Building 7823B, C, D, E; 7831A; 7831C; 7842; 7842B, C; 7878; 7878A; 7879; 7934; 7572; and 7574*
2. *Technical Safety Requirements for the Radioactive Solid Waste Storage Facilities, Building 7823B, C, D, E; 7831A; 7831C; 7842; 7842B, C; 7878; 7878A; 7879; 7934; 7572; and 7574*

**Adequacy of Hazard Categorization**

The facility is assigned Hazard Category 3 without an adequate basis for that category being provided in the SAR. The hazard categorization is based on the bounding RFs. The RF assumption would have to be verified to ensure categorization. Hazard Category 3 is based on facility-specific TQs increased by RF of E5 to E7. This seems high for assumptions of <1% and <33% respirable 10 micron particulate. (Note: No criticality hazard exists for the facility.)

**Adequacy of Hazard Evaluation**

The hazard evaluation is inadequate. The evaluation is not in DOE-STD-3009 format. All of the bounding accidents fall in Risk Bins 2 to 4, partly because of the higher risk acceptance criteria (e.g., >25 rem for natural phenomenon off site). The identification of preventive and mitigative control in the PHA seems incomplete. No common cause analysis has been made of the hazards from U waste stored in nearby storage buildings and staged for vault storage under earthquake, high wind, and/or tornado conditions.

No results are presented in the SAR for dose consequences. The SAR makes generic statements that the consequences are in the "low" range. Reference is made to a PHA summary sheet without providing a document number. The summary sheet in Chapter 3.0 does not include the dose consequence values.

**Adequacy of Controls**

The overall control selection is inadequate. No TSR controls are imposed related to drum stacking height and drum weights. These controls are inherently credited when assuming that a stack of pallets three high can support the stack weight. If an accident can occur with an over-height stack, this should be protected. There is no discussion of drum structural capability or the need to protect drum integrity. The adequacy of the control hierarchy (i.e., administrative controls versus DID) needs to be re-evaluated.

The TSR does not address the four waste types established in the FSAR and discussed in Chapter 5.0. The TSR only states that a program shall be in place to limit the inventory within the bounds of the SAR. No actual limits for isotope curie quantities are provided in the SAR or TSR.

**Adequacy of Implementation of Controls**

Unknown. A facility walkthrough was not done.

**Sense of Overall Risk (L, M, H)**

The overall risk from the facility may be low or moderate, since the analysis is sufficiently weak that the risk basis cannot be independently determined.

**Facility Name**

U Oxide Storage Vaults

**Hazard Category**

Hazard Category 2

**Documents Reviewed**

1. *Safety Analysis Report (SAR) for the Uranium Oxide Storage Vaults, Y/ENG/SAR-76/IA, dated September 1995*
2. *Safety Evaluation Report for the Safety Analysis Report for the Uranium Oxide Storage Vaults, dated February 1997*

**Adequacy of Hazard Categorization**

The Hazard Category seems adequate. DOE-STD-1027 methodology is used, and no facility-specific TQs are established.

**Adequacy of Hazard Evaluation**

The hazard evaluation (i.e., the PHA) is adequate, although the evaluation is not in DOE-STD-3009 format. Secondary events (like water intrusion after earthquake damage to the vault, resulting in hydrogen generation) have not been analyzed. Although effects of hazards in a sealed-filled vault are explicitly excluded from the scope, they should have been analyzed.

**Adequacy of Controls**

The overall selection of controls is inadequate. The SAR does not identify a TSR or any SSCs, although it identifies preventive and mitigative controls in the hazard evaluation. The SAR has commitments for sampling drums and for inventory control from waste shippers. Additionally, the facility is missing the ventilation controls identified in the hazards analysis. These assumptions in the analysis have not been protected. No common cause analysis has been done of the hazards from the nearby storage facilities. No TSR document exists for the facility.

**Adequacy of Implementation of Controls**

Unknown. A facility walkthrough was not done. However, since the facility does not have a TSR document, it is highly unlikely that implementation of the controls (i.e., SMPs) can be verified.

**Sense of Overall Risk (L, M, H)**

The overall risk from the facility is moderate to high. The SAR is written to the DOE 5480.1B format. The level of detail is inadequate to ascertain with certainty the risks associated with the facility. It is recommended the SAR be rewritten to the DOE-STD-3009 format and content. Additionally, there are the missing TSR and SSCs that are credited in the PHA.

**Facility Name****Building 7831, Solid Waste Compactor Facility****Hazard Category**

Hazard Category 3 (Note: This was derived using nonconservative ARFs, which are independent of the release mechanism and a function of the material form.) Since the operations include crash and impact insults, the ARFs could be substantially higher than those assumed in determining the final Hazard Category for the facility.

**Inventory**

No specific  $U_{235}$  inventory limit is provided. It only refers to  $>700$  g  $U_{235}$ .

**Adequacy of Hazard Identification**

The hazard identification is reasonable with respect to generically identifying the types of hazards and screening criteria. However, the hazard identification does not characterize the hazards with respect to quantities or forms. It only provides a measure of the quantities for the purpose of screening.

**Adequacy of the Hazard Analysis**

There is reasonable identification of the initiating events and screening of these. ARFs are provided for the four types of waste materials, which by default assumes a specific waste characterization with respect to a fraction of the waste with certain particulate size ranges. This creates problems not only with respect to the hazard category but also with respect to the bounding consequences and implementation. For the limited set of accident scenarios that is identified, a reasonable set of controls is identified, with a few exceptions.

**Selection of Controls**

As indicated above, for the most part the hazard analysis identifies the most important controls that are needed to prevent or mitigate the identified postulated scenarios. Because of the presence of remote-handled transuranic within the facility, the need to have radiation monitoring (either fixed or portable) has not been identified, nor has the shielding provided by the containers.

The building structure provides a safety significant function with respect to preventing self-collapse during natural phenomena and external events; thus, it needs to be identified as a design feature requiring TSR coverage as long significant quantities of fissile material are present within the facility (i.e., above Hazard Category 3 thresholds).

For external exposures, the analysis assumes that the workers will be evacuating at 1 m/s; however, no mention is made of how such high radiation exposures will be determined (e.g., radiation monitors).

**Adequacy of Implementation of Controls**

N/A. No actual walkthroughs of the facility or review of the procedures occurred.

**Overall Risk**

The risk to the public is low, and the risk to the worker is moderate.

**Deficiencies**

1. Remote-handled transuranic is identified in the SAR as present in the facility, but it is not clear if this waste is to be compacted. Clearly, the SB does not allow any storage within the facility.
2. The SB for this facility is confusing. Even though the SB is supposed to cover low-level waste operations, the analyses are based on transuranic waste inventory levels.

3. This document is almost a cut-and-copy from the Building 7883 SAR.
4. A nonconservative LPF of 0.55 based on the Hanford Test is used in the source/ consequence analysis. The unmitigated accident scenario should evaluate the consequences based on an LPF of 1.0.
5. Table 3-3 identifies consequence bins for on site and the public; however, it breaks the public consequences into man-made and natural phenomena, with different dose range criteria for the same consequence category. This is unacceptable, since there should not be a difference in the criteria for these accident categories.
6. The hazard identification identifies the presence of remote-handled transuranic waste within the facility (i.e., >200 mrem/hr); however, the hazard analysis does not explicitly identify a scenario in which overexposure to workers could occur or the controls that are in place to prevent or mitigate this type of scenario.
7. The criticality control program is covered very loosely in the SAR and TSR. The TSR needs to be more specific with respect to the controls to prevent and mitigate the criticality.
8. There is no correlation between the SAR and any FHA that may have been prepared (if one was prepared).
9. The structure functional requirement is to meet the PC-2 criteria for natural phenomena, due to its safety significant designation and facility hazard categorization. According to the SAR, this facility meets or exceeds the design criteria for PC-2.
10. Natural phenomena events are evaluated well beyond what is required for a PC-2 facility.
11. The hazard/accident analysis only addresses fires from the outside of the facility. Fires initiated within the facility need to be addressed and controls identified.
12. Chapter 4 does not cover any safety significant SSCs, even though it is clear that such SSCs are implicitly or explicitly credited by the hazard analysis and authorization agreement.
13. Besides safety significant SSCs, Chapter 5 does not include a fire protection program.

**Facility Name****Building 7886, Waste Storage Facility****Hazard Category**

Hazard Category 3 (Note: This was derived using nonconservative ARFs, which are independent of the release mechanism and a function of the material form.)

**Documents Reviewed**

1. *Basis for Interim Operation, Interim Waste Management Facility, Building 7886.* ORNL/WM-SWO/7886/BIO/R0-2, dated May 14, 1997
2. *Safety Evaluation Report, Safety Analysis Report and Technical Safety Requirements, Interim Waste Management Facility, Facility 7886 at the Oak Ridge National Laboratory,* dated January 20, 1999

**Inventory**

For  $U_{235}$ , no specific inventory limit is provided. It only refers to  $>700$  g  $U_{235}$ .

**Adequacy of Hazard Identification**

The hazard identification is reasonable with respect to generically identifying the types of hazards and the screening criteria. However, the hazard identification does not characterize the hazards with respect to quantities or forms. It only provides a measure of the quantities for the purpose of screening.

**Adequacy of the Hazard Analysis**

There is a reasonable identification of initiating events and screening of these. ARFs are provided for the four types of waste materials, which by default assumes a specific waste characterization with respect to a fraction of the waste with certain particulate size ranges. This creates problems not only with respect to the hazard category but also with respect to the bounding consequences and implementation. For the limited set of accident scenarios that is identified, a reasonable set of controls is identified, with a few exceptions.

**Selection of Controls**

As indicated above, for the most part, the hazard analysis identifies the most important controls that are needed to prevent or mitigate the identified postulated scenarios. A few exceptions to this are the controls that are explicitly identified and credited to prevent a criticality (i.e., the initial waste acceptance criteria are satisfied before acceptance of the waste into the facility). Because of the conclusions with respect to criticality, this administrative control needs to be covered explicitly in the TSR under an administrative control program.

Because of the presence of remote-handled transuranic within the facility, the need to have radiation monitoring (either fixed or portable) has not been identified, nor has the shielding provided by casks.

The building structure provides a safety significant function with respect to preventing self-collapse during natural phenomena and external events; thus, it needs to be identified as a design feature requiring TSR coverage as long significant quantities of fissile material are present within the facility (i.e., above Hazard Category 3 thresholds).

For external exposures, the analysis assumes that the workers will be evacuating at 1 m/s; however, no mention is made of how such high radiation exposures will be determined (e.g., radiation monitors).

**Adequacy of Implementation of Controls**

N/A. No actual walkthroughs of the facility or review of procedures occurred.

**Overall Risk**

The risk to the public is low. The risk to the worker is moderate.

**Deficiencies**

1. Table 3-3 identifies consequence bins for on site and the public; however, it breaks the public consequences into man-made and natural phenomena, with different dose range criteria for the same consequence category. This is unacceptable, since there should not be a difference in the criteria for these accident categories.
2. The hazard identification identifies the presence of remote-handled transuranic waste within the facility (i.e., >200 mrem/hr); however, the hazard analysis does not explicitly identify a scenario in which overexposure to workers could occur or the controls that are in place to prevent or mitigate this type of scenarios.
3. The criticality control program is covered very loosely in the SAR and TSR. The TSR needs to be more specific with respect to the controls to prevent and mitigate the criticality.
4. There is no correlation between the SAR and any FHA that may have been prepared (if one was prepared).
5. The structure functional requirement is to meet the PC-2 criteria for natural phenomena, due to its safety significant designation and the facility hazard categorization. According to the SAR, this facility meets or exceeds the design criteria for PC-2.
6. The hazard/accident analysis only addresses fires from the outside of the facility. Fires initiated within the facility need to be addressed and the controls identified.
7. Chapter 4 does not cover any safety significant SSCs, even though it is clear that such SSCs are implicitly or explicitly credited by the hazard analysis and authorization agreement.
8. Besides safety significant SSCs, Chapter 5 does not include a fire protection program.
9. The SER prepared for the SAR and TSR is less than adequate. The SER is pretty much a regurgitation of information provided by the SAR and TSR. It does not evaluate the adequacy of the information, and it does not address the risk acceptance of the operations nor any conditions for approval.
10. Elements within Section 5.0 need to be revised to include additional administrative control programs that apply to this system, such as maintenance and in-service inspection. Also, consolidate sections (e.g., 5.2 and 5.5 under emergency response program), etc.

**Facility Name****ETTP, Buildings K-29, K-31, and K-33 LEU Process Buildings****Hazard Category**

Hazard Category 2, based on the potential for criticality. The inventory at each building is below Hazard Category 2 thresholds, but there is a potential for criticality.

**Documents Reviewed**

1. *Basis for Interim Operation of the K-29, K-31, and K-33 Low Enriched Uranium (LEU) Process Buildings at the ETTP*, dated April 1999.
2. *DOE Safety Evaluation Report (SER) for the Basis for Interim Operation of the K-29, K-31, and K-33 Low Enriched Uranium (LEU) Process Buildings at the ETTP*, dated April 23, 1999
3. *USQD for the K-33 Storage Pad LLW Storage Containers*, USQD 2001-04, dated March 29, 2001

**Adequacy of the Hazard Identification**

The BIO does a reasonable job of identifying the major hazards and characterizing them.

**Adequacy of the Hazard Analysis**

The hazard analysis is based on the guidance in DOE-STD-3011, including the use of the frequency, consequence, and risk matrices provided in the standard. For a BIO, the hazard analysis is reasonable (with noted deficiencies identified below) and comprehensive, at least with respect to identifying the major accident scenarios of concern.

Unfortunately, there is an overemphasis on quantitative frequency and consequence estimates, with little added value to the overall conclusion on the safety of the activities conducted. The frequencies (and thus the risk) seem to be inconsistent with respect to being mitigated in some cases and unmitigated in other cases. That is, in many cases, the frequency of occurrence of the postulated accident scenario clearly reflects the presence and success response of identified controls. The consequences are provided generically, and in many cases, it is hard to determine if the consequences provided were for the public or workers, since no distinction was made in the hazard analysis.

The author could very well have come to the same conclusions with respect to the frequency, consequences, and risk based on qualitative arguments. Unfortunately, the emphasis on quantitative evaluations led to a less than adequate identification of controls (comprehensive list). Namely, for the major accident scenarios identified, only a very small set of controls is identified. Examples include the controls associated with combustible/ignition control (which are not identified), the containers (e.g., Type A drums), etc.

Even though, there is a reasonable discussion of the risk for each of the postulated scenarios, there is no clear discussion of the overall cumulative risk of the activities or operations in these facilities with respect to the public or workers.

**Adequacy of the Accident Analysis**

No accident analysis is provided, even though the author presents a hazard analysis that more closely resembles an accident analysis.

**Adequacy of Controls**

Even though credit is clearly taken for some of the SSCs identified in the hazard analysis, most of these are not identified as potential safety significant SSCs (e.g., containers or confinement volumes, structural integrity, etc.). The exception is the sprinkler system. Important administrative controls are, however, reasonably thoroughly identified.



**Adequacy of Implementation of Controls**

Clear recommendations for implementing specific administrative controls are provided for a few programs, such as fire protection.

No inventory control program is identified that will serve the facility to transition from nuclear to non-nuclear status during the decontamination activities, and thus remove themselves from the nuclear SB documents.

No TSR or OSR was identified or reviewed for this facility.

**Facility Name**

Waste Storage Facility, Building 7883

**Hazard Category**

Hazard Category 3 (This was derived using nonconservative ARFs, which are independent of release mechanism and a function of material form. For  $U_{235}$ , no specific inventory limit is provided, the document only refers to  $>700 \text{ g } U_{235}$ ).

**Documents Reviewed**

SAR, TSR, and SER for the Waste Storage Facility, Building 7883

**Adequacy of Hazard Categorization**

The hazard identification is reasonable with respect to generically identifying the types of hazards and the screening criteria. However, the hazard identification does not characterize the hazards with respect to quantities or forms. It only provides a measure of the quantities for the purpose of screening.

**Adequacy of Hazard Evaluation**

There is a reasonable identification of the initiating events and screening of these. ARFs are provided for the four types of waste materials, which by default assumes a specific waste characterization with respect to a fraction of the waste with certain particulate size ranges. However, this creates problems not only with respect to the hazard category but also with respect to the bounding consequences and implementation. For the limited set of accident scenarios that is identified, a reasonable set of controls is identified, with a few exceptions.

**Adequacy of Controls**

As indicated above, for the most part, the hazard analysis identifies the most important controls that are needed to prevent or mitigate the identified postulated scenarios. A few exceptions to this are the controls that were explicitly identified and credited to prevent a criticality (i.e., initial waste acceptance criteria is satisfied before acceptance of the waste into the facility). Because of the conclusions with respect to criticality, this administrative control needs to be covered explicitly in the TSR under an administrative control program.

Because of the presence of remote-handled transuranic within the facility, the need to have radiation monitoring (either fixed or portable) has not been identified, nor has the shielding provided by casks.

The building structure provides a safety significant function with respect to preventing self-collapse during natural phenomena and external events; thus, it needs to be identified as a design feature requiring TSR coverage as long as significant quantities of fissile material are present within the facility (i.e., above Hazard Category 3 thresholds). For external exposures, the analysis assumes that the workers will be evacuating at 1 m/s; however, no mention is made of how such high radiation exposures will be determined (e.g., radiation monitors).

**Adequacy of Implementation of Controls**

The facility walkthrough indicated that selected controls are being implemented.

**Sense of Risk (L, M, H)**

The risk to the public is low. The risk to the worker is moderate.

**Deficiencies**

1. Table 3-3 identifies consequence bins for on site and the public; however, it breaks the public consequences into man-made and natural phenomena, with different dose range criteria for the

same consequence category. This is unacceptable, since there should not be a difference in the criteria for these accident categories.

2. The hazard identification identifies the presence of remote-handled transuranic waste within the facility (i.e., >200 mrem/hr); however, the hazard analysis does not explicitly identify a scenario in which overexposure to workers could occur or the controls that are in place to prevent or mitigate this type of scenario.
3. There is no discussion of the likelihood of a criticality within the facility.
4. The criticality controls and program are covered very loosely in the SAR and TSR. The TSR needs to be more specific with respect to the controls to prevent and mitigate a criticality.
5. There is no correlation between the SAR and any FHA that may have been prepared (if one was prepared).
6. The structure functional requirement is to meet PC-2 criteria for natural phenomena due to its safety significant designation and facility hazard categorization. According to the SAR, this facility meets or exceeds the design criteria for PC-2.
7. The hazard/accident analysis only addresses fires from the outside of the facility. Fires initiated within the facility need to be addressed and the controls identified.
8. Chapter 4 does not cover any safety significant SSCs, even though, it is clear that such SSCs are implicitly or explicitly credited by the hazard analysis/authorization agreement.
9. Besides safety significant SSCs, Chapter 5 does not include a fire protection program.
10. The SER prepared for the SAR and TSR is less than adequate. The SER is pretty much a regurgitation of information provided by the SAR and TSR, and it does not evaluate the adequacy of the information, nor does it address the risk acceptance of the operations or any conditions for approval
11. Elements in Section 5.0 need to be revised to include the additional administrative control programs that apply to this system, such as maintenance and in-service inspection. Also, consolidate sections (e.g., 5.2 and 5.5 under emergency response program), etc.

## **Appendix F – Review of Hazard Categorization for BJC Radiological Facilities**

**Facility Name**

**ETTP, K-1065-A, -B, -C, -D, and -E Waste Management Storage Buildings**

**Documents Reviewed**

*Auditable Safety Analysis, with Hazard Classification, for the K-1065-A, -B, -C, -D, and -E Waste Management Storage Buildings*

**Observations**

The K-1065 Waste Management Storage Buildings are used to store RCRA mixed waste and pond waste sludge.

The discussion of the hazard categorization is inconsistent within the ASA. The "Hazard Identification" section claims that an inventory-based method is used for determining facility classification for radiological hazards. (Note: It cites Lockheed Martin Energy Systems procedure ES/CSET-2/Rs.) However, the ensuing discussion, as well as further discussion provided in the "Initial Hazard Classification" section, refers to releasable quantities being compared to TQ values of DOE-STD-1027-92.

Releasable quantities are calculated by using alternate ARFs from DOE-HDBK-3010-94 for a slurry with less than 40% solids (5E-5). This ARF is used for pond sludge, which is actually 48% solids. The default ARF in DOE-STD-1027-92 is 1E-3. This value is used for the fraction of the inventory that is dried sludge, since it most closely resembles behavior of a powder. An appendix is provided in the ASA that provides the assumptions used in the hazard categorization calculations.

**Conclusion**

There is no evidence or discussion of a preliminary hazard categorization being performed on a gross facility inventory as is required by DOE-STD-1027-92. Based on the total MAR stated in the ASA, the facility would be Hazard Category 3 using gross inventory assumptions. However, because the initial classification was based on adjusted MAR values and it resulted in a radiological classification, DOE was never involved in the review and approval of the hazard categorization results (i.e., approval authority for radiological facilities is delegated to the contractor).

The final hazard categorization compares adjusted MAR values to Hazard Category 3 TQs, which is not consistent with DOE-STD-1027-92. This is because DOE uses a different methodology for calculating Hazard Category 2 and Hazard Category 3 TQs. The BJC calculation uses a ratio of an adjusted ARF against the default ARF used in Hazard Category 2 TQs and then compares the results with Hazard Category 3 TQs. This is contrary to the guidance provided in EH headquarters interpretation letters.

**Facility Name**

ETTP, K-1066-H

**Documents Reviewed**

*Auditable Safety Analysis, Including Hazard Classification, for the K-1066-H Low-Level Waste Storage Area.*

**Observations**

The discussion of the hazard categorization is broad. It consists of one paragraph that claims the facility is a Radiological Facility in accordance with DOE-EM-STD-5502-94, based on the maximum quantity of U potentially present in the low-level waste stored at the K-1066-H Pad. Assumptions given in the ASA for waste storage containers include the following:

- The total quantity of  $U_{235} \geq .96\%$  enrichment in each 55-gallon or smaller container is <15 g per container
- The total quantity of  $U_{235} \geq .96\%$  enrichment in containers larger than 55 gallons is < 350 g.
- No limits on the amount of containers with  $U_{235} \leq .96\%$  enrichment
- No fissile materials other than  $U_{235}$  are permitted on the pad without prior review and approval of the Nuclear Criticality Safety Department. (Note: Is that a Lockheed Martin Energy Systems organization?)

No assumptions are given for how many containers may be present on the pad.

The DOE-STD-1027-92 TQ limit for  $U_{238}$  ( $1.3E+07g$ ) is used as the maximum inventory for consequence calculations. The ASA requires, through the use of an operating limit, control of inventory such that the sum of the ratios of each isotope compared to DOE-STD-1027-92 is maintained below 1.

**Conclusion**

No specific information is given regarding the derivation of the hazard categorization (i.e., comparison of inventory to Table A.1). The final hazard categorization compares adjusted MAR values to Hazard Category 3 TQs, which is not consistent with DOE-STD-1027-92. This is because DOE uses a different methodology for calculating Hazard Category 2 and Hazard Category 3 TQs. The BJC calculation uses a ratio of an adjusted ARF against the default ARF used in Hazard Category 2 TQs and then compares the results with Hazard Category 3 TQs. This is contrary to guidance provided in EH headquarters interpretation letters.

**Facility Name****Y-12 U Chip Oxidation Facility, Building 9401-5****Documents Reviewed**

1. *Auditable Safety Analysis for the Uranium Chip Oxidation Facility, Building 9401-5, Y/ENG/ASA-74/R1*, dated January 23, 1998
2. *USQD Short Work Sheet, Discovery Condition – UCOF Containers*, USQD No. USQD-YT-UCOF-0040, dated March 2001
3. *Unreviewed Change Determination for the Processing of Uranium-Molybdenum Alloy by the Uranium Chip Oxidation Facility (Building 9401-5)*, UCD Number Y-12-WTO-01-UCD-017, dated August 2001
4. *Un-reviewed Change Determination: Shipment of Milled Chip/Sludge Containers to Y12 Development for Treatability Studies from Uranium Chip Oxidation Facility (Building 9401-5)*, UCD Number Y-12-WTO-01-UCD-037, dated November 2001

**Observations**

The MAR is depleted U metal chips that are stabilized to an oxide to eliminate the pyrophoric hazard and facilitate safe interim storage. The facility is operated as a Radiological Facility per DOE-EM-STD-5502 by committing to maintain the inventory below the Hazard Category 3 threshold of DOE-STD-1027. Considering the U isotopic concentration, a weighted threshold value of 21,500 lb (~ 9.8E+6 g) was established as the inventory limit, which is more conservative than assuming the > 99% predominant U<sub>238</sub> isotope (1.3E+7 g) as permitted by DOE-STD-1027.

The ASA requires, through the use of an operating limit, control of inventory such that the facility maximum inventory is less than 21,500 lb of depleted U, and it allows for a 0.85 mass fraction adjustment for oxide. The implementing procedure was not reviewed.

Three USQDs were reviewed that address a discovery condition of different sizes of containers, a proposed change to process U-molybdenum alloy, and a proposed change to package and ship milled chip/sludge to another facility for a treatability study. These do not change the hazard classification.

A chemical hazard classification was also performed due to the depleted U's toxicity effects, and it concludes that the hazard is "Generally Accepted" because the seismic release scenario would result in chemical doses below the range of reversible health effects. The technical basis for this calculation was not reviewed, but the conclusion seems appropriate.

**Conclusion**

The Radiological Facility hazard categorization is appropriate due to the ASA commitment to maintain the facility inventory to less than the DOE-STD-1027 Hazard Category 3 threshold.

**Facility Name**

**Y-12 Building 9720-31 RCRA Motel**

**Documents Reviewed**

*Preliminary Hazard Classification for Bldg. 9720-31, RCRA Motel, Y/M-056, Addenda 1, dated July 1992.*

**Observations**

The facility is a RCRA and mixed waste storage building that is single-story concrete block construction with 15 rooms. It can have significant quantities of flammable liquids and shock sensitive wastes, and it has a number of safety features (i.e., sprinklers, blow-out wall panels, etc.).

There is no nuclear hazard categorization per DOE-STD-1027. There is a hazard classification based on the Oak Ridge methodology (i.e., *Hazard Screening Application Guide*, CSET-2, dated December 1990), which was established prior to the issuance of the standard.

The chemical hazard classification was performed based on cadmium and trichloroethylene toxicity effects, and it concludes that the hazard is "Generally Accepted" because the spill or fire/explosion release scenarios would result in chemical doses below the range of reversible health effects. The technical basis for this calculation was not reviewed, but the conclusion seems appropriate.

The only radioactive component included in the evaluation is depleted U. Results are provided based on a release and dispersion analysis to conclude that the facility should be classified as "Generally Accepted" because the consequences are below the range of reversible health effects. However, no MAR quantities or supporting calculations are provided for the reported consequences that are in units of affected area, nor are any doses or hazard classification criteria presented. The total quantity of depleted U is not presented. There is a statement that waste "is generated from virtually every facility and activity at the plant and includes waste generated from production, maintenance, fabrication, assembly and development. Although WTSD receives and stores uranium and PCB contaminated wastes at other storage facilities, building 9720-31 is generally not used to store or receive these wastes." The presumption is that this is only very low-level waste.

**Conclusion**

The hazard categorization predates DOE-STD-1027; therefore, there is no current determination per the standard that this facility is non-nuclear or whether it should be designated as a Radiological Facility or Industrial Facility (because the radiological inventory could be less than the limits per DOE-EM-STD-5502).



**Facility Name****Mixed Hazardous Waste Storage Facility, Building 7507W****Documents Reviewed**

*Phase I – Safety Analysis Report (SAR) Update Program Hazard Screening, Mixed Hazardous Waste Storage Facility Building 7507W, HS/7507W/F/1/R0, dated November 1992*

**Observations**

The facility is a RCRA and mixed waste storage canvas tent on a concrete pad. It can have significant quantities of flammable and toxic wastes, with some mixed wastes. The majority of the waste is bulk scintillation fluids and scintillation vials.

There is no nuclear hazard categorization per DOE-STD-1027. There is a hazard classification based on the Oak Ridge methodology (i.e., *Hazard Screening Application Guide*, CSET-2, December 1990), which was established prior to the issuance of the standard.

The chemical hazard classification was performed based on multiple chemical toxicity effects, and it concludes that it is a “High” hazard facility (per DOE 5481.1A) because the fire release scenarios would result in chemical doses that could result in irreversible health effects to a very large number of persons on site and a few people off site. But then, it argues that it could also be “Moderate” due to inventory turnover. Therefore, the decision is that the facility is in the “Moderate” to “High” hazard classification. The technical basis for this calculation was not reviewed. The inventory assumption may not be bounding, since it reflects the facility inventory as of January 1992 as representative for a typical hazardous waste facility.

A total facility radionuclide activity limits is proposed as 17,300 Ci of Sr<sub>90</sub> equivalent. No specific estimates of current inventories or postulated maximums are presented. Instead, a “back-calculation” of the 10 rem at 100 meter criterion is used to conclude that if the facility is maintained below this limit, it can be classified as a “Generally Accepted” facility. No specific inventory control system is required because the normally present inventory is orders of magnitudes below the evaluation guideline.

**Conclusion**

The hazard categorization predates DOE-STD-1027; therefore, there is no current determination per the standard that this facility is non-nuclear or whether it should be designated as a Radiological Facility. Since the analysis assumes that the maximum inventory is 17,300 Ci of Sr<sub>90</sub>, it would exceed the DOE-STD-1027 Hazard Category 3 threshold of 16 Ci and almost approach the Hazard Category 2 threshold of 22,000 Ci. It probably should be classified as a Hazard Category 3 nuclear facility, unless the facility can demonstrate that its current inventory of SR<sub>90</sub> equivalent is less than 16 Ci.

**Facility Name****Shielded Transfer Tanks (next to Building 7819)****Documents Reviewed**

1. *Unreviewed Safety Question Determination, Shielded Transfer Tanks Located Next to Building 7819*, USQD No.: BJC-USQD-STT-1999-01, dated February 1999
2. Excerpted pages from a draft ASA (ASA-OR-STT-0094) that is currently being finalized

**Observations**

The Shielded Transfer Tanks are formerly approved Department of Transportation Type B shipping casks for fission product wastes from the Hanford Site. The tanks were drained, but they have heels with some residuals liquids. A USQD was performed in 1999 to address the discovery condition that there is no SB document for this "facility" (i.e., outside tanks under a canopy), and it created a positive USQ. ORO has not dispositioned the positive USQ, and no compensatory measures were recommended. No nuclear hazard categorization per DOE-STD-1027 currently exists.

Based on 1983 and 1998 surveys, an estimate of the radionuclide inventory was made. The age-corrected  $Cs_{137}$  MAR ranges from a minimum of 35 Ci to a maximum of 523 Ci. However, the draft ASA presents newer information that estimates a range from about 170 to 3,014 Ci. The draft ASA also conservatively estimates that there could be 222 grams of  $Pu_{239}$  to justify that there is no criticality hazard. All of these estimates would warrant a preliminary Hazard Category 3 designation because they exceed the 60 Ci threshold for  $Cs_{137}$  and 8.4 g  $Pu_{239}$  threshold from DOE-STD-1027.

The final hazard categorization compares adjusted MAR values to Hazard Category 3 threshold quantities, which is not consistent with DOE-STD-1027-92. This is because DOE uses a different methodology for calculating Hazard Category 2 and Hazard Category 3 TQs. The BJC calculation uses a ratio of an adjusted ARF against the default ARF used in Hazard Category 2 TQs and then compared the results with Hazard Category 3 TQs. This is contrary to the guidance provided in EH headquarters interpretation letters. The draft ASA presents arguments that the ARF is  $1E-4$ , based on the nature of the process and nature and form of the materials (i.e., liquids). This results in a factor of 100 increase to the DOE-STD-1027 Hazard Category 3 threshold (i.e.,  $1E-2$  ARF for semivolatiles), which resulted in a conclusion that it could be a Radiological Facility.

A second argument is presented that the external dose, based on measurements, is below the 10 rem at 30 m criterion used as the basis for the DOE-STD-1027 Hazard Category 3 threshold. This is acceptable per a DOE headquarters interpretation letter. Therefore, the draft ASA concludes that the final hazard classification can be downgraded from Hazard Category 3 to a Radiological Facility.

**Conclusion**

Since the tanks are formerly approved Department of Transportation Type B containers, the penetrations are sealed, and they are located outdoors, the storage hazard categorization could probably be justified as a Radiological Facility. The final ASA should be reviewed by ORO (and EM headquarters because they are the approval authority) for concurrence. However, when decommissioning is authorized, the hazard categorization may warrant a Hazard Category 3 designation.

## **Appendix G - Specific Criticality Observations at Paducah and the K-25 Building**

## Criticality Safety Observations for Paducah and K-25

### Paducah

- The 12 so-called "High Priority" DMSAs identified by the EH headquarters review in 1999 have been fully characterized insofar as criticality safety is concerned. Four items, all converters, were found to contain higher EU. Three of these converters contain more than a minimum 'safe mass' (conservatively derived). All four converters are in DMSAs in Building C-331. Per Nuclear Criticality Safety Evaluation NCSE-RM-PGDP-0002 R0, the mass and enrichment of the material in the three converters are 1230 g, 973 g, and 956 g U<sub>235</sub> at 29.75 wt%, 57.45 wt%, and 42.65 wt% enrichment, respectively. The fourth has less than a safe mass but is over the allowed enrichment of 2%, potentially having 2.033% enriched material. The nuclear criticality safety evaluation is adequate and establishes appropriate controls on the three converters. Therefore, the criticality safety-related issues for the High Priority DMSAs have been adequately addressed.
- Interviews with DOE and BJC staff indicated that a little less than 50% of the remaining Phase 2 DMSAs have been characterized from a criticality safety perspective. No additional items have yet been identified in these DMSAs that present a criticality safety concern. Based on process knowledge, the remaining Phase 2 DMSAs should not have any items containing higher EU in quantities above the 'safe mass' value. The ongoing characterization will resolve this. Review of the criticality safety evaluation for DMSA characterization (NCSE RM-0005) indicates that it is adequate for the task. The team does not see any reason why the DMSA Characterization Program cannot return to normal work. In fact, delaying the program unnecessarily delays risk reduction.
- The BJC Criticality Safety Program at Paducah is adequately staffed and conforms to the BJC program that includes requirements for qualifying the criticality safety engineers.
- Some controls on "Category 2" drums in Building C-746-Q are overly conservative, which may impact space utilization and operational efficiency. However, drum storage in C-746-Q is safe from a criticality safety perspective. Documents reviewed relative to this are the request for criticality safety evaluation, 97-001-01, NCSA 97-001R1, and the nuclear criticality safety evaluation, NCSE-PG-0001 R0. The robust cages surrounding the Category 2 drums provide far more spacing than the minimum needed to maintain criticality safety.
- The concern with the gamma spec uncertainties for materials in drums in Building C-746-Q is being handled appropriately. The area is marked as a criticality safety violation, and movement of drums is curtailed until the issue is resolved. Most of the drums affected are very low mass drums (<15 g). Even with gross errors (up to an order of magnitude), criticality safety margins are still adequate due to the low enrichment of the material and the low masses involved. The BJC criticality safety staff responded appropriately, and necessary actions are being taken to resolve the concern.

**Building K-25**

- The BIO for Building K-25 was issued in 2000. Criticality accidents are prominently mentioned in the BIO. The BIO asserts that criticality safety depends on the nuclear criticality safety program and criticality safety evaluations that demonstrate double contingency for all fissile material operations and storage.
- The attributes of the criticality safety program are not described in sufficient detail to understand the basis for approval by DOE. Therefore, the BIO is inadequate in this area.
- The administrative TSR controls are primarily for criticality safety control. One of them is the ambiguous nuclear criticality safety program. Another one is a requirement to do an annual inspection of Building K-25 equipment bearing more than a minimum critical mass of fissile material. Fifty-one locations are known to contain more than a minimum critical mass. Another TSR control is the requirement for a CAAS.
- The attributes of the annual surveillance are not described. The TSR should be on the attributes of the equipment and not just state the requirement to perform a surveillance. The BIO does not describe what the acceptable conditions are for the inspected equipment, nor does it describe action statements in the event that less than adequate conditions are found.
- The BIO does not credit or describe a system of nuclear material control and accountability measurement programs that are credited by the facility with criticality control. Periodic nondestructive assay re-measurements of the 51 locations are made. In addition, a random sample of 20 locations per month is selected for nondestructive assay confirmatory measurements and 40 locations are selected on a weekly basis to confirm equipment integrity, all in areas other than the 51 specific items.
- There are two contractors responsible for criticality safety at Building K-25. American Technologies, Inc., and WESKEM are both responsible for the criticality safety of their operations. Their contracts with BJC flow down the WSS set and recommend the use of BJC's programs and procedures. American Technologies, Inc., utilizes the same engineers (i.e. from NISYS) as BJC, so there is a potential conflict of interest in BJC's review of WESKEM's work. American Technologies, Inc., has subcontracted to other firms for criticality safety support.
- A classified criticality safety evaluation (KHS-630, Revision 0 with Addendum 1), was reviewed, and it adequately analyses all the credible criticality scenarios for the in-situ U deposits in Building K-25. This evaluation documents that the remaining in-situ U deposits will remain subcritical under all normal and credible abnormal events in accordance with ANSI/ANS-8.1.
- The Building K-25 BIO credits the supporting criticality safety evaluations with demonstrating double contingency for all fissile material processes and operations. However, the BJC evaluation found that double contingency was met in all cases, but the NCSE's did not adequately document double contingency. These have been identified in

the BJC corrective action plan (BJC/OR-1012). Several evaluations had not yet been revised at the time of the team's review. Therefore, the claim in the BIO that double contingency has been demonstrated for all fissile operations and processes is not supported by all the underlying criticality safety evaluations. No USQs were declared on discovery of the deficient criticality safety evaluations, even though the BIO explicitly credited these evaluations with demonstrating double contingency. No instances of loss of DCP were identified. Anomalous Condition Reports were processed for the identified conditions.