DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

September 7, 2018

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

The Defense Nuclear Facilities Safety Board evaluated the Department of Energy's Richland Operations Office and contractor radiological practices and safety strategy for the remediation of the contaminated soil underneath the Hanford 300 Area, 324 Building B-Cell.

The Board's staff team determined that DOE's estimated dose consequences for a bounding fire event in the 324 Building B-cell used a non-conservative airborne release fraction and respirable fraction that could result in an underestimate of the dose consequences to the onsite worker and the public. Using the bounding values of airborne release fraction and respirable fraction from DOE Handbook 3010, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, could increase the estimated dose consequence to the public above the DOE evaluation guideline to require safety class controls. Such a dose consequence makes it imperative that DOE ensure the use of the appropriate control set. Additional details are provided in the enclosed staff report for your information.

Yours Truly,

Bruce Hamilton
Acting Chairman

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

April 16, 2018

MEMORANDUM FOR: S.A. Stokes, Technical Director

COPIES: Board Members

FROM: J. Abrefah

SUBJECT: Hanford Site 324 Building Radiological Safety

Members of the Defense Nuclear Facilities Safety Board's (Board) staff (staff team) evaluated the Department of Energy's (DOE) Richland Operations Office (DOE-RL) and the CH2M Hill Plateau Remediation Company (CHPRC) radiological practices and safety strategy for remediation of contaminated soil underneath the Radiochemical Engineering Complex (REC) B-Cell. For the review, the staff team examined (a) the work performed to characterize the dose level and distribution of radioisotopes in the soil and (b) project activities designed to remediate the soil for packaging and disposition. The staff team agrees with CHPRC's current safety strategy, which is focused on establishing and maintaining a fully remote operation for the soil remediation activities.

The staff team also reviewed the potential unmitigated offsite radiological consequences associated with the contamination levels at REC B-Cell. The staff team identified a potential safety item in the CHPRC estimates of the dose consequences to the public and collocated worker for its bounding *fire event in the B-Cell*. CHPRC selected non-conservative airborne release fraction (ARF) and respirable fraction (RF) values from DOE Handbook 3010, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, to calculate the dose consequences, which resulted in onsite worker dose consequences of 3.8 rem and public dose consequences of 1.1 rem. Selection of more appropriately conservative ARF and RF values from the handbook could increase the estimated unmitigated onsite dose consequences to 3165 rem and the estimated public dose consequences to 916 rem. Because this estimated public dose consequence is above the evaluation guideline in DOE Standard 3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, it would require safety class controls.

Background. The Waste Technology Engineering Laboratory, 324 Building, is a former non-reactor defense nuclear facility located in the 300 Area of the Hanford Site. The building houses a series of hot cells that were used to conduct diverse studies on chemical and physical processing of high-activity radioactive materials, including spent nuclear fuel. Operations in the facility ended in 1998 and CHPRC currently is stabilizing and deactivating the 324 Building.

Preparations for the building's stabilization and eventual demolition, which began in November 1999, proceeded until November 2010, when radiological surveys within the B-Cell in the REC hot cell complex (a grouping of four interconnected hot cells [designated as "A," "B," "C," and "D"], and an associated airlock), detected anomalous high direct radiation exposure levels (14,400 roentgen per hour) that could not be accounted for by contamination levels measured within the cells. Further evaluation suggested that the anomalous radiation levels could be due to very high contamination levels in the soil immediately under REC's B-Cell.

Remote sensing probes ("geoprobes") inserted into the soil under the cell detected direct radiation levels as high as 10,000 roentgen per hour, along with elevated temperatures and neutron levels, in several locations. After analyzing the data and two soil samples, the DOE contractor at the time, Washington Closure Hanford, Inc., concluded that the high direct radiation levels and elevated temperatures were due to the presence of high concentrations of cesium-137 and strontium-90, and the elevated neutron levels were due to lower concentrations of transuranic elements, primarily plutonium-238, and curium-243 and -244, in the soil. The analysis also found evidence that the contamination differentially had migrated downward at least 20 feet below the footing of the cell. Analytical results show that high radiation levels under the cell adequately explain the anomalous radiation levels within B-Cell.

Evaluation of activities conducted in the building during its operation determined that the primary source of the cesium and strontium contamination was a 1986 spill of 510 liters of concentrated cesium-137/strontium-90 solution. The estimated radiochemical inventory of the spill solution was 883,000 Ci of cesium-137 and 388,000 Ci of strontium-90. In their presentation to the Board's staff, CHPRC personnel said that the spill leaked into the soil underneath the cell through a breach in the stainless steel liner at the sump and through asphalt-impregnated felt expansion joints along the inside floor perimeter of the cell wall. However, CHPRC data to date shows the highest concentration of activity in the soil is at the opposite corner of the cell, away from the sump location, which suggests the possibility of at least one additional leakage pathway from the cell to the soil.

Based on the very high radiation levels in the soil, DOE-RL concluded that demolition of the facility could not proceed as originally planned until the soil contamination was reduced sufficiently to eliminate the extremely high radiation levels. Two basic concerns led to this decision. First, some of the contamination was very soluble and had the potential to reach the ground water and ultimately the nearby Columbia River, particularly after the building above it was demolished. Second, the extremely high radiation levels near the surface precluded the use of normal demolition and cleanup practices. As a consequence, DOE-RL shifted the focus of the project to remediation of the soil contamination under the cell.

DOE-RL and CHPRC developed detailed plans for remotely remediating the soil contamination. The plan proposes to cut out the floor of the cell remotely and excavate the soil from inside the cell, load the soil into containers, and move the filled containers out of the cell into the airlock. CHPRC will measure the radiation dose rate of each container in the airlock, and will move high-activity containers into the A-, C-, or D-Cells and grout them in place. It will remove low-activity containers from the airlock and prepare them for shipment to the

Environmental Remediation Disposal Facility (ERDF). CHPRC has begun procuring equipment and initiated the prerequisite work of structurally stabilizing B-Cell and clearing interferences. It also is preparing the REC airlock to allow access to the cells and ensure that the ventilation system and in-cell cranes are adequate to perform their functions throughout the soil remediation effort.

Discussion.

Facility and Mockup Walk-downs—The staff team was able to walk down both the 324 Building and the B-cell mockup, which is under construction to support equipment testing and operator training. The staff team was able to observe B-Cell and the airlock from the gallery windows in order to gain an understanding of the general condition of the building.

As noted above, at the time when the contractor discovered the high levels of soil contamination under B-Cell, it was progressing towards stabilizing and decontaminating the building in preparation for eventual demolition. The contractor had deactivated and removed some utility services and support equipment for other essential systems, such as the confinement ventilation system and in-cell cranes, in accordance with perceived reduction in the material-at-risk inventory and lack of long-term need. The discovery of the soil contamination led the contractor and DOE to recognize that some of those essential systems would be needed to support the soil remediation project.

During the walk down and follow-on discussions, DOE and CHPRC informed the staff team of the ongoing planning and activities to ensure that the building's essential equipment will be adequate to support the project. Five building systems are of particular importance to the soil remediation project: the confinement ventilation system (CVS), the fire suppression system, the cell doors and related operating mechanisms, the in-cell cranes, and the hot cell manipulators.

Although CHPRC hopes to be able to maintain the ventilation system and manipulators for the life of the project, workers could rebuild and replace both of these systems if they fail. CHPRC has not maintained the in-cell cranes for a number of years, but it has remotely tested and inspected the cranes and knows they are functional. However, crane capacity in the cells for moving the soil containers and remediation equipment is limited, and replacing a failed crane would be very impractical because it would likely require workers to enter the cell. CHPRC intends to minimize the use of the B-Cell crane during the project and has a contingency plan if needed, but CHPRC has not determined the full implications of a crane failure.

The building also needs structural modifications to ensure the stability of B-Cell during removal of the floor and the underlying soil, and CHPRC now is planning for these modifications. Also, prior to beginning remediation operations, CHPRC will need to create about 20 new penetrations through the B-Cell shield walls to install in-cell remotely operated excavation equipment and supporting cameras, utility services, and instrumentation. While the staff team had some discussions with DOE-RL and CHPRC about these plans during this review, the modifications were not the subject of this review. A separate staff team will evaluate the structural modification plans later in calendar year 2018.

The staff team inquired about the presence of the geoprobe piping inserted into the soil under the cell, and whether that, or any other piping encountered during the excavation of the soil, could present a hazard to the remotely operated excavation equipment or the activity. CHPRC acknowledged that the remote excavation equipment is not equipped with strain gauges that could detect abnormally high loadings on the equipment. However, CHPRC said it has sufficient information about where the geoprobe pipes are located and has the ability to cut the pipes remotely so that they can be removed without complication during excavation. Furthermore, CHPRC's evaluations of the construction of the building have not found any utility services (e.g., electrical conduits or liquid or gas plumbing) within the area of the proposed excavation.

The mockup facility provides a full-scale, high-fidelity model of the major B-Cell structural components, including full-thickness concrete walls and the cell floor. This mockup will facilitate development of procedures for installing and operating the remote handling and excavation equipment in the cell, comprehensive testing of that equipment, and training of operating personnel. The equipment installed in the mockup also can be used as spares for the equipment installed in B-Cell, should spares be needed.

The staff team concluded that the development of the high-fidelity mockup for planning, equipment testing, and training will provide valuable information and experience for the planners and operating staff. The review team considers the resources and efforts put into creating this facility to be a notable practice.

Safety Strategy for the Project—The staff team evaluated the safety strategy for the project by following five lines of inquiry addressing:

- Worker radiation dose management;
- Engineered barriers and administrative controls to mitigate radiological hazards;
- Strategy for responding to radiological events;
- End-state criteria for the project and how they will be determined from dose rate measurements; and
- The potential for excavation activities to increase, disturb, or further disperse contamination into the remaining soil.

Concerning worker radiation dose management, CHPRC demonstrated workers would conduct remotely all handling of high activity materials and soils, and no workers would be directly exposed to high radiation dose rates. All high activity materials and soil containers will be remotely handled and stored within the REC hot cells, which were designed to provide shielding for exposure rates of up to 10^6 roentgen/hour, while allowing occupancy of the surrounding gallery areas. CHPRC expects the general radiation fields within B-Cell during the excavation will be on the order of 4,000 roentgen/hour. Soil containers that are determined to have radiation levels low enough to be contact-handled will be remotely grouted within the airlock and then removed and shipped to ERDF for disposition.

Workers will have to enter the airlock in support of work activities. CHPRC will remotely monitor radiation dose rates within the airlock prior to workers' entry, and will survey to verify the dose rates. It will decontaminate the airlock when necessary to minimize personnel exposure. Workers will wear proper personal protective equipment, respirators, and real-time dosimetry to enter the airlock.

CHPRC still is developing and reviewing the soil remediation project addendum to the Basis for Interim Operation (BIO). However, engineered barriers currently in place for the building that are important-to-safety for this project include the hot cell structure, the Zones I and II CVS, the differential pressure monitoring system, the in-cell/A-frame filters (not credited), and the final high-efficiency particulate air (HEPA) filters.

The Administrative Controls and Safety Management Programs (SMP) currently in place and expected to be relevant to the project include:

- Material management inside Zones I and II CVS: packaging, management of dispersible materials;

- Management of Zones I and II CVS: HEPA protection, differential pressure, shield door closure;

- Material management outside Zones I and II CVS: containers, storage area management;

- Radiation protection SMP, including effluent monitoring, external dosimetry, periodic surveys around hot cells, respiratory protection; and

- Training SMP, including preparation for normal, upset, and emergency conditions.

CHPRC has in place emergency response procedures for occupants of 324 Building to follow in the event of an unexpected radiological alarm. The staff team noted that these procedures predate the soil remediation project, and suggested that CHPRC should consider reviewing them to ensure that they still are appropriate for the project.

CHPRC's strategy for the soil remediation project is to remove the high-dose-rate soil, but it will not completely remediate all contaminated soil under the building. However, the end-state will be governed by DOE-RL and U.S. Environmental Protection Agency (EPA) agreed criteria for the project, which are based on in-situ assay of the cesium-137 concentration and process sampling of a specified set of radionuclides. The agreement also states that once the sampling is completed and results evaluated, CHPRC will fill the excavation with controlled-density fill to allow it to restart building demolition preparatory activities.[1]

[1] Memorandum between R.F. Garcia, DOE-RL, and B. Sims, EPA, *End state criteria for meeting Tri-Party Agreement Milestone M-016-85A and gaining backfill concurrence authorization for B Cell in preparation of 324 facility demolition and final remediation of the 300-296 waste site,* August 17, 2017.

The staff team inquired about the potential for remediation activities to contribute to, or redistribute, contamination in the soil, particularly cutting and removal of the floor, since CHPRC will introduce water into B-Cell to cool the saw blade at a rate of roughly nine gallons per hour. CHPRC has performed calculations that indicate that adding up to 22,000 gallons of water would not substantively affect the migration of radionuclides in the soil. CHPRC estimates that the floor cutting activities, at most, will require 1,300 gallons of water. The staff team will review the calculation during the structural review.

Radiological Practices—Although CHPRC expects to conduct excavation activities remotely, building and hot cell modifications necessary to prepare for those activities have the potential to expose workers to direct radiation fields and airborne contamination. Besides the cell wall penetrations mentioned above, CHPRC also will need to remove contaminated gloveboxes used for sample removal from the cells to provide clearance for the penetrations, and will need to install structural underpinnings around the cell to support the modifications necessary to stabilize B-Cell. While CHPRC expects the footings to be outside the high-dose-rate soil areas, there is still a potential to encounter contaminated soil.

CHPRC already has performed some of the radiological work associated with the soil remediation project; specifically, it has made multiple entries into the airlock to survey the area, cleaned out excess equipment, and decontaminated the airlock to the maximum extent possible. However, residual contamination and elevated radiation levels remained even after the airlock was cleaned and partially decontaminated, so CHPRC will control all work within the airlock during the project using appropriate radiological controls. Prior to work being performed in the airlock during the project, technicians will remotely evaluate radiation levels and survey the area upon the initial entry. CHPRC will not allow entry to the airlock when high-dose-rate soil containers are present.

CHPRC will conduct all radiological work using pre-existing facility procedures, including development of an ALARA (as low as reasonably achievable) Management Worksheet that will be used to identify required radiological controls for the work being performed. CHPRC will incorporate those controls into a radiological work permit (RWP) and relevant work instructions, as appropriate. RWPs will specify the necessary training, dosimetry, and personal protective equipment for the work, and will include action levels and void limits to ensure that radiological conditions encountered during the work are within the conditions assumed when the work was planned.

As expected at this stage of the planning, CHPRC has not completed the ALARA Management Worksheet and RWPs for the actual soil excavation activities. Also, CHPRC intends to install continuous air monitors, area radiation monitors, and telemetry systems, as necessary, to support the soil remediation project. At the time of this review, plans for those systems were still incomplete, so the Board's staff considers it prudent to review these documents once they become available.

Characterization of Contamination Levels and Distribution in the Soil under B-Cell—In preparing for this review, the staff team noted that characterization of contamination levels and distribution in the soil under B-Cell did not provide a full understanding of conditions that could be encountered during execution of the project. The staff team recognized that the difficulty of remotely evaluating those conditions was the cause of this incomplete understanding, and that it could not be avoided. Therefore, the staff team developed lines of inquiry that focused on the uncertainties associated with what is known about the contamination levels and whether CHPRC's approach is sufficiently conservative to address potential unknowns.

The floor of B-Cell is lined with a 1/8-inch steel liner. The discovery of a crack in the liner within the sump that is located at the northeast corner of the cell led to the initial assumption that the leak and associated contamination would be primarily in that corner, so CHPRC inserted the initial geoprobes into that area. Subsequent insertion of geoprobes under the central area of the cell and the wall opposite of the sump location discovered high levels of radiation that appeared to be associated with the expansion joint. In fact, radiation levels in some areas along the wall opposite the sump were twice as high as the levels measured around the sump. These measurements led to the conclusion that there was a non-uniform leak pathway through the expansion joint. Given the incomplete set of measurements, CHPRC based its analysis of the contamination distribution under the cell on the assumption that there was a uniform pattern of contamination confined to a four-foot wide area centered on the entire expansion joint.

CHPRC also inserted geoprobes to various depths under the cell, allowing a measurement of the downward migration of the contamination. This data led to the assumption that, although there was evidence of significant downward migration of some radionuclides, depending on their chemical behavior, the high-dose-rate contamination was limited to less than the first 10 feet of soil under the cell.

After CHPRC took the soil measurements, it capped the geoprobes and filled in the temporary excavation next to the building that facilitated insertion of the geoprobes. Since that time, CHPRC has installed two new horizontal pipes (referred to as "Hydraulic Hammer Units," or HHU locations) with active radiation detectors at specific locations and depths under B-Cell. CHPRC records the radiation readings at the two HHU locations monthly to assess whether there is any indication of further migration of the contaminants downward toward the ground water. As of November 2017, the results have not shown any further migration of contaminants at the locations sampled.

As a result of these assumptions about the distribution, depth, and breadth of the high-dose-rate contamination, CHPRC designed the project with the intention of removing soil from a four-foot-wide trench, centered on the expansion joint, and no more than 10 feet deep. CHPRC assumes that the soil under the middle of the cell is less contaminated, and will not remove it unless surveys conducted after the floor is removed indicate the need to do otherwise. These assumptions led to two significant project design criteria, the reach of the remote excavation equipment (maximum of 10 feet) and the amount of space needed to store the high activity containers inside the A, C, and D-Cells.

With regard to the 10-foot reach of the remote excavation equipment, CHPRC said that the soil layer only extends roughly seven feet below the foundation of the cell, and below that is a layer of cobble that it does not intend to excavate. Given the configuration of the remote excavation equipment and the geometrical dimensions of B-Cell, the review team concluded that the equipment reach should be adequate to reach the depth necessary to satisfy the end-state criteria prior to encountering the cobble layer. The only caveat is that the reach of the equipment may not be sufficient to excavate the central area of the cell, should contamination surveys indicate that it is necessary.

Regarding the amount of space available to store the high-activity soil containers, CHPRC estimates that there is space available for between 249 and 274 containers in the other three cells. CHPRC also estimates that it will need to store about 215 to 237 containers in these cells. The estimates for the number of containers to be stored are based on the assumptions that CHPRC will be able to fill the containers to 80-90 percent capacity; that the soil density will average 1.56 grams per cubic centimeter; and that the area of excavation is 4 feet wide by 7 feet deep, centered around the expansion joint. The assumed soil density is near the upper limit of typical soil values (typical values are 1.0–1.6 grams per cubic centimeter), and it may be difficult for in-cell operation to consistently fill the containers to the assumed 80-90 percent volume fraction.

CHPRC is aware that this raises the potential for running out of storage space in the cells. Its backup plan for the disposal of high-activity soil containers would involve making more room for storage by removing containers from the cell to the airlock, where they would be grouted. Subsequently, CHPRC would remove the soil containers from the airlock and ship them to ERDF. Use of this method is manageable, but could result in higher worker exposure and increase the potential for inadvertent releases during shipment. CHPRC has not analyzed the increased risk of worker exposure and releases to the environment to ascertain the safety significance but the staff team concluded these operations can be conducted safely with appropriate controls.

Potential for High Unmitigated Offsite Radiological Consequences Associated with the Project—CHPRC performed the hazards and accident analysis for the current stabilization and deactivation state of 324 Building in the safety basis document, CHPRC-02979, Revision 1, *324 Building Basis for Interim Operation (BIO)*. In the BIO, CHPRC identified the radiological and chemical hazards present in the cell as well as energy sources with the potential to initiate, or contribute to, uncontrolled releases of hazardous material. The accident analysis evaluated four categories of operational accidents: fires, spills, explosions, and natural phenomena hazards. CHPRC analyzed representative accidents by evaluating potential unmitigated and mitigated consequences.

The bounding accident analyzed in the BIO is the potential for a large fire in B-Cell. The main combustible loading materials for the fire are electrical wire insulation, plastic sleeves on the manipulators, and the hot cell window oil; the ignition source could be any activities involving welding, machining operations, hot surfaces, electrical arcs, and plasma torch cutting done for size reduction. CHPRC estimated unmitigated dose consequences for this bounding fire event in B-Cell are 3.8 rem to the onsite worker and 1.1 rem to public. CHPRC based its estimated dose consequences to the public and the onsite worker on an ARF of 6E-3 and an RF of 1E-2. These are the values for plutonium oxide powder and are obtained from DOE Handbook-3010.

However the radioactive material contamination within B-cell is mostly cesium-137 and strontium-90 that precipitated out of solution onto various surfaces. Consequently, the staff team expects the particle size distribution from the deposited contaminated particles that are released from the B-Cell walls, insulation, and plastic sleeves during a fire event to have a larger fraction of particles within the respirable range than the referenced DOE Handbook 3010 plutonium oxide powder values used by CHPRC. The staff team believes that more appropriately bounding ARFs and RFs are found in Section 5.1 of DOE Handbook 3010, which recommends a bounding ARF of 5E-2 and an RF of 1.0 for deposited radioactive contamination on combustible material such as the plastics in B-Cell. The ratio of the conservative ARF x RF to the CHPRC selected ARF x RF is:

$$\frac{Conservative\ ARF \times RF}{CHPRC\ ARF\ \times RF} = \frac{5 \times 10^{-2}\ \times 1}{6 \times 10^{-3} \times 1 \times 10^{-2}} = 833$$

Using the conservative ARFs and RFs in the dose consequence calculations increases the unmitigated onsite collocated worker dose consequences to 3165 (i.e., 3.8 x 833) rem and the offsite public dose consequences to 916 (i.e., 1.1 x 833) rem. This dose consequence to the public is above the evaluation guideline in DOE Standard 3009-94, therefore requiring safety class controls.

Based on discussions during the initial review, CHPRC provided additional information related to its selection of ARF and RF values for the B-Cell fire accident. The staff team reviewed the additional documents and held a follow-up discussion with CHPRC and DOE-RL representatives but concluded that the CHPRC selected ARF and RF were not bounding for the radionuclides that comprise the contamination in B-Cell. During the teleconference discussion, CHPRC stated that expected temperatures during a fire event would be too low to result in a volatile release of the contaminated cesium and strontium radionuclides. CHPRC also stated that the current flammable material inventory, as well as radioactive material at risk inventory, is substantially below values identified in the existing safety basis calculation, and that it is using the revised inventories in an upcoming BIO addendum in development to support removal of the contaminated soil. CHPRC observed that reducing the flammable material at risk inventories could result in lowering fire temperatures and consequently lowering radioactive material releases to mitigate the staff team's dose consequence concern.

However, after review of the additional material provided, the staff team notes that the fire temperatures identified in the fire hazard analysis are above the melting points for expected cesium compounds and, therefore, could result in a release of gaseous cesium compounds. Consequently, the staff team determined that the technical basis used for CHPRC's selection of ARF and RF for the postulated accident still is not adequately linked to the physical properties of the cesium and strontium contamination. While the staff team agrees that reduced flammable material and material at risk inventories will reduce consequence levels, it would still be appropriate to identify and justify appropriate ARF and RF values, and then revise the consequence calculation in order to fully understand consequence levels for a B-Cell fire event and ensure that appropriate controls are in place during soil removal work.

Conclusions.

The staff team concluded that given that CHPRC's current safety strategy is focused on establishing and maintaining a fully remote operation for the soil remediation activities, there are no immediate safety concerns with the execution of the project. However, the staff team identified a potential safety item associated with the technical basis for the estimated dose consequences to the public and collocated worker for the bounding fire event in B-Cell as well as some situations that could represent project vulnerabilities.

Potential safety item to be addressed:

- **Dose-Consequence Estimates:** CHPRC's estimated dose consequences, in the 324 Building BIO CHPRC-02979, Revision 1, for the public and the onsite worker are based on ARF and RF values from DOE Handbook 3010. The staff team is concerned that the values used may not be conservatively bounding. The selection of appropriately conservative ARF and RF values could increase the unmitigated onsite and public dose consequences. The estimated public dose consequence based on the conservative ARF and RF in Section 5.1 of DOE Handbook 3010 could be 916 rem, which is above the evaluation guideline in DOE Standard 3009-94. This would require safety class controls for operational activities in 324 Building, including the soil remediation project.

Project vulnerabilities for consideration:

- **Cranes:** CHPRC has not maintained the existing in-cell cranes for a number of years. However, it has tested and inspected the cranes remotely, and knows they are functional. CHPRC has not yet determined the full implications of a crane failure. Crane capacity for moving soil containers and remediation equipment is limited, and replacing a failed crane would be impractical because it would require human entry into the cell. Current and anticipated high radiation levels within the cells would preclude any human entry without appropriate shielding, which would require an extensive effort to design, fabricate, and install. If human entry into the high radiation areas becomes necessary, the Board's staff should review the plans for these activities prior to their execution.

- **In-Cell Storage Space:** Assumptions used in estimating the amount of in-cell storage space necessary to contain the high activity soil containers may be overly optimistic. If the project were to run out of storage space, CHPRC may need to remove some high-activity soil containers from the facility for individual packaging and disposal. This could delay project completion, create high radiation fields in occupied areas, and increase the potential for inadvertent releases during shipment.