March 25, 2002

The Honorable Everet H. Beckner
Deputy Administrator for Defense Programs
National Nuclear Security Administration
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Dr. Beckner:

Since the spring of 1999, the Defense Nuclear Facilities Safety Board (Board) has been following closely the design of the Highly Enriched Uranium Materials Facility (HEUMF) at the Y-12 National Security Complex (Y-12). The Board encourages the Department of Energy (DOE) to complete this project in a timely manner in order to significantly improve the Y-12 safety posture.

On January 8–9, 2002, members of the Board's staff conducted a review of the design documentation of the HEUMF and held discussions with representatives of the National Nuclear Security Administration's Y-12 Area Office and the contractor, BWXT Y-12. The purpose of this review was to determine whether the safety basis documentation is sufficiently descriptive and complete to support design activities by the architect-engineering firm. Based on the results of this review, the Board concludes that major safety issues remain that need to be addressed prior to initiating detailed design activities. These issues are summarized below:

- General design criteria needs to more adequately capture the appropriate codes and standards.

- Safety basis documents need further development to address all the hazards and define all the safety related structures, systems and components (SSCs).

- Safety basis documents need to more adequately specify the form and the packaging of uranium for long-term storage.

- The statement of work prepared for the architect-engineer should more adequately define documentation requirements, and provide for work involving nonconformance and engineering changes during construction.

- Planned design reviews should be completed to ensure the adequacy of the design.

- Specific requirements for safety SSCs should be specified in terms of performance category, and specifications also be established for other areas such as documentation, record retention, construction standards for mechanical and electrical equipment and systems, design change requests or nonconformance reports, and quality assurance.

During the review, the Board's staff also identified concerns regarding building foundation alternatives and the need to obtain higher-quality data on soil and rock material properties. Recommendations, contained in a report, *HEU Material Facility Geotechnical Review, January 7–10, 2002*, prepared by the contractor's geotechnical consultant, if properly implemented, appear to provide reasonable solutions to these issues.

These issues are discussed in more detail in the enclosed three reports, provided for your consideration. The Board will continue to monitor the design effort as it progresses, including resolution of the issues identified herein.

Sincerely,

John T. Conway
Chairman

c: Mr. William J. Brumley
Mr. Mark B. Whitaker, Jr.

Enclosures (3)

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

February 27, 2002

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: F. Bamdad

SUBJECT: Design and Safety Basis Requirements for Highly Enriched Uranium Materials Facility Program, Y-12 National Security Complex

This report documents observations made by the staff of the Defense Nuclear Facilities Safety Board (Board) regarding the design of the Highly Enriched Uranium Materials Facility (HEUMF) at the Y-12 National Security Complex (Y-12). Members of the Board's staff W. Andrews, J. Blackman, F. Bamdad, C. Coones, M. Helfrich, and A. Gwal, together with site representatives P. Gubanc and M. Forsbacka, reviewed the relevant available documents and held meetings at the site on January 8–10, 2002.

Highly Enriched Uranium Materials Facility. The HEUMF is being built as part of the Y-12 Site Integrated Modernization Program to support the highly enriched uranium storage mission of the U. S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) for the next 50 years. The current Y-12 Management and Operating contractor, BWXT Y-12, and the architect-engineer (A-E) it selected are responsible for performing specific parts of the HEUMF design work; BWXT Y-12 is responsible for the design criteria and the safety analysis of the facility in accordance with the Program Requirements Document prepared by the NNSA, while the A-E is responsible for detailed design.

General Design Criteria—This document, prepared by the contractor, provides the design criteria and specific requirements applicable to engineering disciplines for design and construction of the HEUMF. Volume 1 includes the general design information for foundation and generic design requirements applicable to the entire facility and its site. Volume 2 presents the design criteria for site clearing and preparation work, as well as new site work. A review of Volume 1 by the Board's staff and discussions with NNSA and BWXT Y-12 representatives revealed the need to revise this document to reflect the appropriate codes and standards more adequately and comprehensively. The current version fails to incorporate some DOE directives and important industry standards or the latest revision of some standards already identified in Volume 1. For example, it does not include Instrumentation, Systems and Automation Standard 84.01, *Application of Safety Instrumented Systems for the Process Industries*; it references

DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, without identifying Change Notice 1, issued in 1999; and it references the 1997 version of AG-1, *Code on Nuclear Air and Gas Treatment*, instead of the latest revision issued in 2000. Such deficiencies could result in an inadequate set of controls or inadequate design of the identified systems.

Safety Basis Documents—The safety basis of the HEUMF is summarized in the Technical Safety Basis (TSB) document. Potential safety structures, systems, and components (SSCs) are derived in the TSB on the basis of a Preliminary Hazard Analysis (PHA) that relied on a team of subject matter experts to identify the hazards and produce a qualitative estimate of their consequences. The PHA identifies the hazards and the bounding events and categorizes them according to their type (e.g., criticality, fire, and spills). The potential impact of these events on the facility workers, collocated workers, and the public are estimated, and controls to prevent or mitigate the events are identified. The TSB uses the information presented in the PHA and further classifies these controls as safety-class, safety-significant, or defense-in-depth SSCs. Currently, the building structure, storage racks, and secondary confinement boundary are identified as safety-class, and the storage containers (primary confinement), criticality accident alarm system, and fire sprinkler system are designated as safety-significant. These SSCs will be forwarded to the A-E for future detailed design work.

In the future, the contractor intends to prepare a Preliminary Safety Analysis Report (PSAR), consistent with the requirements of Part 830 of Title 10 to the Code of Federal Regulations (10 CFR 830), *Nuclear Safety Management,* and its safe harbor provisions. The hazard analysis supporting the PSAR will be based on a more detailed process hazards analysis methodology as recommended by DOE directives. This more comprehensive analysis, however, will not be available until the detailed design is 30 percent complete.

- The set of safety-class and safety-significant SSCs identified in the TSB may be inadequate or incomplete. The TSB identifies the functional requirements which these safety SSCs must meet in the event of an accident. The boundaries of these safety systems, however, are not clearly defined in the TSB, and this could result in the identification of additional safety systems or in the need to upgrade parts of support systems to safety-class or safety-significant. For example, the confinement system relies on isolation valves in the ventilation discharge system. These isolation valves are actuated by instrumentation and control systems that detect loss of negative pressure in the building or activation of water flow in the fire sprinkler system. Systems that support these instruments (e.g., electrical power) are not included in the boundaries of these safety-class confinement systems, as is recommended by DOE directives.

- Potential deficiencies in the Y-12 site procedures may have led to an inadequate set of safety systems. The current analyses identify the Oxygen Deprivation Monitoring System as a defense-in-depth system. This system is identified for the materials inspection area to

prevent potential death of the facility workers resulting from an accidental release of nitrogen used for operation of the Californium Shuffler. This approach appears to be consistent with the site procedures. However, application of DOE directives to this scenario would lead to identifying the Oxygen Deprivation Monitoring System as safety-significant. Eventually, all the supporting systems required to ensure proper activation of this system would also have to be safety-significant, according to the DOE guidance.

- Some of the containers identified in the safety basis documents for the long-term storage of uranium metal and oxides may not meet site requirements. The HEUMF Anticipated Fissile Material Inventory Document (Y/DD-960/SRD) identifies the types of containers and drums that are allowed to be used for the long-term storage of highly enriched uranium in the HEUMF. These storage containers are identified in the TSB as safety-significant systems for primary confinement of the hazardous materials. The Program Requirements Document, prepared by NNSA, requires that the materials be stored in accordance with the criteria identified for prolonged low-maintenance storage in an existing site document, *Criteria for the Safe Storage of Enriched Uranium at the Y-12 Plant*, dated July 1995. Some of the containers identified in the safety basis documents do not meet the requirements set forth in this Y-12 procedure. Furthermore, the current process relies on the existing facilities to package the material for shipment to and storage at the HEUMF since the new facility will not have the capability for repackaging. A process or procedure does not appear to have been established to ensure that the shipping facilities will meet the site requirements for packaging of the uranium materials in the specified containers. Lack of such process may lead to storage of materials in the new facility that are outside its safety basis. Finally, an existing site procedure establishes criteria for the long-term storage of canned subassemblies (CSAs)—*Criteria for the Safe Storage of Canned Subassemblies at the Oak Ridge Y-12 Plant*, dated March 1998. This procedure should be cited in the HEUMF safety basis as the applicable standard for long-term storage of CSAs in the HEUMF.

- The Board's staff was informed that in addition to CSAs current planning allows for only two forms of uranium—metal and oxide—to be placed into long-term storage in the HEUMF. Some of the current safety basis documentation, however, indicates otherwise. This planning needs to be codified as soon as possible. The only forms of highly enriched uranium to be placed in long-term storage in the HEUMF should be metal, oxide, and CSAs, in accordance with the site procedures. This decision should result in a single container (sealed 304L stainless steel as recommended by site procedure) for the storage of both metal and oxide in the HEUMF and in the establishment of only two nuclear criticality safety mass limits in the entire facility—one for metal and one for oxides. The resulting administrative criticality safety controls would be simple and effective. The confusing controls that exist in some current Y-12 facilities with many different forms of

uranium, tens of different containers, and different postings for almost every storage array have resulted in a significant number of operator failures.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

February 27, 2002

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: J. Blackman

SUBJECT: Foundation and Ground Motion Considerations for the Highly Enriched Uranium Materials Facility Program, Y-12 National Security Complex

This issue report documents the observations made by the staff of the Defense Nuclear Facilities Safety Board (Board) regarding the design of the Highly Enriched Uranium Materials Facility (HEUMF) at the Y-12 National Security Complex (Y-12). Board staff member J. Blackman, and outside experts J. Stevenson and P. Rizzo, reviewed the available documents and participated in discussions at the site on January 8–10, 2002.

Background. The HEUMF is being built as part of the Y-12 Site Integrated Modernization Program to support the highly enriched uranium storage mission of the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) for the next 50 years. The Y-12 contractor, BWXT Y-12, and its architect-engineer (A-E) are responsible for performing separate parts of the HEUMF design work: BWXT Y-12 is responsible for identification of the design criteria requirements and safety analysis of the facility in accordance with the Program Requirements Document prepared by NNSA's Y-12 Area Office, while the A-E is responsible for preparing and implementing design and construction documents.

Building Foundation. The building and its foundation are designated as a safety-class, Performance Category (PC)-3 structure. Therefore, proper planning, design, and analysis are required to ensure compliance with DOE standards and established and proven industry design practices for safety-class structures, systems, and components. Subsurface investigations indicate the presence of fill material beneath the north and east portions of the site, varying from 26 to 36 feet below current grade. BWXT Y-12 will provide the A-E with a subsurface investigation report containing basic soil and rock parameters for the proposed building site, and will recommend foundation alternatives for consideration. The A-E will also be provided downhole shear wave profiles and basic site ground motion input data. Based on the design criteria prepared by BWXT Y-12, the A-E is required to evaluate proposed foundation alternatives, and the need for additional geotechnical investigations, and to make suitable recommendations to BWXT Y-12 regarding the most appropriate foundation alternative and any additional field testing required. Although not specifically delineated in the statement

of work, these recommendations will have to be provided early in the design process so that the building design can proceed. BWXT Y-12 and NNSA must evaluate the A-E's recommendations and concur or request evaluations of other alternatives. Furthermore, the foundation configuration for the HEUMF requires special consideration because of the relatively difficult geologic conditions of the site, specifically the presence of heterogeneous fill on the north and east side of the site and possibly on the west side as well.

Several foundation alternatives could be considered, as well as those currently proposed by BWXT Y-12, to provide adequate support. Examples include (1) using a mat foundation, bearing directly on the loose fill material; (2) using drilled caissons to support the building directly on bedrock; (3) removing all of the soft fill material and backfilling with structural fill; (4) treating the fill material to increase its bearing capacity and minimize potential settlement; and (5) using a mat foundation, with subsequent undercutting of 10 feet below the bottom of the mat foundation, and replacement of the excavated material with structural fill. Based on the schedule provided in the statement of work for the HEUMF, the selection of an alternative will have to be made no later than at the end of preliminary design, which is 90 days after the notice to proceed is given.

Alternative (1), while the least expensive, involves supporting the building foundation directly on the underlying soils. However, the soils report indicates that the portion of the building on the fill material would settle excessively. Five inches of settlement is predicted. While it is not clear what soil properties were used in the settlement analysis, the magnitude predicted is representative of the what is typically encountered for fill materials of this nature. Given the heterogeneous nature of the fill material, the building would be expected to crack and warp excessively, rendering it unsafe for storage of highly enriched uranium. If this foundation alternative were used, the confinement system developed for storage of the highly enriched uranium would have to be designed to accommodate a large differential settlement and associated cracking of the building structure. It is not clear how one could design such a building and conform to requirements associated with PC-3 structural design.

Alternative (2) involves using caissons drilled into the rock beneath the fill, thereby directly transferring dead, live, and natural phenomena hazard-induced loads directly from the building to the rock below. With this arrangement, the fill does not participate in resisting load. However, the bearing capacity of the rock beneath each caisson would have to be investigated because of the weathered rock zone beneath the overburden. Experience indicates that such investigation is best accomplished with a boring at each caisson drilled to a depth not less than 1.5 diameters below the proposed bottom of the caisson. Core recovery, fracture spacing, and degree of weathering should be used to establish the final design founding level of each caisson.

Construction practice and quality control during caisson construction are of paramount importance, given that caisson failures occur most often as a consequence of poor construction practice rather than design shortfalls. Good practice involves use of permanent steel casing, placement of concrete in the dry as opposed to tremie operations, use of full-depth steel cages and low-slump

concrete, continuous placement by pumping, and quality supervision and inspection. Given the relatively high water table at the proposed site, meeting required quality control provisions during caisson construction could be difficult.

Alternative (3) involves the removal of all of the soft fill material and backfilling with structural fill. Use of this alternative would preclude the need for additional field tests prior to developing the foundation design, but would later require field density testing as the backfill was placed and compacted.

Alternative (4), which involves treating the fill material to increase its bearing capacity and minimize potential settlement, is a viable alternative. Various methods for treating the fill could be considered. However, as in Alternative (3), additional field testing would be required to determine whether the objective of the treatment had been achieved.

BWXT Y-12 indicated that Alternative (5) (use of a mat foundation coupled with undercutting 10 feet of heterogeneous fill and backfilling with structural fill) had been selected as the foundation alternative to be used in the current facility cost estimate. If BWXT Y-12 proceeds with this alternative, settlement estimates will be critical. Consequently, standard engineering practice dictates that additional borings on a closely spaced grid, including standard penetration tests and undisturbed sampling, will be required. A relatively large number of consolidation tests, index tests, grain-size analyses, and moisture content tests will be required to adequately characterize the fill for purposes of settlement analysis. The laboratory program must also include testing of remolded samples of the fill material to be used as replacement structural fill. In addition, BWXT Y-12's geotechnical consultant has assigned a relatively low potential for liquefaction of the underlying materials, based on geologic age and origin, fine content and plasticity index, saturation, depth below grade, and soil penetration resistance. However, it would be prudent to formally evaluate the potential for liquefaction at this site if a portion of the existing fill is to be used. These additional data are required to ensure compliance of the design and analysis with DOE standards and established and proven industry practices for safety-class structures, systems, and components.

As noted, alternative (3)—removal of all the soft fill material and backfilling with structural fill—would not require obtaining additional geotechnical data with further borings and laboratory testing to provide an adequate basis for preparation of a sound design. Given the 90-day constraint discussed above, this would appear to be the only viable alternative. To proceed with any of the other alternative without additional field and laboratory testing would introduce a degree of uncertainty inconsistent with the design of safety-class structures. Alternative 3, however, may not be the most economical choice.

Seismic Analysis and Soil Structure Interaction. The HEUMF, designated as a PC-3 structure, must comply with DOE requirements for safety-class structures, systems, and components. BWXT Y-12's design criteria require the A-E to perform a seismic analysis and soil structure

interaction analysis. The seismic design basis will be based on site-specific PC-3 response spectra derived by the United States Geological Survey for bedrock with a peak ground acceleration of 0.25 g. The seismic analysis will consider the amplification of bedrock motion upward to the foundation level.

BWXT Y-12 staff indicated that they believe additional field testing to determine dynamic soil and rock properties is not necessary for this site. They indicated that it has been their experience that the properties of the soil and rock of east Tennessee are reasonably constant from location to location, and thus it is not necessary to obtain additional test data. Since no information has been developed by BWXT Y-12 to support this position, the Board's staff believes that additional data are in fact needed to confirm the dynamic properties assumed by the project to date. The additional tests also need to address the horizontal variation of soil properties, the quality and quantity of existing dynamic soil properties, and both shear wave velocity and damping properties. It would also be advisable to consider conducting additional geotechnical studies, consisting of field and laboratory tests, to obtain higher-quality data on geotechnical properties than those initially used for analysis of soil structure interaction, site response, and settlement. Such studies would include additional (1) shear wave velocity measurements (downhole and crosshole), and (2) resonant column tests to measure modulus degradation and damping versus strain. The testing program ought to include a relatively large number of samples of fill, virgin soil, weathered rock, and fresh rock, and must address the heterogeneity of the fill if a foundation alternative that relies on suitably treated fill material is chosen.

Follow-on Information. Subsequent to the review by the Board's staff, the contractor, after discussion with its geotechnical consultants, has decided to proceed with using a mat foundation, remove all existing fill material, and backfill with structural fill as the foundation concept for the A-E to use in design of the facility. The Board's staff, after review of the geotechnical consultants report, believe that the report recommendations are sound and represent a reasonable framework to resolve our concerns discussed above.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

February 27, 2002

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: J. Blackman

SUBJECT: Configuration Management of the Authorization Basis for the Highly Enriched Uranium Materials Facility Program, Y-12 National Security Complex

This issue report documents observations of the staff of the Defense Nuclear Facilities Safety Board (Board) regarding the authorization basis of the Highly Enriched Uranium Materials Facility (HEUMF) at the Y-12 National Security Complex (Y-12). Staff members J. Blackman and M. Helfrich, along with site representative M. Forsbacka and outside expert J. Stevenson, reviewed the relevant available documents and held discussions at the site on January 8–10, 2002.

Background. The HEUMF is being built as part of the Y-12 Site Integrated Modernization Program to support the highly enriched uranium storage mission of the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) for the next 50 years. The Y-12 management and operating contractor, BWXT Y-12, and the architect-engineer (A-E) it selects, are responsible for performing separate parts of the HEUMF design work. BWXT Y-12 is responsible for identification of the design criteria requirements and the safety analysis of the facility in accordance with the Program Requirements Document prepared by NNSA's Y-12 Area Office. BWXT Y-12 is also responsible for overseeing the A-E's work products for NNSA and reviewing and approving major design-related documents. The A-E is responsible for preparing and implementing design and construction documents. The Board's staff understands that BWXT Y-12 will be overseeing the construction manager and that the A-E will provide engineering support for dispositioning potential nonconformance reports, engineering change notices, and the like.

Development of Authorization Basis. Project personnel have developed the processes and procedures necessary to document and control the development of design requirements and the implementation of the design. These processes and procedures also establish the contractual relationship between BWXT Y-12, acting as the owner's (NNSA) agent, and the A-E, which will perform the preliminary and detailed design of the HEUMF. The A-E's deliverables, coupled with BWXT Y-12's completed scope of work, will form the authorization basis for the facility. The requirements, processes, and procedures include the following:

- *Statement of Work and Appendices*—This document provides the schedule the A-E is to follow in preparing its deliverables as well as a list of major milestones. It also outlines BWXT Y-12's review cycles. The content of this document lacks the specificity normally seen for nuclear projects as the basis of a contractual relationship between the owner's representative and the A-E. In particular, a document entitled *Document Control and Records Management Plan for the HEUMF Project* has been prepared that lists 62 different types of design documents to be prepared for the HEUMF project. This design list is part of a much larger list of more than 200 documents covering procurement and construction as well as design. Very few of these design documents are specified in the statement of work or the general design criteria referenced therein. As a result, the Board's staff believes that significant differences will arise between the work scope expected by BWXT Y-12 and that provided by the A-E.

- *General Design Criteria*—This document, comprising two volumes, provides a general summary treatment of the design requirements applicable to structures and systems based on conceptual design. The document, however, does not identify that specific design requirements for the components and subsystems are to be developed during the preliminary and detailed design phases.

- *Design Basis Oversight and Review Responsibilities*—NNSA is responsible for conforming with safety requirements contained in its directives. Presentations made to the staff indicate, however, that BWXT Y-12 is responsible for conducting necessary reviews of all project design deliverables. It is not clear how NNSA's safety responsibilities will be carried out. In addition, it is not clear whether BWXT Y-12's HEUMF project organization is fully aware of its responsibilities for the design of systems and components. For most nuclear design projects, the detailed design basis for subsystems and components, while prepared by the A-E during the preliminary and detailed design phases, remains the responsibility of the operating organization during later facility operations. In developing the detailed design basis for subsystems and components, the A-E generally acts as the agent of the owner or its representative (BWXT Y-12). Carrying out this role requires a close and manpower-intensive working relationship between the BWXT Y-12's HEUMF project organization and the A-E. HEUMF project personnel have recognized the need to perform independent design reviews during the preliminary and detailed design phases. Such reviews on nuclear projects are typically conducted on 5 to10 specific structures, systems, and components (SSCs). The SSCs selected are critical to safety or mission performance and involve a broad range of engineering disciplines. Typically each SSC review involves a number of senior engineers and requires several hundred man-hours to perform. The primary purpose of a design review is to ensure the adequacy of the SSC's

performance and to evaluate the effectiveness of the actual design process. Discussions with HEUMF project staff indicated that the design reviews would be broad reviews of a large number of SSCs to provide a redundant check on the routine checking and approval or verification of design documents. This type of review is usually not effective in ensuring adequate SSC performance or evaluating the effectiveness of the design process.

- *Preparation, Review, and Disposition of Nonconformance Reports and Engineering Change Notices*—On typical nuclear projects, a major aspect of the A-E's work takes place during the construction phase after the detailed design is completed. This work involves identification, review, and resolution of Nonconformance Reports (NCRs) and other required changes (usually referred to as Engineering Change Notices [ECNs]) due to interferences that develop during construction and may require modification of the design basis and configuration management documents. It is not unusual for this phase of the A-E's work to represent 20–30 percent of the total engineering work for a project. While the HEUMF Project may not require this level of effort because of the facility's relatively simple mission, and while the project team recognizes the need for NCRs, ECNs, and the like, the team has not addressed the significant work, resources, and cost associated with processing of field changes. For example, the statement of work prepared for the A-E does not mention resolution of NCRs or ECNs.

- *Documentation for Highly Enriched Uranium Materials Facility Project*—More than 200 types of documents are identified in the *Document Control and Records Management Plan for the HEUMF Project*. These include documents associated with design, procurement, and construction. However, there is no indication of the organization responsible for preparing or approving a particular document or its content and format. As discussed above the statement of work and the general design criteria, which form the basis for the contract between BWXT Y-12 and the A-E, identify only about 30 percent of the design documents listed in the Document Control and Records Plan. The Board's staff believes a comprehensive list of project documents, including organizations responsible for preparing, reviewing, revising, and approving those documents is needed. In addition, the Board's staff believes a description of each document, including content and format requirements, as well as a preliminary schedule for the document's preparation, review, and approval, is needed.

- *Correlation of Structures, Systems, and Components with Natural Phenomenon Hazard Categories*—The System Design Descriptions (SDDs) refer to SSCs in terms of Grades 1–4, with Grade 1 as safety-class and Grade 2 as safety-significant. However, the appendices to the General Design Criteria refer to SSCs in terms of Performance Categories (PC) 1–3. The PC designations dictate the requirements for natural phenomenon hazard design as specified in DOE-STD-1020-1996, *Natural Phenomenon Hazards Design and Evaluation Criteria for Department of Energy Facilities*. There appears to be no

HEUMF document that correlates the SDD grades with the performance categories. Without such correlation, the natural phenomenon hazard design basis for the SSCs is not specified. The Board's staff believes such correlation must be developed and made available to the A-E before the preliminary design work begins.

- *Graded Approach to Design, Procurement, and Construction*—While project personnel recognize that SSCs have different grades and performance categories, they have not provided sufficient requirements and guidance on how the A-E or other potential subcontractors will use these gradations. Normally, construction specifications for the various performance categories of SSCs draw clear distinctions with respect to use of different construction standards for each category, as specified in DOE-STD-1020-96, *Natural Phenomenon Hazards Design and Evaluation Criteria for Department of Energy Facilities*. While the project has tailored the requirements for preparing an SDD to reflect the system grade, it has not addressed grading in other areas, such as documentation, record retention, construction standards for mechanical and electrical equipment and systems, Design Change Requests or NCRs, and quality assurance (QA) as a function of grade or performance category. The Board's staff believes these aspects of the design configuration need to be resolved and appropriate requirements developed by the project.

- *Quality Assurance*—Project personnel have implemented QA requirements for the project based on 10 Code of Federal Regulations 830.120, Subpart A, *Quality Assurance Requirements*, using BWXT Y-12's site QA requirements document, Y60-101 PD, *Quality Program Description*. The QA plan identifies the QA procedures to be followed for project activities and prescribes a systematic process for performing evaluations of suppliers, reviews of procurement specifications, surveillance and inspection of suppliers, management assessments, and so on. In general, the engineer that briefed the staff on QA demonstrated knowledge and competence with regard to the current requirements and status of QA within the nuclear industry. The Board's staff reviewed several of the implementing quality assurance procedures and concluded that they present a good start toward the implementation of quality assurance requirements on the part of project personnel.